



# Flood Risk Report

*Concord River Watershed*

*Middlesex and Worcester Counties, Massachusetts:*

Report Number 001

*2/27/2013*



**FEMA**

**RiskMAP**  
Increasing Resilience Together

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# Preface

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The Department of Homeland Security (DHS), Federal Emergency Management Agency's (FEMA) Risk Mapping, Assessment, and Planning (Risk MAP) program provides states, tribes, and local communities with flood risk information and tools that they can use to increase their resilience to flooding and better protect their citizens. By pairing accurate floodplain maps with risk assessment tools and planning and outreach support, Risk MAP has transformed traditional flood mapping efforts into an integrated process of identifying, assessing, communicating, planning for, and mitigating flood-related risks.

This Flood Risk Report (FRR) provides non-regulatory information to help local or tribal officials, floodplain managers, planners, emergency managers, and others better understand their flood risk, take steps to mitigate those risks, and communicate those risks to their citizens and local businesses.

Because flood risk often extends beyond community limits, the FRR provides flood risk data for the entire Flood Risk Project as well as for each individual community. This also emphasizes that flood risk reduction activities may impact areas beyond jurisdictional boundaries.

Flood risk is always changing, and there may be other studies, reports, or sources of information available that provide more comprehensive information. The FRR is not intended to be regulatory or the final authoritative source of all flood risk data in the project area. Rather, it should be used in conjunction with other data sources to provide a comprehensive picture of flood risk within the project area.

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# FLOOD RISK REPORT

## 1 Introduction

### 1.1. About Flood Risk

Floods are naturally occurring phenomena that can and do happen almost anywhere. In its most basic form, a flood is an accumulation of water over normally dry areas. Floods become hazardous to people and property when they inundate an area where development has occurred, causing losses. Mild flood losses may have little impact on people or property, such as damage to landscaping or the generation of unwanted debris. Severe flooding can destroy buildings, ruin crops, and cause critical injuries or death.

#### 1.1.1 Calculating Flood Risk

It is not enough to simply identify where flooding may occur. Just because one knows where a flood occurs does not mean they know the **risk** of flooding. The most common method for determining flood risk, also referred to as vulnerability, is to identify the probability of flooding and the consequences of flooding. In other words:

- **Flood Risk** (or Vulnerability) = **Probability x Consequences**; where
- **Probability** = the likelihood of occurrence
- **Consequences** = the estimated impacts associated with the occurrence

**The probability of a flood** is the likelihood that a flood will occur. The probability of flooding can change based on physical, environmental, and/or contributing engineering factors. Factors affecting the probability that a flood will impact an area range from changing weather patterns to the existence of mitigation projects. The ability to assess the probability of a flood and the level of accuracy for that assessment are also influenced by modeling methodology advancements, better knowledge, and longer periods of record for the water body in question.

**The consequences of a flood** are the estimated impacts associated with the flood occurrence. Consequences relate to human activities within an area and how a flood impacts the natural and built environments.

#### 1.1.2 Risk MAP Flood Risk Products

Through Risk MAP, FEMA provides communities with updated Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies (FISs) that focus on the probability of floods and that show where flooding may occur as well as the calculated 1% annual chance flood elevation. The 1% annual chance flood, also known as the base flood, has a 1% chance



Flooding is a natural part of our world and our communities. Flooding becomes a significant hazard, however, when it intersects with the built environment.

Which picture below shows more flood risk?



Even if you assume that the flood in both pictures was the same probability—let's say a 10-percent-annual-chance flood—the consequences in terms of property damage and potential injury as a result of the flood in the bottom picture are much more severe. Therefore, the flood risk in the area shown in the bottom picture is higher.

of being equaled or exceeded in any given year. FEMA understands that flood risk is dynamic—that flooding does not stop at a line on a map—and as such, provides the following flood risk products:

- Flood Risk Report (FRR): The FRR presents key risk analysis data for the Flood Risk Project.
- Flood Risk Map (FRM): Like the example found in Section 3.1 of this document, the FRM shows a variety of flood risk information in the project area. More information about the data shown on the FRM may be found in Section 2 of this report.
- Flood Risk Database (FRD): The FRD is in GIS format and houses the flood risk data developed during the course of the flood risk analysis that can be used and updated by the community. After the Flood Risk Project is complete, this data can be used in many ways to visualize and communicate flood risk within the Flood Risk Project.

These Flood Risk Products provide flood risk information at both the Flood Risk Project level and community level (for those portions of each community within the Flood Risk Project). They demonstrate how decisions made within a Flood Risk Project can impact properties downstream, upstream, or both. Community-level information is particularly useful for mitigation planning and emergency management activities, which often occur at a jurisdictional level.



Whether or not an area might flood is one consideration. The extent to which it might flood adds a necessary dimension to that understanding.

## 1.2. Uses of this Report

The goal of this report is to help inform and enable communities and tribes to take action to reduce flood risk. Possible users of this report include:

- Local elected officials
- Floodplain managers
- Community planners
- Emergency managers
- Public works officials
- Other special interests (e.g., watershed conservation groups, environmental awareness organizations, etc.)

State, local, and tribal officials can use the summary information provided in this report, in conjunction with the data in the FRD, to:

- **Update local hazard mitigation plans.** As required by the 2000 Federal Stafford Act, local hazard mitigation plans must be updated at least every five (5) years. Summary information presented in Section 3 of this report and the FRM can be used to identify areas that may need additional focus when updating the risk assessment section of a local hazard mitigation plan. Information found in

Section 4 pertains to the different mitigation techniques and programs and can be used to inform decisions related to the mitigation strategy of local plans.

- **Update community comprehensive plans.** Planners can use flood risk information in the development and/or update of comprehensive plans, future land use maps, and zoning regulations. For example, zoning codes may be changed to better provide for appropriate land uses in high-hazard areas.
- **Update emergency operations and response plans.** Emergency managers can identify low-risk areas for potential evacuation and sheltering and can help first responders avoid areas of high-depth flood water. Risk assessment results may reveal vulnerable areas, facilities, and infrastructure for which planning for continuity of operations plans (COOP), continuity of government (COG) plans, and emergency operations plans (EOP) would be essential.
- **Develop hazard mitigation projects.** Local officials (e.g., planners and public works officials) can use flood risk information to re-evaluate and prioritize mitigation actions in local hazard mitigation plans.
- **Communicate flood risk.** Local officials can use the information in this report to communicate with property owners, business owners, and other citizens about flood risks, changes since the last FIRM, and areas of mitigation interest. The report layout allows community information to be extracted in a fact sheet format.
- **Inform the modification of development standards.** Floodplain managers, planners, and public works officials can use information in this report to support the adjustment of development standards for certain locations. For example, heavily developed areas tend to increase floodwater runoff because paved surfaces cannot absorb water, indicating a need to adopt or revise standards that provide for appropriate stormwater retention.

The Flood Risk Database, Flood Risk Map, and Flood Risk Report are “non-regulatory” products. They are available and intended for community use but are neither mandatory nor tied to the regulatory development and insurance requirements of the National Flood Insurance Program (NFIP). They may be used as regulatory products by communities if authorized by state and local enabling authorities.

### 1.3. Sources of Flood Risk Assessment Data Used

To assess potential community losses, or the consequences portion of the “risk” equation, the following data is typically collected for analysis and inclusion in a Flood Risk Project:

- Information about local assets or resources at risk of flooding



Vulnerability of infrastructure is another important consideration.



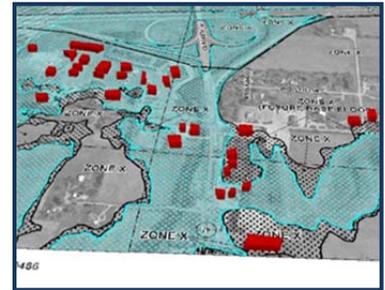
Flooding along the Wabash River in Clark County, Illinois, contributed to a federal disaster declaration on June 24, 2008.

- Information about the physical features and human activities that contribute to that risk
- Information about where the risk is most severe
- For most Flood Risk Projects, FEMA uses the following sources of flood risk information to develop this report:
  - Hazus estimated flood loss information
  - New engineering analyses (e.g., hydrology and hydraulic modeling) to develop new flood boundaries
  - Locally supplied data (see Section 7 for a description)
  - Sources identified during the Discovery process

## 1.4. Related Resources

For a more comprehensive picture of flood risk, FEMA recommends that state and local officials use the information provided in this report in conjunction with other sources of flood risk data, such as those listed below.

- **FIRMs and FISs.** This information indicates areas with specific flood hazards by identifying the limit and extent of the 1-percent-annual-chance floodplain and the 0.2-percent-annual-chance floodplain. FIRMs and FIS Reports do not identify all floodplains in a Flood Risk Project. The FIS Report includes summary information regarding other frequencies of flooding, as well as flood profiles for riverine sources of flooding. In rural areas and areas for which flood hazard data are not available, the 1-percent-annual-chance floodplain may not be identified. In addition, the 1-percent-annual-chance floodplain may not be identified for flooding sources with very small drainage areas (less than 1 square mile).
- **Hazus Flood Loss Estimation Reports.** Hazus can be used to generate reports, maps and tables on potential flood damage that can occur based on new/proposed mitigation projects or future development patterns and practices. Hazus can also run specialized risk assessments, such as what happens when a dam or levee fails. Flood risk assessment tools are available through other agencies as well, including the National Oceanic and Atmospheric Administration (NOAA) and the U.S. Army Corps of Engineers (USACE). Other existing watershed reports may have a different focus, such as water quality, but may also contain flood risk and risk assessment information. See Section 6 for additional resources.
- **Flood or multi-hazard mitigation plans.** Local hazard mitigation plans include risk assessments that contain flood risk information and mitigation strategies that identify community priorities and actions to reduce flood risk. This report was informed by any existing mitigation plans in the Flood Risk Project.



FEMA data can be leveraged to identify and measure vulnerability by including local building information (i.e. building type). The examples above show various ways to display flooding intersecting with buildings.

- **FEMA Map Service Center (MSC).** The MSC has useful information, including fly sheets, phone numbers, data, etc. Letters of Map Change are also available through the MSC. The user can view DFIRM databases and the National Flood Hazard Layer (NFHL) Database.

## 2 Flood Risk Analysis

### 2.1. Overview

Flood hazard identification uses FIRMs, and FIS Reports identify where flooding can occur along with the probability and depth of that flooding. Flood risk assessment is the systematic approach to identifying how flooding impacts the environment. In hazard mitigation planning, flood risk assessments serve as the basis for mitigation strategies and actions by defining the hazard and enabling informed decision making. Fully assessing flood risk requires the following:

- Identifying the flooding source and determining the flood hazard occurrence probability
- Developing a complete profile of the flood hazard including historical occurrence and previous impacts
- Inventorying assets located in the identified flood hazard area
- Estimating potential future flood losses caused by exposure to the flood hazard area

Flood risk analyses are different methods used in flood risk assessment to help quantify and communicate flood risk. Flood risk analysis can be performed on a large scale (state, community) level and on a very small scale (parcel, census block). Advantages of large-scale flood risk analysis, especially at the watershed level, include identifying how actions and development in one community can affect areas up- and downstream. On the parcel or census block level, flood risk analysis can provide actionable data to individual property owners so they can take appropriate mitigation steps.

### 2.2. Analysis of Risk

The FRR, FRM, and FRD contain a variety of flood risk analysis information to help describe and visualize flood risk within the project area. Depending on the scope of the Flood Risk Project for this project area, this information may include some or all of the following elements:

- Changes Since Last FIRM
- Water Surface, Flood Depth, and Analysis Grids
- Flood Risk Assessment Information
- Areas of Mitigation Interest



Flooding impacts non-populated areas too, such as agricultural lands and wildlife habitats.

State and Local Hazard Mitigation Plans are required to have a comprehensive all-hazard risk assessment. The flood risk analyses in the FRR, FRM, and FRD can inform the flood hazard portion of a community's or state's risk assessment. Further, data in the FRD can be used to develop information that meets the requirements for risk assessments as it relates to the hazard of flood in hazard mitigation plans.

### 2.2.1 Changes Since Last FIRM

The Changes Since Last FIRM (CSLF) dataset, stored in the FRD and shown in Section 3 of this report, illustrates where changes to flood risk may have occurred since the last FIRM was published for the subject area. Communities can use this information to update their mitigation plans, specifically quantifying “what is at risk” and identifying possible mitigation activities.

The CSLF dataset identifies changes in the Special Flood Hazard Area (SFHA) and floodway boundary changes since the previous FIRM was developed. These datasets quantify land area increases and decreases to the SFHA and floodway, as well as areas where the flood zone designation has changed (e.g., Zone A to AE, AE to VE, shaded Zone X protected by levee to AE for de-accredited levees).

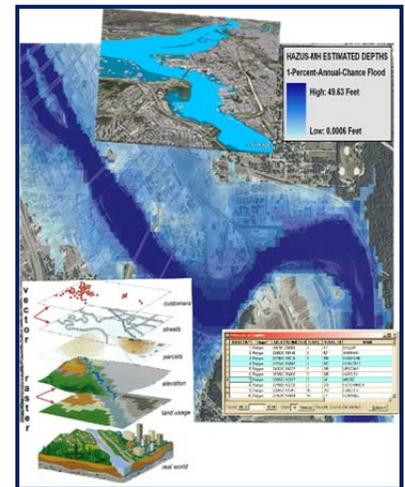
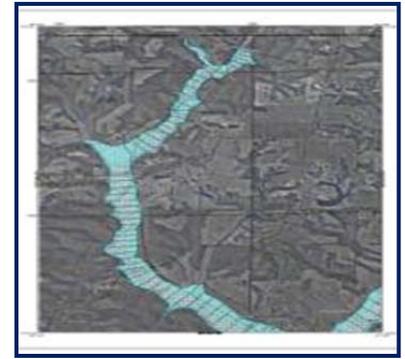
The CSLF dataset is created in areas that were previously mapped using digital FIRMs. The CSLF dataset for this project area includes:

- Floodplain and/or Floodway Boundary Changes: Any changes to the existing floodplain or floodway boundaries are depicted in this dataset
- Floodplain Designation Changes: This includes changed floodplain designations (e.g., Zone A to Zone AE).
- CSLF Information: Within this dataset additional information is provided to help explain the floodplain and floodway boundary changes shown on the FIRM. This information is stored as digital attributes within the CSLF polygons and may include some or all of the following:
  - Changes in peak discharges
  - Changes to the modeling methodology (e.g., tide gage analysis)
  - New flood control structures (e.g., dams, levees, etc.)
  - Changes to hydraulic structures (e.g., bridges, culverts, etc.)
  - Sedimentation and/or Erosion
  - Man-made changes to a watercourse (e.g., realignment or improvement)

It should be noted that reasons for the floodplain and floodway changes (also known as Contributing Engineering Factors) are intended to give the user a general sense of what caused the change, as opposed to providing a reason for each and every area of change.

### 2.2.2 Flood Depth and Analysis Grids

**Grids are FEMA datasets provided in the FRD to better describe the risk** of the flood hazard. While the FIRM and FIS Report describe “what” is at risk by identifying the hazard areas, water surface, flood depth, and analysis grids can help define “how bad” the risk is within those



Floodplain maps have evolved considerably from the older paper-based FIRMs to the latest digital products and datasets.

CSLF data can be used to communicate changes in the physical flood hazard area (size, location) as part of the release of new FIRMs. It can also be used in the development or update of hazard mitigation plans to describe changes in hazard as part of the hazard profile.

CSLF data is shown in the FRR, and underlying data is stored in the FRD.

identified areas. These grids are intended to be used by communities for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management.

Grids provided in the FRD for this project area include the following:

- Flood Depth Grids: (for the calculated flood frequencies included in the FIS Report):** Flood Depth Grids are created for each flood frequency calculated during the course of a Flood Risk Project. These grids communicate flood depth as a function of the difference between the calculated water surface elevation and the ground. Five grids will normally be delivered for riverine areas for the standard flood frequencies (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance). Coastal areas only receive the 1-percent-annual-chance grid.

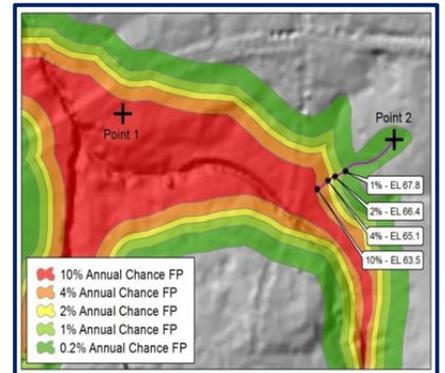
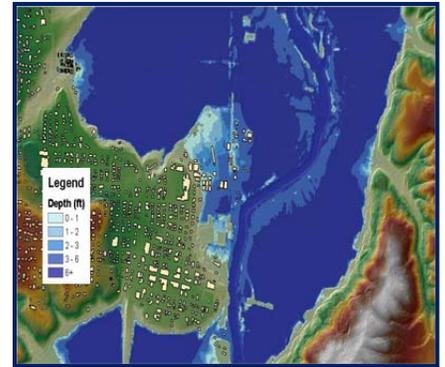
Depth grids form the basis for refined Hazus loss estimates (as presented in a table in Section 3 of this report) and are used to calculate potential flood losses for display on the FRM and for tabular presentation in this report. Depth grids may also be used for a variety of ad-hoc risk visualization and mitigation initiatives.

- Percent Annual Chance of Flooding Grid:** This is a grid dataset that represents the percent annual chance of flooding for locations along a flooding source. This grid uses the five standard flood frequencies.
- Percent 30-Year Chance of Flooding Grid:** This is a grid dataset that represents the estimated likelihood of flooding at least once within a 30-year period, which is the average lifespan for a home mortgage, for all locations within the extent of the 1-percent-annual-chance and 0.2-percent-annual-chance floodplain.

### 2.2.3 Estimate Flood Loss Information

Flood loss estimates provided in the FRR were developed using a FEMA flood loss estimation tool, Hazus. Originally developed for earthquake risk assessment, Hazus has evolved into a multi-hazard tool developed and distributed by FEMA that can provide loss estimates for floods, earthquakes, and hurricane winds. Hazus is a nationally accepted, consistent flood risk assessment tool to assist individuals and communities to create a more accurate picture of flood risk. Some benefits of using Hazus include the following:

- Outputs that can enhance state and local mitigation plans and help screen for cost-effectiveness in FEMA mitigation grant programs
- Analysis refinement through updating inventory data and integrating data produced using other flood models
- Widely available support documents and networks (Hazus Users Groups)



Grid data can make flood mapping more informative. The top image is a flood depth grid showing relative depths of water in a scenario flood event. The bottom image is a percent annual chance of flooding grid, which shows inundation areas of various frequency floods.

Grid data can be used to communicate the variability of floodplains, such as where floodplains are particularly deep or hazardous, where residual risks lie behind levees, and where losses may be great after a flood event. For mitigation planning, grid data can inform the hazard profile and vulnerability analysis (what is at risk for different frequencies) and can be used for preliminary benefit-cost analysis screening. For floodplain management, higher regulatory standards can be developed in higher hazard flood prone areas (i.e., 10-percent-chance floodplains or deep floodplains).

Grid data is stored in the FRD, and a list of available grid data is provided in the FRR. Visualizations of grids (maps) are not provided.

Files from the FRD can be imported into Hazus to develop other risk assessment information including:

- Debris generated after a flood event
- Dollar loss of the agricultural products in a study region
- Utility system damages in the region
- Vehicle loss in the study region
- Damages and functionality of lifelines such as highway and rail bridges, potable water, and wastewater facilities



### Scenario-Based Flood Loss Estimates:

Scenario-based flood losses have been calculated using Hazus for the 10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events. In this report, these losses are expressed in dollar amounts and are provided for the Flood Risk Project area only, even though results are shown for the entire watershed and at the local jurisdiction level.

Loss estimates are based on best available data, and the methodologies applied result in an approximation of risk. These estimates should be used to understand relative risk from flood and potential losses.

Uncertainties are inherent in any loss estimation methodology, arising in part from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, demographics, or economic parameters).

Flood loss estimates are being provided at the project and community levels for multiple flood frequencies including:

- **Residential Asset Loss:** These include direct building losses (estimated costs to repair or replace the damage caused to the building) for all classes of residential structures including single family, multi-family, manufactured housing, group housing, and nursing homes. This value also includes content losses.
- **Commercial Asset Loss:** These include direct building losses for all classes of commercial buildings including retail, wholesale, repair, professional services, banks, hospitals, entertainment, and parking facilities. This value also includes content and inventory losses.
- **Other Asset Loss:** This includes losses for facilities categorized as industrial, agricultural, religious, government, and educational. This value also includes content and inventory losses.
- **Essential Facility Losses:** Essential facilities are defined in Hazus as facilities which provide services to the community and should be functional after a flood, including schools, police stations, fire stations, medical facilities, and emergency operation centers. These facilities would otherwise be considered critical

Hazus is a loss estimation methodology developed by FEMA for flood, wind, and earthquake hazards. The methodology and data established by Hazus can also be used to study other hazards.

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facilities for mitigation planning purposes. Estimated damages (in terms of loss of function) for essential facilities are determined on a site-specific basis according to latitude and longitude. For this report, Hazus calculates the types and numbers of essential facilities impacted.

- **Infrastructure:** For analysis of infrastructure, Hazus supports the analysis of transportation systems and lifeline utility systems. Transportation systems include highways, railways, light railways, busses, ports and harbors, ferries, and airport systems. Utility systems include potable water systems, wastewater, oil, natural gas, electric power, and communication systems. For this report, Hazus calculates the types of infrastructure impacted.
- **Business Disruption:** This includes the losses associated with the inability to operate a business due to the damage sustained during the flood. Losses include inventory, income, rental income, wage, and direct output losses, as well as relocation costs.
- **Annualized Losses:** Annualized losses are calculated using Hazus by taking losses from multiple events over different frequencies and expressing the long-term average by year. This factors in historic patterns of frequent smaller floods with infrequent but larger events to provide a balanced presentation of flood damage.
- **Loss Ratio:** The loss ratio expresses the scenario losses divided by the total building value for a local jurisdiction and can be a gage to determine overall community resilience as a result of a scenario event. For example, a loss ratio of 5 percent for a given scenario would indicate that a local jurisdiction would be more resilient and recover more easily from a given event, versus a loss ratio of 75 percent which would indicate widespread losses. An annualized loss ratio uses the annualized loss data as a basis for computing the ratio. Loss ratios are not computed for business disruption. These data are presented in the FRR.
- **Hazus Flood Risk Value:** On the FRM, flood risk is expressed in the following five categories: very low, low, medium, high, and very high for census blocks that have flood risk. It is based on the 1-percent-annual-chance total asset loss by census block.

Hazus-estimated loss data can be used in many ways to support local decision making and explanation of flood risk. For mitigation planning purposes, loss data can be used to help meet requirements to develop loss information for the hazard of flood. Also, the FRM can show where flood risk varies by geographic location. For emergency management, Hazus data can help forecast losses based on predicted events, and resources can be assigned accordingly. Loss information can support floodplain management efforts, including those to adopt higher regulatory standards. *Also, awareness of exposed essential facilities and infrastructure encourages mitigation actions to protect citizens from service disruption should flooding occur.*

Hazus estimated loss data is summarized in the FRR and on the FRM and stored in the FRD.

#### 2.2.4 Areas of Mitigation Interest

Many factors contribute to flooding and flood losses. Some are natural, and some are not. In response to these risks, there has been a focus by the federal government, state agencies, and local jurisdictions to mitigate properties against the impacts of flood hazards so that future losses and impacts can be reduced. An area identified as an Area of

Mitigation Interest (AoMI) is an important element of defining a more comprehensive picture of flood risk and mitigation activity in a watershed, identifying target areas and potential projects for flood hazard mitigation, encouraging local collaboration, and communicating how various mitigation activities can successfully reduce flood risk.

This report and the FRM may include information that focuses on identifying Areas of Mitigation Interest that may be contributing (positively or negatively) to flooding and flood losses in the Flood Risk Project. AoMIs are identified through coordination with local stakeholders; through revised hydrologic and hydraulic and/or coastal analyses; by leveraging other studies or previous flood studies; from community mitigation plans, floodplain management plans, and local surveys; and from the mining of federal government databases (e.g., flood claims, disaster grants, and data from other agencies). Below is a list of the types of Areas of Mitigation Interest that may be identified in this Flood Risk Report, shown on the Flood Risk Map, and stored in the Flood Risk Database:

- **Dams**

A dam is a barrier built across a waterway for impounding water. Dams vary from impoundments that are hundreds of feet tall and contain thousands of acre-feet of water (e.g., Hoover Dam) to small dams that are a few feet high and contain only a few acre-feet of water (e.g., small residential pond). “Dry dams,” which are designed to contain water only during floods and do not impound water except for the purposes of flood control, include otherwise dry land behind the dam.

While most modern, large dams are highly engineered structures with components such as impervious cores and emergency spillways, most smaller and older dams are not. State dam safety programs emerged in the 1960s, and the first Federal Guidelines for Dam Safety were not prepared until 1979. By this time, the vast majority of dams in the United States had already been constructed.

- **Reasons dams are considered AoMIs:**

- Many older dams were not built to any particular standard and thus may not withstand extreme rainfall events. Older dams in some parts of the country are made out of an assortment of materials. These structures may not have any capacity to release water and could be overtopped, which could result in catastrophic failure.
- Even dams that follow current dam safety programs may not be regulated, as downstream risk may have changed since the dam was constructed. Years after a dam is built, a house, subdivision, or other development may be constructed in the area downstream of the dam. Thus, a subsequent dam failure could result in damage. Since these



Dams vary in size and shape, the amount of water they impound, and their assigned hazard classification.



This dam failure caused flooding that damaged several homes and vehicles.

dams are not regulated, it is impossible to predict how safe they are.

- A significant dam failure risk is structural deficiencies associated with older dams that are not being adequately addressed today through needed inspection/maintenance practices.
- For larger dams a flood easement may have been obtained on a property. However, there may have been buildings constructed in violation of the flood easement.
- When a new dam is constructed, the placement of such a large volume of material in a floodplain area (if that is the dam location) will displace flood waters and can alter how the watercourse flows. This can result in flooding upstream, downstream, or both.
- For many dams, the dam failure inundation zone is not known. Not having knowledge of these risk areas could lead to unprotected development in these zones.

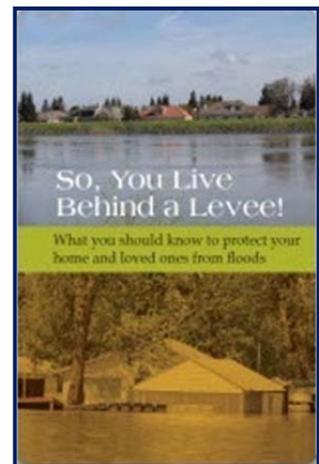
- **Levees and Major Embankments**

FEMA defines a levee as “a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.” Levees are sometimes referred to as dikes. Soil used to construct a levee is compacted to make the levee as strong and stable as possible. To protect against erosion and scouring, levees can be covered with everything from grass and gravel to harder surfaces like stone (riprap), asphalt, or concrete.

Similar to dams, levees have not been regulated in terms of safety and design standards until relatively recently. Many older levees were constructed in a variety of ways, from a farmer piling dirt along a stream to prevent nuisance flooding to levees made out of old mining spoil material. As engineered structures, levees are designed to a certain height and can fail if a flood event is greater than anticipated.

A floodwall is a vertical wall that is built to provide protection from a flood in a similar manner as a levee. Typically made of concrete or steel, floodwalls often are erected in urban locations where there is not enough room for a levee. Floodwalls are sometimes constructed on a levee crown to increase the levee’s height.

Most new dams and levees are engineered to a certain design standard. If that design is exceeded, they could be overtopped and fail catastrophically, causing more damage than if the levee was not there in the first place. Few levees anywhere in the nation are built to more than a 1-percent-annual-chance flood protection rating,



For more information about the risks associated with living behind levees, consult the publication “So, You Live Behind a Levee!” published by the American Society of Civil Engineers at <http://content.asce.org/ASCELeveeGuide.html>.

and the areas behind them are still at some risk for flooding. This threat is called residual risk. In some states, residual risk areas can extend up to 15 miles from a riverbank. Although the probability of flooding may be lower because a levee exists, risk is nonetheless still present. The American Society of Civil Engineers' publication "So, You Live Behind a Levee!" provides an in-depth explanation of levee and residual risk.

Major embankments, on the other hand, are rarely designed with any flood protection level in mind. Railroads, road abutments, and canals—especially in the Western United States—are not considered levees or dams and have issues such as unknown construction materials/methods. These embankments are not regulated from a flood risk standpoint.

o **Reasons levees and major embankments are considered AoMIs:**

- Like dams, many levees in the United States were constructed using unknown techniques and materials. These levees have a higher failure rate than those that have been designed to today's standards.
- A levee might not provide the flood risk reduction it once did as a result of flood risk changes over time. Flood risk can change due to a number of factors, including increased flood levels due to climate change or better estimates of flooding, development in the watershed increasing flood levels and settlement of the levee or floodwall, and sedimentation in the levee channel. Increased flood levels mean decreased flood protection. The lack of adequate maintenance over time will also reduce the capability of a levee to contain the flood levels for which it was originally designed.
- Given enough time, any levee will eventually be overtopped or damaged by a flood that exceeds the levee's capacity. Still, a widespread public perception of levees is that they will always provide protection. This perception may lead to not taking mitigation actions such as purchasing flood insurance.
- A levee is a system that can fail due to its weakest point, and therefore maintenance is critical. Many levees in the United States are poorly maintained or not maintained at all. Maintenance also includes maintaining the drainage systems behind the levees so they can keep the protected area dry.



Canal levee breaches as a result of Hurricane Katrina in New Orleans in 2005. Note damages can be more extensive due to high velocity flood flows than if the levee was not there.

- **Stream Flow Constrictions**

A stream flow constriction occurs when a human-made structure, such as a culvert or bridge, constricts the flow of a river or stream. The results of this constriction can be increased damage potential to the structure, an increase in velocity of flow through the structure, and the creation of significant ponding or backwater upstream of the structure. Regulatory standards regarding the proper opening size for a structure spanning a river or stream are not consistent and may be non-existent. Some local regulations require structures to pass a volume of water that corresponds to a certain size rain event; however, under sizing, these openings can result in flood damage to the structure itself. After a large flood event, it is not uncommon to have numerous bridges and culverts “washed out.”

- **Reasons stream flow constrictions are considered AoMIs:**

- Stream flow constrictions can back water up on property upstream of the structure if not designed properly.
- These structures can accelerate the flow through the structure causing downstream erosion if not properly mitigated. This erosion can affect the structure itself, causing undermining and failure.
- If the constriction is a bridge or culvert, it can get washed out causing an area to become isolated and potentially more difficult to evacuate.
- Washed-out culverts and associated debris can wash downstream and cause additional constrictions.

- **At-Risk Essential Facilities**

Essential facilities, sometimes called “critical facilities,” are those whose impairment during a flood could cause significant problems to individuals or communities. For example, when a community’s wastewater treatment is flooded and shut down, not only do contaminants escape and flow into the floodwaters, but backflows of sewage can contaminate basements or other areas of the community. Similarly, when a facility such as a hospital is flooded, it can result in a significant hardship on the community not only during the event but long afterwards as well.

- **Reasons at-risk essential facilities are considered AoMIs:**

- Costly and specialized equipment may be damaged and need to be replaced.
- Impairments to facilities such as fire stations may result in lengthy delays in responding and a focus on evacuating the facility itself.

- Critical records and information stored at these facilities may be lost.

- **Past Flood Insurance Claims and Individual Assistance/Public Assistance Hotspots**

Assistance provided after flood events (flood insurance in any event and Individual Assistance [IA] or Public Assistance [PA] after declared disasters) occurs in flood affected areas. Understanding geographically where this assistance is being provided may indicate unique flood problems.

Flood insurance claims are not always equally distributed in a community. Although estimates indicate that 20 to 50 percent of structures in identified flood hazard areas have flood insurance, clusters of past claims may indicate where there is a flood problem. However, clusters of past claims and/or areas where there are high payments under FEMA’s IA or PA Programs may indicate areas of significant flood hazard.

- **Reasons past claim hotspots are considered AoMIs:**

- A past claim hotspot may reflect an area of recent construction (large numbers of flood insurance policies as a result of a large number of mortgages) and an area where the as-built construction is not in accordance with local floodplain management regulations.
- Sometimes clusters of past claims occur in subdivisions that were constructed before flood protection standards were in place, places with inadequate stormwater management systems, or in areas that may not have been identified as SFHAs.
- Clusters of IA or PA claims may indicate areas where high flood insurance coverage or other mitigation actions are needed.

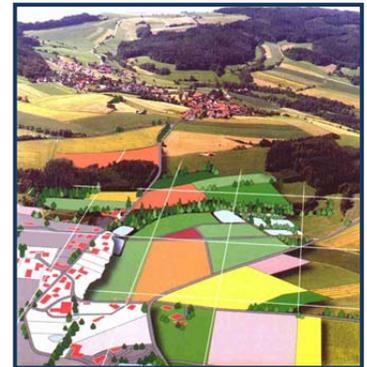
- **Areas of Significant Land Use Change**

Development, whether it is a 100-lot subdivision or a single lot big box commercial outlet, can result in large amounts of fill and other material being deposited in flood storage areas, thereby increasing flood hazards downstream.

Additionally, when development occurs, hard surfaces such as parking lots, buildings and driveways do not allow water to absorb into the ground, and more of the rainwater becomes runoff flowing directly into streams. As a result, the “peak flow” in a stream after a storm event will be higher and will occur faster. Without careful planning, major land use changes can affect the impervious area of a site and result in a significant increase in flood risk caused by streams that cannot handle the extra storm water runoff.



*Clusters of past flood insurance claims can show where there is a repetitive flood problem.*



Rooftops, pavements, patios, and driveways contribute to the impervious area in a watershed. This occurs in both urban areas and rural areas being developed.

Sometimes a major land use change may be for planning purposes only. For example, a land use change that rezones land from a classification such as floodplain that restricts development to a zone such as industrial or high density residential could result in significant new infrastructure and structures in high flood risk areas.

- **Reasons Areas of Significant Land Use Change are considered AoMIs:**

- Development in areas mapped SFHA reduces flood storage areas, which can make flooding worse at the development site and downstream of it.
- Impervious surfaces speed up the water flowing in the streams, which can increase erosion and the danger that fast-flowing floodwaters pose to people and buildings.
- Rezoning flood-prone areas to high densities and/or higher intensity uses can result in more people and property at risk of flooding and flood damage.

- **Key Emergency Routes Overtopped During Frequent Flooding Events**

Roads are not always elevated above estimated flood levels, and present a significant flood risk to motorists during flooding events. When alternate routes are available, risks may be reduced, including risks to life and economic loss.

- **Reasons overtopped roads are considered AoMIs:**

- Such areas, when identified, can be accounted for and incorporated into Emergency Action Plans.
- Roads may be elevated or reinforced to reduce the risk of overtopping during flood events.

- **Drainage or Stormwater-Based Flood Hazard Areas, or Areas Not Identified as Floodprone on the FIRM But Known to Be Inundated**

Flood hazard areas exist everywhere. While FEMA maps many of these, others are not identified. Many of these areas may be located in communities with existing, older, and often inadequate stormwater management systems or in very rural areas. Other similar areas could be a result of complex or unique drainage characteristics. Even though they are not mapped, awareness of these areas is important so adequate planning and mitigation actions can be performed.

- **Reasons drainage or stormwater-based flood hazard areas or unidentified floodprone locations are considered AoMIs:**

- So further investigation of such areas can occur and, based on scientific data, appropriate mitigation actions can result (i.e., land use and building standards).



When large highways close due to flooding, traffic is detoured causing inconvenience and economic loss.

- To create viable mitigation project applications in order to reduce flood losses.

- **Areas of Mitigation Success**

Flood mitigation projects are powerful tools to communicate the concepts of mitigation and result in more resilient communities. Multiple agencies have undertaken flood hazard mitigation actions for decades. Both structural measures—those that result in flood control structures—and non-structural measures have been implemented in thousands of communities. An extensive list of mitigation actions can be found in Section 4.

- **Reasons areas of mitigation success are considered AoMIs:**

- Mitigation successes identify those areas within the community that have experienced a reduction or elimination of flood risk.
- Such areas are essential in demonstrating successful loss reduction measures and in educating citizens and officials on available flood hazard mitigation techniques.
- Avoided losses can be calculated and shown.

- **Areas of Significant Riverine or Coastal Erosion**

Stream channels and coastlines are constantly subject to the forces of erosion. Areas of erosion (stream or coastal) threaten infrastructure, general building stock, and businesses, and also pose a threat to human life.

- **Reasons why areas of significant riverine or coastal erosion are considered AoMIs:**

- A community may wish to avoid development in areas identified as subject to erosion hazards.
- Riverine flood damage assessments generally consider inundation alone.
- Landslides and mudslides are a result of erosion.
- Bank erosion caused by within channel flows is not recognized as a significant hazard in Federal floodplain management regulations.
- Riverine and coastal erosion can undercut structures and roads, causing instability and possible collapse.
- Approximately one-third of the nation's streams experience severe erosion problems.

- **Other**

Other types of flood risk areas include drainage or stormwater-based flood hazard areas, or areas known to be inundated during storm events.

## **Flood Risk Analysis Results**

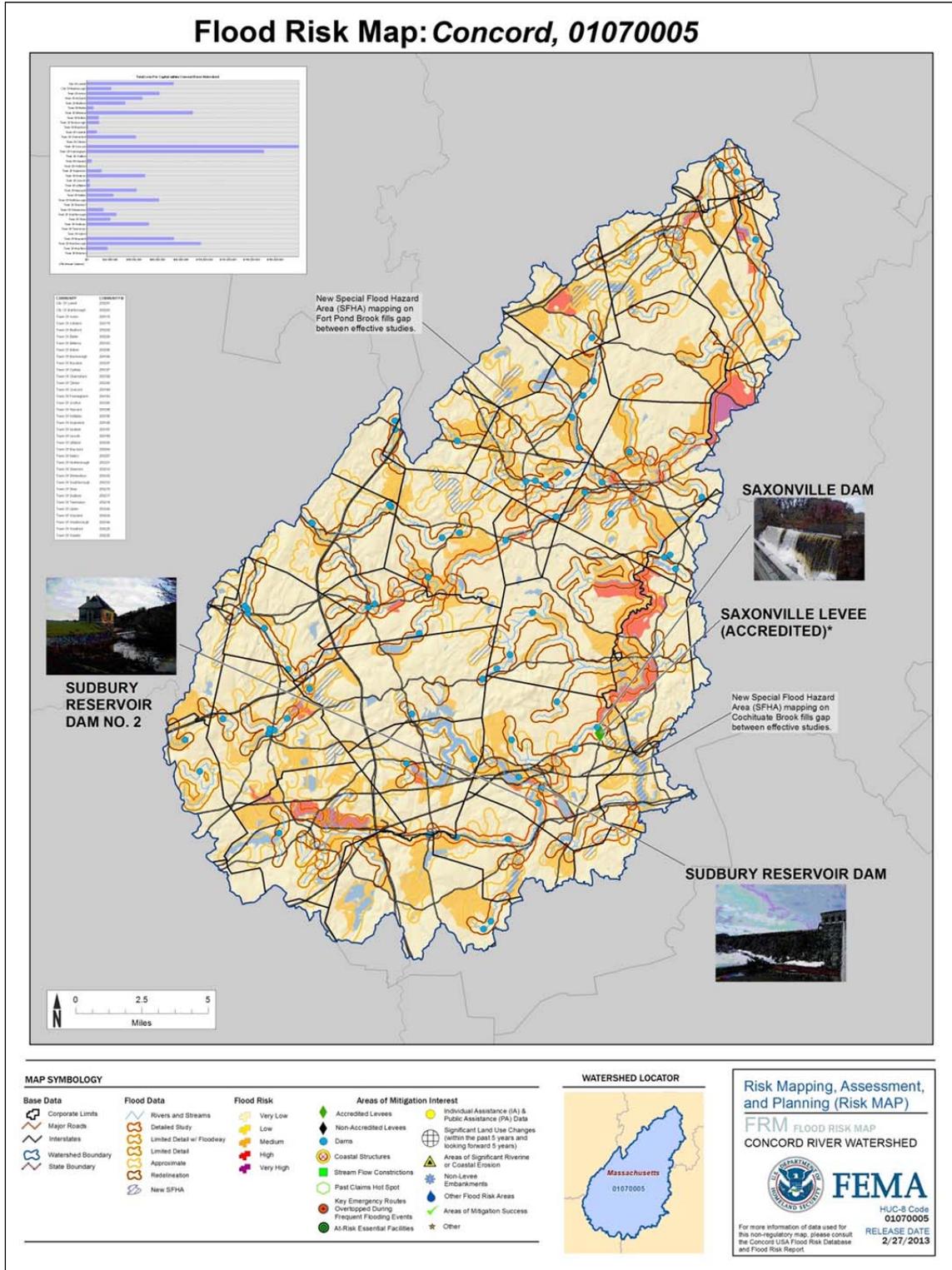
The following pages provide summary flood risk results for the Flood Risk Project as follows:

- **Flood Risk Map (FRM).** Within the Flood Risk Project the FRM displays base data reflecting community boundaries, major roads, and stream lines; potential losses that include both the 2010 Flood Average Annualized Loss (AAL) Study supplemented with new Hazus runs for areas with new or updated flood modeling; new Flood Risk Project areas; a bar chart summarizing community per capita loss; and graphics and text that promote access and usage of additional data available through the FRD, FIRM, and National Flood Hazard Layer and viewers (desktop or FEMA website, etc.). This information can be used to assist in Flood Risk Project-level planning as well as for developing mitigation actions within each jurisdiction located within the Flood Risk Project.
- **Flood Risk Project Summary.** Within the Flood Risk Project area, summary data for some or all of the following datasets are provided for the entire project area and also on a jurisdiction by jurisdiction basis:
  - **Changes Since Last FIRM (CSLF).** This is a summary of where the floodplain and flood zones have increased or decreased (only analyzed for areas that were previously mapped using digital FIRMs).
  - **Flood Depth and Analysis Grids.** A general discussion of the data provided in the FRD.
  - **Flood Risk Assessment Information.** A loss estimation of potential flood damages using different flood scenarios.
  - **Areas of Mitigation Interest.** A description of areas that may require mitigation or additional risk analysis.

The FRM provides a graphical overview of the Flood Risk Project which highlights areas of risk that should be noted, based on potential losses, exposed facilities, etc., based on data found in the FRD. Refer to the data in the FRD to conduct additional analyses.

## 2.3. Flood Risk Map

The Flood Risk Map for this Flood Risk Project is shown below. In addition to this reduced version of the map, a full size version is available within the FRD.



## 2.4. Concord Flood Risk Project Area Summary

The Concord Watershed encompasses portions of 2 counties and 36 communities in Massachusetts with a total land area of 678 square miles. The Assabet and Sudbury River confluence forms the Concord River. For approximately 15 miles the Concord River flows north through the towns of Concord, Carlisle, Bedford and Billerica. At its mouth, the Concord River makes confluence with the Merrimack River, in the Town of Lowell. In Billerica, the Talbot Mills Dam and the Centennial Island Hydropower Project Dam compound the Concord River. Within a one mile stretch, there are three waterfalls on the Concord River, in the Town of Lowell. Both the Mill Brook and River Meadow Brook are tributaries to the Concord River. The Town of Billerica’s treated water supply comes from the Concord River. Additionally the Concord River receives discharges from four municipalities’ wastewater treatment plants, along with several industrial users.

### 2.4.1 Overview

*The Concord Watershed, located in Massachusetts, includes the following communities:*

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
City Of Lowell	250201	105,159	34	14.5	34	Y	N/A	Y
City Of Marlborough	250203	37,783	100	22.1	100	Y	N/A	Y
Town Of Acton	250176	22,216	100	20.3	100	Y	N/A	Y
Town Of Ashland	250179	17,428	95	12.9	95	Y	N/A	Y
Town Of Bedford	255209	12,589	26	13.8	26	Y	N/A	Y
Town Of Berlin	250294	4,592	100	13.2	100	Y	N/A	Y
Town Of Billerica	250183	39,015	51	26.3	51	Y	N/A	Y
Town Of Bolton	250296	5,230	72	20.1	72	Y	N/A	Y
Town Of Boxborough	250184	6,239	66	10.4	66	Y	N/A	Y
Town Of Boylston	250297	4,032	24	19.7	24	Y	N/A	Y
Town Of Carlisle	250187	9,637	100	15.5	100	Y	N/A	Y

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Chelmsford	250188	33,856	65	23.1	65	Y	N/A	Y
Town Of Clinton	250300	13,435	15	7.3	15	Y	N/A	Y
Town Of Concord	250189	20,489	95	25.8	95	Y	N/A	Y
Town Of Framingham	250193	73,095	100	26.5	100	Y	N/A	Y
Town Of Grafton	250306	14,894	7	23.3	7	Y	N/A	Y
Town Of Harvard	250308	5,981	22	27.2	22	Y	N/A	Y
Town Of Holliston	250195	13,815	1	19.0	1	Y	N/A	Y
Town Of Hopkinton	250196	13,346	75	27.9	75	Y	N/A	Y
Town Of Hudson	250197	20,166	100	11.9	100	Y	N/A	Y
Town Of Lincoln	250199	8,042	27	15.0	27	Y	N/A	Y
Town Of Littleton	250200	8,144	42	17.5	42	Y	N/A	Y
Town Of Maynard	250204	11,583	100	5.4	100	Y	N/A	Y
Town Of Natick	250207	32,074	40	16.0	40	Y	N/A	Y
Town Of Northborough	250321	16,273	100	18.7	100	Y	N/A	Y
Town Of Sherborn	250212	4,566	20	16.1	20	Y	N/A	N/A
Town Of Shrewsbury	250332	31,626	37	21.8	37	Y	N/A	Y
Town Of Southborough	250333	11,158	100	15.5	100	Y	N/A	Y
Town Of Stow	250216	7,495	100	18.0	100	Y	N/A	Y
Town Of Sudbury	250217	20,680	100	24.7	100	Y	N/A	Y

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Tewksbury	250218	28,828	5	21.1	5	Y	10	Y
Town Of Upton	250340	5,642	3	21.8	3	Y	N/A	Y
Town Of Wayland	250224	15,640	96	15.9	96	Y	N/A	Y
Town Of Westborough	250344	20,056	100	21.5	100	Y	N/A	Y
Town Of Westford	250225	20,796	34	31.4	34	Y	N/A	Y
Town Of Weston	250226	11,483	9	17.3	9	Y	N/A	Y

Community-specific results are provided on subsequent pages. Data provided below and on subsequent pages only includes areas located within the Concord Flood Risk Project and do not necessarily represent community-wide totals.

Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.4.2 Flood Risk Datasets

As a part of this Flood Risk Project, flood risk datasets were created for inclusion in the Flood Risk Database. Those datasets are summarized for this Flood Risk Project below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Concord Watershed were updated due to new engineering analysis and stream redelineation. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the watershed.

Area of Interest	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Area within SFHA*	104.0	15.8	14.2	1.6
Area within Floodway*	17.0	4.0	2.0	2.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Concord, the figures in this table only represent information within the Concord.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- Evidence of actual flood losses can be one of the most compelling factors for increasing a community’s flood risk awareness. **During this Risk MAP project, FEMA confirmed several areas within this watershed as having mitigation potential and encourages the communities within the watershed to continue working with the State Hazard Mitigation Officer to further identify and mitigate these high-risk areas and structures.** Specific areas within each jurisdiction are detailed within the individual community summaries.
- **Flood Depth and Analysis Grids**
  - The FRD contains datasets in the form of depth grids for the entire Flood Risk Project that can be used for additional analysis, enhanced visualization, and communication of flood risks for hazard mitigation planning and emergency management. The data provided within the FRD should be used to further isolate areas where flood mitigation potential is high and may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation. Section 2 of the FRR provides general information regarding the development of and potential uses for this data.
- **Flood Risk Results Information**
  - The Concord Watershed flood risk analysis incorporates results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were estimated as well as potential loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>1</sup>	Loss Ratio <sup>2</sup>								
Residential Building/Contents	\$45,092,200,000	63%	\$225,900,000	1%	\$367,700,000	1%	\$495,100,000	1%	\$622,800,000	1%	\$14,000,000	0%
Commercial Building/Contents	\$16,927,900,000	24%	\$251,600,000	1%	\$365,800,000	2%	\$478,500,000	3%	\$574,900,000	3%	\$30,400,000	0%
Other Building/Contents	\$9,028,500,000	13%	\$115,800,000	1%	\$172,300,000	2%	\$226,400,000	3%	\$262,000,000	3%	\$16,700,000	0%
Total Building/Contents <sup>2</sup>	\$71,048,600,000	100%	\$593,300,000	1%	\$905,800,000	1%	\$1,199,900,000	2%	\$1,459,700,000	2%	\$61,100,000	0%
Business Disruption <sup>3</sup>	N/A	N/A	\$21,100,000	N/A	\$30,900,000	N/A	\$38,900,000	N/A	\$44,400,000	N/A	\$3,200,000	N/A
<b>TOTAL<sup>4</sup></b>	\$71,048,600,000	N/A	\$610,000,000	1%	\$930,900,000	1%	\$1,231,000,000	2%	\$1,495,800,000	2%	\$64,300,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>2</sup>Loss ratio = Dollar Losses ÷ Estimated Value. Loss Ratios are rounded to the nearest integer percent.

<sup>3</sup>Total Building ÷ Contents Loss = Residential Building ÷ Contents Loss + Commercial Building ÷ Contents Loss + Other Building ÷ Contents Loss.

<sup>4</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>5</sup>Total Loss = Total Building ÷ Contents + Business Disruption

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5. Communities

The following sections provide an overview of the community’s floodplain management program as of the date of this publication, as well as summarize the flood risk analysis performed for each project area in Concord Watershed.

### 2.5.1 City Of Lowell Summary (CID 250201)

The following pages include Flood Risk data for the City Of Lowell.

#### 2.5.1.1. Overview

The City of Lowell is located at the confluence of the Merrimack and Concord rivers in north Middlesex County. It is the fourth largest city in Massachusetts. The bordering towns (clockwise from north) are Dracut, Tewksbury, Billerica, Chelmsford, and Tyngsboro. The information below provides an overview of the City Of Lowell as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
City Of Lowell	250201	105,159	34	14.5	34	Y	N/A	Y

- Participating in Northern Middlesex Region, MA Pre-Disaster Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 1,107 policies totaling approximately \$199,242,900
- NFIP-recognized repetitive loss properties = 53

Data provided below only includes areas within the City Of Lowell, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.1.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the City of Lowell were updated due to new engineering analysis performed on the Concord River and the redelineation of Hales Brook, Marginal Brook and River Meadow Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.4	0.0	0.1	0.0
Within Floodway	0.2	0.0	0.1	-0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of City Of Lowell, the figures in this table only represent information within the City Of Lowell.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The City of Lowell’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$2,660,200,000	4%	\$7,300,000	0%	\$19,100,000	1%	\$15,700,000	1%	\$24,100,000	1%	\$3,300,000	0%
Commercial Building/Contents	\$1,056,300,000	1%	\$17,700,000	2%	\$32,600,000	3%	\$37,100,000	4%	\$55,500,000	5%	\$5,200,000	0%
Other Building/Contents	\$472,300,000	1%	\$14,500,000	3%	\$23,100,000	5%	\$16,600,000	4%	\$21,500,000	5%	\$4,200,000	1%
Total Building/Contents <sup>2</sup>	\$4,188,800,000	6%	\$39,500,000	1%	\$74,700,000	2%	\$69,500,000	2%	\$101,000,000	2%	\$12,600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$3,500,000	N/A	\$5,100,000	N/A	\$4,400,000	N/A	\$5,500,000	N/A	\$800,000	N/A
<b>TOTAL<sup>4</sup></b>	\$4,188,800,000	N/A	\$42,900,000	1%	\$79,700,000	2%	\$73,800,000	2%	\$106,500,000	3%	\$13,400,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.2 City Of Marlborough Summary (CID 250203)

The following pages include Flood Risk data for the City Of Marlborough.

### 2.5.2.1. *Overview*

The City Of Marlborough is located in western Middlesex County. Marlborough is bordered by six towns: Hudson on the north, Berlin and Northborough on the west, Southborough on the south, Sudbury and Framingham on the east. The information below provides an overview of the City Of Marlborough as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
City Of Marlborough	250203	37,783	100	22.1	100	Y	N/A	Y

- Participating in Marlborough, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 8/7/2013.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 34 policies totaling approximately \$8,458,000

Data provided below only includes areas within the City Of Marlborough, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.2.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the City of Marlborough were updated due to new engineering analysis performed on the Assabet River, Assabet River Tributary 5, Assabet River Tributary 5.1, Assabet River Tributary 6, Barefoot Brook, Fort Meadow Tributary 1, Road Brook, Road Brook Tributary 2, South Brook, South Street Brook, Tributaries C and D to Hop Brook North and the redelineation of Broad Meadow Brook, Fort Meadow Brook, Hop Brook, Mowry Brook, and Walker Brook 3. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.7	0.6	0.3	0.3
Within Floodway	0.1	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of City Of Marlborough, the figures in this table only represent information within the City Of Marlborough.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The City of Marlborough’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios									
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>						
Residential Building/Contents	\$3,770,500,000	5%	\$2,300,000	0%	\$2,600,000	0%	\$3,500,000	0%	\$3,400,000	0%
Commercial Building/Contents	\$1,777,400,000	3%	\$3,700,000	0%	\$4,700,000	0%	\$11,400,000	1%	\$6,600,000	0%
Other Building/Contents	\$1,207,000,000	2%	\$1,800,000	0%	\$2,100,000	0%	\$5,100,000	0%	\$2,800,000	0%
Total Building/Contents <sup>2</sup>	\$6,754,800,000	10%	\$7,800,000	0%	\$9,400,000	0%	\$20,100,000	0%	\$12,700,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$300,000	N/A	\$300,000	N/A	\$800,000	N/A	\$400,000	N/A
<b>TOTAL<sup>4</sup></b>	\$6,754,800,000	N/A	\$7,900,000	0%	\$9,600,000	0%	\$20,700,000	0%	\$13,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined and potential mitigation actions that could be considered for each type.

### 2.5.3 Town Of Acton Summary (CID 250176)

The following pages include Flood Risk data for the Town Of Acton.

#### 2.5.3.1. Overview

The Town of Acton is located in central Middlesex County. Acton has two primary stream systems: the Nashoba Brook system including the incoming streams Butter Brook, Will's Hole Brook and Conant Brook and the Fort Pond Brook system including the incoming streams Guggins Brook, Inch Brook, Grassy Pond Brook, Pratt's Brook and Coles Brook. Both stream systems empty into the Assabet River, which passes briefly through the town at its southern corner. It is bordered by Westford and Littleton to the north, Concord and Carlisle to the east, Stow and Maynard to the south, and Boxborough to the west. The information below provides an overview of the Town Of Acton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Acton	250176	22,216	100	20.3	100	Y	N/A	Y

- Participating in Acton, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 4/27/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 136 policies totaling approximately \$31,386,200
- NFIP-recognized repetitive loss properties = 13

Data provided below only includes areas within the Town Of Acton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.3.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Acton were updated due to new engineering analysis performed on the Assabet River, Coles Brook, Coles Brook Tributary 2, Fort Pond Brook, Fort Pond Brook Branch 1, Fort Pond Brook Tributary 1, Fort Pond Brook Tributary 2, Fort Pond Brook Tributary 3, Grassy Pond Brook, Grassy Pond Brook Tributary 1, Grassy Pond Brook Tributary 2, Heath Hen Meadow Brook, Heath Hen Meadow Brook Split 1, Inch Brook, Muddy Brook, Nashoba Brook, Pratts Brook, Pratts Brook Tributary 1, Pratts Brook Tributary 1.1, Pratts Brook Tributary 3 and the redelineation of Butter Brook, Coles Brook, Conant Brook, Fort Pond Brook, Grassy Pond Brook, Guggins Brook, Inch Brook, Nagog Brook,

Nashoba Brook, Tributary 1 To Coles Brook, and Tributary 2 To Tributary 1 To Coles Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	3.2	0.3	0.5	-0.2
Within Floodway	0.7	0.2	0.0	0.2

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Acton, the figures in this table only represent information within the Town Of Acton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Acton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$2,539,300,000	4%	\$10,000,000	0%	\$21,300,000	1%	\$29,300,000	1%	\$37,500,000	1%	\$500,000	0%
Commercial Building/Contents	\$710,100,000	1%	\$10,400,000	1%	\$16,000,000	2%	\$20,200,000	3%	\$24,000,000	3%	\$1,700,000	0%
Other Building/Contents	\$378,600,000	1%	\$5,000,000	1%	\$8,300,000	2%	\$11,000,000	3%	\$12,900,000	3%	\$600,000	0%
Total Building/Contents <sup>2</sup>	\$3,627,900,000	5%	\$25,400,000	1%	\$45,700,000	1%	\$60,400,000	2%	\$74,400,000	2%	\$2,900,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$800,000	N/A	\$1,200,000	N/A	\$1,600,000	N/A	\$1,900,000	N/A	\$100,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,627,900,000	N/A	\$26,100,000	1%	\$46,700,000	1%	\$61,800,000	2%	\$76,100,000	2%	\$3,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.4 Town Of Ashland Summary (CID 250179)

The following pages include Flood Risk data for the Town Of Ashland.

### 2.5.4.1. *Overview*

The Town of Ashland is located in southern Middlesex County. Ashland Marlborough is bordered by five towns: Framingham on the northeast, Sherborn on the east, Holliston on the south, Hopkinton on the southwest and Southborough on the northwest. The information below provides an overview of the Town Of Ashland as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Ashland	250179	17,428	95	12.9	95	Y	N/A	Y

- Participating in Ashland, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 3/5/2014.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 58 policies totaling approximately \$13,270,800
- NFIP-recognized repetitive loss properties = 2

Data provided below only includes areas within the Town Of Ashland, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.4.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Ashland were updated due to new engineering analysis performed on Beaverdam Brook, Cold Spring Brook, Indian Brook, Indian Brook Tributary 1, Sudbury River, Sudbury River Tributary 10, Sudbury River Tributary 11, Tributary To Cold Spring Brook, Waushakum Pond and the redelineation of Beaverdam Brook, Brook From Waushakum Pond, Cold Spring Brook, Sudbury River Tributary 12, Tributary To Cold Spring Brook, and Tributary To Waushakum Pond. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.1	0.5	0.3	0.2
Within Floodway	0.3	0.0	0.1	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Ashland, the figures in this table only represent information within the Town Of Ashland.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Ashland’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,555,200,000	2%	\$7,300,000	0%	\$11,700,000	1%	\$14,700,000	1%	\$21,900,000	1%	\$300,000	0%
Commercial Building/Contents	\$392,900,000	1%	\$10,600,000	3%	\$14,800,000	4%	\$18,800,000	5%	\$22,100,000	6%	\$1,600,000	0%
Other Building/Contents	\$265,900,000	0%	\$4,200,000	2%	\$7,900,000	3%	\$11,600,000	4%	\$9,500,000	4%	\$1,000,000	0%
Total Building/Contents <sup>2</sup>	\$2,214,000,000	3%	\$22,000,000	1%	\$34,500,000	2%	\$45,100,000	2%	\$53,400,000	2%	\$2,800,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$700,000	N/A	\$1,800,000	N/A	\$2,400,000	N/A	\$1,400,000	N/A	\$200,000	N/A
<b>TOTAL<sup>4</sup></b>	\$2,214,000,000	N/A	\$22,700,000	1%	\$36,100,000	2%	\$47,300,000	2%	\$54,600,000	2%	\$3,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.5 Town Of Bedford Summary (CID 255209)

The following pages include Flood Risk data for the Town Of Bedford.

### 2.5.5.1. *Overview*

The Town Of Bedford is located in central Middlesex County with the Concord River forming a portion of the town's border. Its neighbors, clockwise, starting from 12 o'clock, are: Billerica, Burlington, Lexington, Lincoln, Concord, and Carlisle. The information below provides an overview of the Town Of Bedford as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Bedford	255209	12,589	26	13.8	26	Y	N/A	Y

- Participating in Bedford, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 2/4/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 146 policies totaling approximately \$33,546,200
- NFIP-recognized repetitive loss properties = 35.

Data provided below only includes areas within the Town Of Bedford, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.5.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Bedford were updated due to new engineering analysis performed on the Concord River, Mill Brook and the redelineation of a tributary to Mill Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.5	0.1	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Bedford, the figures in this table only represent information within the Town Of Bedford.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Bedford’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$375,500,000	1%	\$17,800,000	5%	\$23,200,000	6%	\$25,400,000	7%	\$30,300,000	8%	\$200,000	0%
Commercial Building/Contents	\$46,500,000	0%	\$3,900,000	8%	\$4,900,000	10%	\$5,400,000	12%	\$6,100,000	13%	\$300,000	1%
Other Building/Contents	\$16,900,000	0%	\$1,100,000	6%	\$1,400,000	8%	\$1,500,000	9%	\$1,700,000	10%	\$80,000	0%
Total Building/Contents <sup>2</sup>	\$438,900,000	1%	\$22,800,000	5%	\$29,400,000	7%	\$32,300,000	7%	\$38,100,000	9%	\$600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$200,000	N/A	\$300,000	N/A	\$300,000	N/A	\$300,000	N/A	\$20,000	N/A
<b>TOTAL<sup>4</sup></b>	\$438,900,000	N/A	\$23,000,000	5%	\$29,600,000	7%	\$32,500,000	7%	\$38,400,000	9%	\$600,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.6 Town Of Berlin Summary (CID 250294)

The following pages include Flood Risk data for the Town Of Berlin.

### 2.5.6.1. *Overview*

The Town of Berlin is located in southern Worcester County. Berlin is bordered by Hudson and Marlborough to the east, Bolton to the north, Clinton and Boylston to the west, and Northborough to the south. Berlin is the center of population for New England. The information below provides an overview of the Town Of Berlin as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Berlin	250294	4,592	100	13.2	100	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan, which expires on 8/16/2015.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 6 policies totaling approximately \$2,030,000

Data provided below only includes areas within the Town Of Berlin, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.6.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Berlin were updated due to new engineering analysis performed on the Assabet River, Barefoot Brook, Cooledge Brook, North Brook, North Brook Tributary 2, North Brook Tributary 8, Wrack Meadow Brook Tributary 1 and the redelineation of Assabet River Branch No 2, North Brook, North Brook Tributary 2, North Brook Tributary 8, and Wrack Meadow Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.6	0.2	0.1	0.1
Within Floodway	0.2	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Berlin, the figures in this table only represent information within the Town Of Berlin.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Berlin’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$266,300,000	0%	\$1,100,000	0%	\$1,400,000	1%	\$2,300,000	1%	\$2,600,000	1%	\$10,000	0%
Commercial Building/Contents	\$221,700,000	0%	\$500,000	0%	\$800,000	0%	\$1,000,000	0%	\$1,200,000	1%	\$60,000	0%
Other Building/Contents	\$45,500,000	0%	\$1,200,000	3%	\$1,200,000	3%	\$1,900,000	4%	\$2,100,000	5%	\$10,000	0%
Total Building/Contents <sup>2</sup>	\$533,500,000	1%	\$2,800,000	1%	\$3,300,000	1%	\$5,300,000	1%	\$5,900,000	1%	\$90,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$90,000	N/A	\$100,000	N/A	\$100,000	N/A	\$200,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$533,500,000	N/A	\$2,900,000	1%	\$3,400,000	1%	\$5,400,000	1%	\$6,000,000	1%	\$90,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.7 Town Of Billerica Summary (CID 250183)

The following pages include Flood Risk data for the Town Of Billerica.

### 2.5.7.1. *Overview*

The Town of Billerica is located in Middlesex County. Billerica is located about 22 miles (35 km) north-northwest of Boston along Route 3, positioning it a short distance from both the Route 128/Interstate 95 high-technology belt around Boston to the south, and the city of Lowell, six miles (10 km) to the north. This has established Billerica as the border between Greater Lowell and the much larger Greater Boston region. The information below provides an overview of the Town Of Billerica as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Billerica	250183	39,015	51	26.3	51	Y	N/A	Y

- Participating in Northern Middlesex Region, MA Pre-Disaster Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 240 policies totaling approximately \$56,867,300
- NFIP-recognized repetitive loss properties = 143

Data provided below only includes areas within the Town Of Billerica, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.7.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Billerica were updated due to new engineering analysis performed on Concord River, Dolly Brook, Hales Brook, Mill Brook, Pages Brook, and Pages Brook Branch. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.9	0.3	0.2	0.1
Within Floodway	0.5	0.1	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Billerica, the figures in this table only represent information within the Town Of Billerica.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Billerica’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,857,600,000	3%	\$22,400,000	1%	\$30,700,000	2%	\$36,400,000	2%	\$42,000,000	2%	\$2,100,000	0%
Commercial Building/Contents	\$805,200,000	1%	\$22,100,000	3%	\$29,100,000	4%	\$38,100,000	5%	\$32,500,000	4%	\$3,700,000	0%
Other Building/Contents	\$865,600,000	1%	\$6,500,000	1%	\$8,900,000	1%	\$13,000,000	2%	\$11,600,000	1%	\$2,800,000	0%
Total Building/Contents <sup>2</sup>	\$3,528,500,000	5%	\$51,000,000	1%	\$68,600,000	2%	\$87,500,000	2%	\$86,100,000	2%	\$8,600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,600,000	N/A	\$2,100,000	N/A	\$2,900,000	N/A	\$2,400,000	N/A	\$400,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,528,500,000	N/A	\$52,300,000	1%	\$70,300,000	2%	\$89,900,000	3%	\$88,000,000	2%	\$9,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.8 Town Of Bolton Summary (CID 250296)

The following pages include Flood Risk data for the Town Of Bolton.

### 2.5.8.1. *Overview*

The Town of Bolton is located in the central eastern border of Worcester County. Bolton is bordered by Harvard to the north, Stow to the east, Hudson and Berlin to the south, Clinton to the southwest, and Lancaster to the northwest. The information below provides an overview of the Town Of Bolton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Bolton	250296	5,230	72	20.1	72	Y	N/A	Y

- Participating in Bolton, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 2/5/2015.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 16 policies totaling approximately \$3,639,800
- NFIP-recognized repetitive loss properties = 2

Data provided below only includes areas within the Town Of Bolton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.8.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Bolton were updated due to new engineering analysis performed on Great Brook Tributary 1, Great Brook Tributary 2, Great Brook Tributary 2.2, Great Brook Tributary 2.3, Great Brook Tributary 4, Mill Brook West, Mill Brook West Tributary 1, Mill Brook West Tributary 2, Mill Brook West Tributary 3, Mill Brook West Tributary 3.1, Mill Brook West Tributary 4, Mill Brook West Tributary 5, Mill Brook West Tributary 6, North Brook and the redelineation of Great Brook, Great Brook Tributary 4, and Mill Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.4	0.2	0.3	-0.1
Within Floodway	0.1	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Bolton, the figures in this table only represent information within the Town Of Bolton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Bolton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$407,800,000	1%	\$300,000	0%	\$600,000	0%	\$2,000,000	0%	\$1,300,000	0%	\$0	0%
Commercial Building/Contents	\$130,000,000	0%	\$3,700,000	3%	\$4,700,000	4%	\$6,400,000	5%	\$6,300,000	5%	\$0	0%
Other Building/Contents	\$65,700,000	0%	\$400,000	1%	\$600,000	1%	\$1,400,000	2%	\$900,000	1%	\$0	0%
Total Building/Contents <sup>2</sup>	\$603,400,000	1%	\$4,400,000	1%	\$6,000,000	1%	\$9,800,000	2%	\$8,400,000	1%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$400,000	N/A	\$500,000	N/A	\$600,000	N/A	\$600,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$603,400,000	N/A	\$4,700,000	1%	\$6,300,000	1%	\$10,200,000	2%	\$8,900,000	1%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.9 Town Of Boxborough Summary (CID 250184)

The following pages include Flood Risk data for the Town Of Boxborough.

### 2.5.9.1. *Overview*

The Town Of Boxborough is located in the central western border of Middlesex County. Boxborough is bordered by Littleton to the north, Acton to the east, Stow to the south, and Harvard to the west. The information below provides an overview of the Town Of Boxborough as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Boxborough	250184	6,239	66	10.4	66	Y	N/A	Y

- Participating in Boxborough, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 2/4/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 11 policies totaling approximately \$3,167,000

Data provided below only includes areas within the Town Of Boxborough, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.9.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Boxborough were updated due to new engineering analysis performed on Elizabeth Brook, Fort Pond Brook, Fort Pond Brook Branch 2, Fort Pond Brook Branch 2 Tributary 1, Fort Pond Brook Branch 2 Tributary 2, Guggins Brook Tributary 1, Heath Hen Meadow Brook, Heath Hen Meadow Brook Tributary 2, Heath Hen Meadow Brook Tributary 3, Heath Hen Meadow Brook Tributary 5 and the redelineation of Elizabeth Brook 2, Fort Pond Brook, Fort Pond Brook Branch 2, and Guggins Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.0	0.3	0.1	0.2
Within Floodway	0.1	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Boxborough, the figures in this table only represent information within the Town Of Boxborough.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Boxborough’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$515,400,000	1%	\$1,800,000	0%	\$3,900,000	1%	\$4,600,000	1%	\$5,500,000	1%	\$0	0%
Commercial Building/Contents	\$152,900,000	0%	\$1,700,000	1%	\$3,000,000	2%	\$3,800,000	2%	\$6,300,000	4%	\$0	0%
Other Building/Contents	\$62,900,000	0%	\$900,000	1%	\$1,500,000	2%	\$1,800,000	3%	\$2,800,000	4%	\$0	0%
Total Building/Contents <sup>2</sup>	\$731,300,000	1%	\$4,400,000	1%	\$8,400,000	1%	\$10,100,000	1%	\$14,600,000	2%	\$10,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$200,000	N/A	\$300,000	N/A	\$400,000	N/A	\$600,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$731,300,000	N/A	\$4,500,000	1%	\$8,600,000	1%	\$10,400,000	1%	\$15,000,000	2%	\$10,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.10 Town Of Boylston Summary (CID 250297)

The following pages include Flood Risk data for the Town Of Boylston.

### 2.5.10.1. *Overview*

The Town Of Boylston is located along the central eastern border of Worcester County. The Wachusett Reservoir, Boston's water source, lies in the northwestern part of the town and covers about 5,000 acres (20 km<sup>2</sup>) of land. The town of Boylston is bordered by the towns of Shrewsbury, West Boylston, Sterling, Clinton, Berlin and Northborough. The information below provides an overview of the Town Of Boylston as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Boylston	250297	4,032	24	19.7	24	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 4 policies totaling approximately \$818,600

Data provided below only includes areas within the Town Of Boylston, that area located within the Concord, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.10.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Boylston were updated due to new engineering analysis performed on Rawson Hill Brook, Wrack Meadow Brook, Wrack Meadow Brook Tributary 1 and the redelineation of Cold Harbor Brook, and Wrack Meadow Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.5	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Boylston, the figures in this table only represent information within the Town Of Boylston.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Boylston’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$99,100,000	0%	\$100,000	0%	\$100,000	0%	\$800,000	1%	\$200,000	0%	\$0	N/A
Commercial Building/Contents	\$12,500,000	0%	\$50,000	0%	\$50,000	0%	\$200,000	2%	\$60,000	0%	\$0	N/A
Other Building/Contents	\$6,900,000	0%	\$10,000	0%	\$10,000	0%	\$90,000	1%	\$10,000	0%	\$0	N/A
Total Building/Contents <sup>2</sup>	\$118,500,000	0%	\$200,000	0%	\$200,000	0%	\$1,100,000	1%	\$300,000	0%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$10,000	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$118,500,000	N/A	\$200,000	0%	\$200,000	0%	\$1,100,000	1%	\$300,000	0%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.11 Town Of Carlisle Summary (CID 250187)

The following pages include Flood Risk data for the Town Of Carlisle.

#### 2.5.11.1. *Overview*

The Town Of Carlisle is located in Middlesex County. Conservation land makes up about a quarter of the town's area. Besides town-owned land overseen by the town's conservation committee, Carlisle is home to Great Brook Farm State Park and a portion of the Great Meadows National Wildlife Refuge neighboring the Concord River. Carlisle is located about 8 miles (13 km) south-southwest of Lowell and 19 miles (31 km) northwest of Boston. It borders the towns of Concord, Acton, Westford, Chelmsford, Billerica, and Bedford. The information below provides an overview of the Town Of Carlisle as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Carlisle	250187	9,637	100	15.5	100	Y	N/A	Y

- Participating in Town of Carlisle Hazard Mitigation Plan, which expires on 3/16/2017.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 16 policies totaling approximately \$4,765,000

Data provided below only includes areas within the Town Of Carlisle, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.11.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Carlisle were updated due to new engineering analysis performed on Concord River, Meadow River Branch, Pages Brook Branch, Pond Brook, Russell Millpond Brook, Spencer Brook, Spencer Brook and the redelineation of Meadow River Branch, Pages Brook, Pages Brook, and Pages Brook Branch. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	2.5	0.2	0.2	0.1
Within Floodway	0.2	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Carlisle, the figures in this table only represent information within the Town Of Carlisle.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Carlisle’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$706,800,000	1%	\$2,600,000	0%	\$4,300,000	1%	\$5,000,000	1%	\$7,800,000	1%	\$10,000	0%
Commercial Building/Contents	\$86,600,000	0%	\$1,000,000	1%	\$1,400,000	2%	\$1,600,000	2%	\$2,000,000	2%	\$20,000	0%
Other Building/Contents	\$51,300,000	0%	\$1,000,000	2%	\$1,300,000	2%	\$1,500,000	3%	\$1,700,000	3%	\$70,000	0%
Total Building/Contents <sup>2</sup>	\$844,700,000	1%	\$4,600,000	1%	\$7,000,000	1%	\$8,200,000	1%	\$11,400,000	1%	\$100,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$200,000	N/A	\$200,000	N/A	\$200,000	N/A	\$300,000	N/A	\$10,000	N/A
<b>TOTAL<sup>4</sup></b>	\$844,700,000	N/A	\$4,800,000	1%	\$7,200,000	1%	\$8,400,000	1%	\$11,700,000	1%	\$100,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.12 Town Of Chelmsford Summary (CID 250188)

The following pages include Flood Risk data for the Town Of Chelmsford.

### 2.5.12.1. *Overview*

The Town Of Chelmsford is located in northern Middlesex County. Chelmsford is bordered by two sizable rivers: the Merrimack River to the north, and the Concord River to the east. It is bordered by (clockwise from north) Lowell, Tewksbury, Billerica, Carlisle, Westford, and Tyngsborough. The information below provides an overview of the Town Of Chelmsford as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Chelmsford	250188	33,856	65	23.1	65	Y	N/A	Y

- Participating in Northern Middlesex Region, MA Pre-Disaster Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 268 policies totaling approximately \$67,479,600
- NFIP-recognized repetitive loss properties = 22

Data provided below only includes areas within the Town Of Chelmsford, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.12.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Chelmsford were updated due to new engineering analysis performed on Beaver Brook 2 Tributary 2, Beaver Brook 2 Tributary 3, Cathy Road Tributary, Cathy Road Tributary Tributary 1, Concord River, Farley Brook, Farley Brook Split 1, Hales Brook, Pond Brook, Pond Brook Tributary 1, Pond Brook Tributary 1.1, Putnam Brook, River Meadow Brook, Russell Millpond Brook and the redelineation of Hales Brook, and River Meadow Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.9	0.2	0.4	-0.3
Within Floodway	0.2	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Chelmsford, the figures in this table only represent information within the Town Of Chelmsford.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- Town Of Chelmsford’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$2,181,300,000	3%	\$2,500,000	0%	\$8,000,000	0%	\$12,100,000	1%	\$15,200,000	1%	\$100,000	0%
Commercial Building/Contents	\$790,300,000	1%	\$5,600,000	1%	\$7,600,000	1%	\$10,800,000	1%	\$12,400,000	2%	\$500,000	0%
Other Building/Contents	\$626,000,000	1%	\$8,300,000	1%	\$13,300,000	2%	\$17,200,000	3%	\$19,400,000	3%	\$1,200,000	0%
Total Building/Contents <sup>2</sup>	\$3,597,600,000	5%	\$16,400,000	0%	\$28,900,000	1%	\$40,200,000	1%	\$47,000,000	1%	\$1,900,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,000,000	N/A	\$1,500,000	N/A	\$1,800,000	N/A	\$2,100,000	N/A	\$100,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,597,600,000	N/A	\$17,300,000	0%	\$30,300,000	1%	\$41,800,000	1%	\$48,900,000	1%	\$2,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.13 Town Of Clinton Summary (CID 250300)

The following pages include Flood Risk data for the Town Of Clinton.

#### 2.5.13.1. *Overview*

The Town Of Clinton is located in Worcester County. The Nashua River runs through the town, and the large Wachusett Reservoir lies to the south of the town center. It is bordered by Lancaster to the north, Bolton to the northeast, Berlin to the east, Boylston to the south, and Sterling to the west. The information below provides an overview of the Town Of Clinton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Clinton	250300	13,435	15	7.3	15	Y	N/A	Y

- Participating in Clinton, MA Natural Hazard Pre-Disaster Mitigation Plan, which expires on 4/5/2015.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 123 policies totaling approximately \$16,393,900
- NFIP-recognized repetitive loss properties = 6

Data provided below only includes areas within the Town Of Clinton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.13.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Clinton were updated due to new engineering analysis performed on North Brook Tributary 8, and Wrack Meadow Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.1	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Clinton, the figures in this table only represent information within the Town Of Clinton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Clinton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$101,800,000	0%	\$0	0%	\$0	0%	\$40,000	0%	\$0	0%	\$0	0%
Commercial Building/Contents	\$3,700,000	0%	\$0	0%	\$0	0%	\$20,000	1%	\$0	0%	\$0	N/A
Other Building/Contents	\$8,700,000	0%	\$0	0%	\$0	0%	\$50,000	1%	\$0	0%	\$0	0%
Total Building/Contents <sup>2</sup>	\$114,200,000	0%	\$0	0%	\$0	0%	\$100,000	0%	\$0	0%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$114,200,000	N/A	\$0	0%	\$0	0%	\$100,000	0%	\$0	0%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.14 Town Of Concord Summary (CID 250189)

The following pages include Flood Risk data for the Town Of Concord.

### 2.5.14.1. *Overview*

The Town of Concord is located in central Middlesex County. The town center is located near the confluence of the Sudbury and Assabet rivers, forming the Concord River, which flows north to the Merrimack River in Lowell. It is bordered by the towns of (clockwise from north) Carlisle, Bedford, Lincoln, Sudbury, and Acton. The information below provides an overview of the Town Of Concord as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Concord	250189	20,489	95	25.8	95	Y	N/A	Y

- Participating in Concord, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 12/9/2015.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 145 policies totaling approximately \$38,665,600
- NFIP-recognized repetitive loss properties = 18

Data provided below only includes areas within the Town Of Concord, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.14.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Concord were updated due to new engineering analysis performed on Assabet River, Concord River, Concord River Tributary 6, Jenny Dugan Brook, Pond 15, Pond 16, Second Division Brook, Spencer Brook, Sudbury River and the redelineation of Dakins Brook, Fort Pond Brook, Mill Brook 2, Nashoba Brook, Pole Brook, Sawmill Brook 2, Spencer Brook, Tributary 1 To Sudbury River, and Tributary 2 To Assabet River. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	4.1	0.5	0.4	0.1
Within Floodway	1.5	0.3	0.2	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Concord, the figures in this table only represent information within the Town Of Concord.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Concord’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$2,184,100,000	3%	\$39,200,000	2%	\$55,400,000	3%	\$63,100,000	3%	\$80,500,000	4%	\$1,300,000	0%
Commercial Building/Contents	\$1,015,800,000	1%	\$69,700,000	7%	\$92,200,000	9%	\$96,800,000	10%	\$119,100,000	12%	\$3,200,000	0%
Other Building/Contents	\$275,700,000	0%	\$11,100,000	4%	\$15,300,000	6%	\$17,500,000	6%	\$21,800,000	8%	\$1,200,000	0%
Total Building/Contents <sup>2</sup>	\$3,475,500,000	5%	\$120,000,000	3%	\$162,900,000	5%	\$177,400,000	5%	\$221,400,000	6%	\$5,700,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$2,800,000	N/A	\$3,500,000	N/A	\$3,600,000	N/A	\$4,400,000	N/A	\$300,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,475,500,000	N/A	\$121,700,000	4%	\$165,100,000	5%	\$179,700,000	5%	\$224,300,000	6%	\$5,900,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.15 Town Of Framingham Summary (CID 250193)

The following pages include Flood Risk data for the Town Of Framingham.

#### 2.5.15.1. *Overview*

The Town Of Framingham is located in Middlesex County. It is bordered by Southborough and Marlborough on the west; Sherborn and Ashland on the south; Natick on the east; Wayland on the northeast; and Sudbury on the north. The information below provides an overview of the Town Of Framingham as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Framingham	250193	73,095	100	26.5	100	Y	N/A	Y

- Participating in Town of Framingham Multiple Hazard Mitigation Plan Update , which expires on 10/12/2017.
- Past Federal Disaster Declarations for flooding in Middlesex County= 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 832 policies totaling approximately \$144,764,200
- NFIP-recognized repetitive loss properties = 44

Data provided below only includes areas within the Town Of Framingham, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.15.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Framingham were updated due to new engineering analysis performed on Angelica Brook, Birch Meadow Brook, Cochituate Brook, Course Brook, Crooked Spring Brook, Pond 10, Pond 11, Stony Brook, Sudbury River, Sudbury River Tributary 6, Sudbury River Tributary 7, Tributary 1 To Stony Brook and the redelineation of Angelica Brook, Baiting Brook, Beaverdam Brook, Birch Meadow Brook, Brook From Waushakum Pond, Cochituate Brook, East Outlet, Farm Pond, and Landham Allowance Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	3.2	0.5	0.7	-0.2
Within Floodway	0.8	0.0	0.2	-0.2

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Framingham, the figures in this table only represent information within the Town Of Framingham.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
    - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
    - Percent annual chance of flooding grids
    - Percent chance of flooding over a 30-year period grids
    - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- Hazus Estimated Loss Information**

- The Town Of Framingham’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$6,872,300,000	10%	\$29,500,000	0%	\$49,600,000	1%	\$63,600,000	1%	\$119,300,000	2%	\$3,600,000	0%
Commercial Building/Contents	\$2,986,500,000	4%	\$21,500,000	1%	\$37,400,000	1%	\$56,500,000	2%	\$105,100,000	4%	\$6,500,000	0%
Other Building/Contents	\$1,252,700,000	2%	\$12,100,000	1%	\$19,000,000	2%	\$26,500,000	2%	\$47,800,000	4%	\$2,300,000	0%
Total Building/Contents <sup>2</sup>	\$11,111,500,000	16%	\$63,000,000	1%	\$106,000,000	1%	\$146,700,000	1%	\$272,300,000	2%	\$12,300,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,900,000	N/A	\$3,500,000	N/A	\$4,600,000	N/A	\$9,500,000	N/A	\$500,000	N/A
<b>TOTAL<sup>4</sup></b>	\$11,111,500,000	N/A	\$64,700,000	1%	\$109,000,000	1%	\$150,400,000	1%	\$280,500,000	3%	\$12,800,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.16 Town Of Grafton Summary (CID 250306)

The following pages include Flood Risk data for the Town Of Grafton.

#### 2.5.16.1. *Overview*

The Town Of Grafton is located in Worcester County. Grafton is located 30 miles (48 km) west of Boston and 5 miles (8.0 km) southeast of Worcester. It is bordered by (clockwise from north) Shrewsbury, Westborough, Upton, Northbridge, Sutton, Millbury, and Worcester. The information below provides an overview of the Town Of Grafton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Grafton	250306	14,894	7	23.3	7	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 48 policies totaling approximately \$12,455,300
- NFIP-recognized repetitive loss properties = 2

Data provided below only includes areas within the Town Of Grafton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.16.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Grafton were updated due to new engineering analysis. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.0	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Grafton, the figures in this table only represent information within the Town Of Grafton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Grafton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$69,900,000	0%	\$0	N/A								
Commercial Building/Contents	\$17,800,000	0%	\$0	N/A	\$0	N/A	\$0	0%	\$0	N/A	\$0	N/A
Other Building/Contents	\$27,000,000	0%	\$0	N/A	\$0	N/A	\$0	0%	\$0	N/A	\$0	N/A
Total Building/Contents <sup>2</sup>	\$114,800,000	0%	\$0	N/A	\$0	N/A	\$0	0%	\$0	N/A	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$114,800,000	N/A	\$0	N/A	\$0	N/A	\$0	0%	\$0	N/A	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.17 Town Of Harvard Summary (CID 250308)

The following pages include Flood Risk data for the Town Of Harvard.

#### 2.5.17.1. Overview

The Town Of Harvard is located in Worcester County. The town is largely wooded with small rolling hills, fields and wetlands. In addition to the numerous streams and brooks throughout Harvard, Bare Hill Pond is a central, iconic locale. Harvard is bordered by Ayer to the north, Littleton and Boxborough to the east, Stow to the southeast, Bolton to the south, Lancaster to the southwest, and Shirley to the northwest. The information below provides an overview of the Town Of Harvard as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Harvard	250308	5,981	22	27.2	22	Y	N/A	Y

- Participating in Harvard, MA Natural Hazard Pre-Disaster Mitigation Plan, which expires on 3/26/2015.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 11 policies totaling approximately \$3,017,000

Data provided below only includes areas within the Town Of Harvard, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.17.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Harvard were updated due to new engineering analysis performed on the Elizabeth Brook, Elizabeth Brook 1, Elizabeth Brook Tributary 3, Great Brook Tributary 1, Great Brook Tributary 2, Great Brook Tributary 2.2 and the redelineation of Elizabeth Brook 2, and Tributary To Elizabeth Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.5	0.1	0.0	0.1
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Harvard, the figures in this table only represent information within the Town Of Harvard.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Harvard’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$193,800,000	0%	\$40,000	0%	\$90,000	0%	\$3,900,000	2%	\$600,000	0%	\$0	N/A
Commercial Building/Contents	\$22,300,000	0%	\$90,000	0%	\$100,000	0%	\$300,000	1%	\$100,000	1%	\$0	N/A
Other Building/Contents	\$8,500,000	0%	\$0	0%	\$0	0%	\$20,000	0%	\$0	0%	\$0	N/A
Total Building/Contents <sup>2</sup>	\$224,600,000	0%	\$100,000	0%	\$200,000	0%	\$4,200,000	2%	\$700,000	0%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$224,600,000	N/A	\$100,000	0%	\$200,000	0%	\$4,200,000	2%	\$700,000	0%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.18 Town Of Holliston Summary (CID 250195)

The following pages include Flood Risk data for the Town Of Holliston.

### 2.5.18.1. *Overview*

The Town Of Holliston is located in the most southward border of Middlesex County. The Charles River passes near the southern region of town. It is bordered by Hopkinton, Ashland, and Sherborn within Middlesex County. The information below provides an overview of the Town Of Holliston as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Holliston	250195	13,815	1	19.0	1	Y	N/A	Y

- Participating in Holliston, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 8/7/2013.
- Past Federal Disaster Declarations for flooding in Middlesex County= 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 91 policies totaling approximately \$21,907,400
- NFIP-recognized repetitive loss properties = 5

Data provided below only includes areas within the Town Of Holliston, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.18.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Holliston were updated due to new engineering analysis. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.0	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Holliston, the figures in this table only represent information within the Town Of Holliston.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Holliston’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$4,100,000	0%	\$0	0%	\$0	0%	\$10,000	0%	\$10,000	0%	\$0	0%
Commercial Building/Contents	\$700,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%
Other Building/Contents	\$300,000	0%	\$0	0%	\$0	1%	\$0	2%	\$0	1%	\$0	0%
Total Building/Contents <sup>2</sup>	\$5,200,000	0%	\$0	0%	\$10,000	0%	\$20,000	0%	\$10,000	0%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$5,200,000	N/A	\$0	0%	\$10,000	0%	\$20,000	0%	\$10,000	0%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.19 Town Of Hopkinton Summary (CID 250196)

The following pages include Flood Risk data for the Town Of Hopkinton.

#### 2.5.19.1. *Overview*

The Town Of Hopkinton is located along the southern border of Middlesex County. Hopkinton is 17 miles (27 km) east of Worcester, 26 miles (42 km) west of Boston, and 195 miles (314 km) from New York City. It is bordered by Ashland and Holliston within Middlesex County. The information below provides an overview of the Town Of Hopkinton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Hopkinton	250196	13,346	75	27.9	75	Y	N/A	Y

- Participating in Hopkinton, MA Multi-Hazard Mitigation Plan (SouthWest), which expires on 4/28/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County= 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 20 policies totaling approximately \$4,768,400

Data provided below only includes areas within the Town Of Hopkinton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.19.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Hopkinton were updated due to new engineering analysis performed on Cold Spring Brook, Cold Spring Brook Tributary 3, Indian Brook, Indian Brook Tributary 4, Sudbury River, Sudbury River Split 1, Whitehall Brook Tributary 3 and the redelineation of Cold Spring Brook, Piccadilly Brook, and Whitehall Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.5	0.6	0.3	0.2
Within Floodway	0.2	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Hopkinton, the figures in this table only represent information within the Town Of Hopkinton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Hopkinton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,231,000,000	2%	\$2,100,000	0%	\$3,700,000	0%	\$7,400,000	1%	\$5,400,000	0%	\$60,000	0%
Commercial Building/Contents	\$380,400,000	1%	\$600,000	0%	\$800,000	0%	\$3,600,000	1%	\$900,000	0%	\$30,000	0%
Other Building/Contents	\$122,900,000	0%	\$300,000	0%	\$400,000	0%	\$1,500,000	1%	\$600,000	0%	\$30,000	0%
Total Building/Contents <sup>2</sup>	\$1,734,300,000	2%	\$3,100,000	0%	\$4,900,000	0%	\$12,500,000	1%	\$7,000,000	0%	\$100,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$30,000	N/A	\$40,000	N/A	\$200,000	N/A	\$60,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$1,734,300,000	N/A	\$3,100,000	0%	\$4,900,000	0%	\$12,600,000	1%	\$7,000,000	0%	\$100,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.20 Town Of Hudson Summary (CID 250197)

The following pages include Flood Risk data for the Town Of Hudson.

### 2.5.20.1. *Overview*

The Town Of Hudson is located along the western border of Middlesex County. The Assabet River flows through the town. It is bordered by Stow, Sudbury, and Marlborough within Middlesex County. The information below provides an overview of the Town Of Hudson as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Hudson	250197	20,166	100	11.9	100	Y	N/A	Y

- Participating in Hudson, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 12/9/2015.
- Past Federal Disaster Declarations for flooding in Middlesex County= 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 57 policies totaling approximately \$15,345,600

Data provided below only includes areas within the Town Of Hudson, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.20.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Hudson were updated due to new engineering analysis performed on Assabet River, Fort Meadow Brook Tributary 1, Hog Brook, Tributary C To Hop Brook North, Tributary C To Hop Brook North Tributary 1 and the redelineation of Assabet Branch No. 3, Assabet Branch No. 4, Assabet River Branch No 2, Boons Pond, Fort Meadow Brook, Hog Brook, and Mill Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.6	0.3	0.2	0.1
Within Floodway	0.3	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Hudson, the figures in this table only represent information within the Town Of Hudson.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Hudson’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,870,200,000	3%	\$8,600,000	0%	\$16,100,000	1%	\$19,500,000	1%	\$27,100,000	1%	\$400,000	0%
Commercial Building/Contents	\$523,100,000	1%	\$6,300,000	1%	\$10,200,000	2%	\$12,500,000	2%	\$19,200,000	4%	\$800,000	0%
Other Building/Contents	\$609,700,000	1%	\$9,600,000	2%	\$13,400,000	2%	\$15,800,000	3%	\$19,100,000	3%	\$900,000	0%
Total Building/Contents <sup>2</sup>	\$3,003,000,000	4%	\$24,500,000	1%	\$39,700,000	1%	\$47,800,000	2%	\$65,400,000	2%	\$2,100,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,200,000	N/A	\$1,700,000	N/A	\$2,000,000	N/A	\$2,500,000	N/A	\$100,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,003,000,000	N/A	\$25,500,000	1%	\$41,000,000	1%	\$49,300,000	2%	\$67,400,000	2%	\$2,300,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.21 Town Of Lincoln Summary (CID 250199)

The following pages include Flood Risk data for the Town Of Lincoln.

#### 2.5.21.1. *Overview*

The Town Of Lincoln is located in central Middlesex County. It is bordered by (counterclockwise from south) Wayland, Weston, Waltham, Lexington, Bedford, Concord, and Sudbury. The information below provides an overview of the Town Of Lincoln as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Lincoln	250199	8,042	27	15.0	27	Y	N/A	Y

- Participating in Lincoln, MA Multi-Hazard Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 19 policies totaling approximately \$3,698,400
- NFIP-recognized repetitive loss properties = 2

Data provided below only includes areas within the Town Of Lincoln, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.21.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Lincoln were updated due to new engineering analysis performed on Sudbury River and the redelineation of Farrar Pond Brook, Pole Brook, and Sudbury River Tributary 4. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.6	0.0	0.0	0.0
Within Floodway	0.3	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Lincoln, the figures in this table only represent information within the Town Of Lincoln.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Lincoln’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$188,500,000	0%	\$1,100,000	1%	\$1,600,000	1%	\$1,800,000	1%	\$2,400,000	1%	\$0	0%
Commercial Building/Contents	\$39,500,000	0%	\$200,000	0%	\$200,000	1%	\$300,000	1%	\$300,000	1%	\$0	0%
Other Building/Contents	\$22,000,000	0%	\$40,000	0%	\$50,000	0%	\$70,000	0%	\$90,000	0%	\$0	0%
Total Building/Contents <sup>2</sup>	\$250,000,000	0%	\$1,400,000	1%	\$1,900,000	1%	\$2,200,000	1%	\$2,800,000	1%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$250,000,000	N/A	\$1,400,000	1%	\$1,900,000	1%	\$2,200,000	1%	\$2,800,000	1%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.22 Town Of Littleton Summary (CID 250200)

The following pages include Flood Risk data for the Town Of Littleton.

### 2.5.22.1. *Overview*

The Town Of Littleton is located along the western border of Middlesex County. Littleton borders the following towns: Groton, Westford, Acton, Boxborough, Harvard, and Ayer. The information below provides an overview of the Town Of Littleton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Littleton	250200	8,144	42	17.5	42	Y	N/A	Y

- Participating in Littleton, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 4/27/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 18 policies totaling approximately \$5,226,600

Data provided below only includes areas within the Town Of Littleton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.22.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Littleton were updated due to new engineering analysis performed on Fort Pond Brook, Fort Pond Brook Branch 2 Tributary 2, Fort Pond Brook Tributary 4, Long Pond Brook and the redelineation of Nagog Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.0	0.2	0.0	0.1
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Littleton, the figures in this table only represent information within the Town Of Littleton.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Littleton’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$320,000,000	0%	\$0	0%	\$0	0%	\$300,000	0%	\$0	0%	\$0	N/A
Commercial Building/Contents	\$116,200,000	0%	\$10,000	0%	\$20,000	0%	\$500,000	0%	\$20,000	0%	\$0	0%
Other Building/Contents	\$121,000,000	0%	\$0	N/A	\$0	N/A	\$1,600,000	1%	\$0	N/A	\$0	N/A
Total Building/Contents <sup>2</sup>	\$557,100,000	1%	\$10,000	0%	\$20,000	0%	\$2,500,000	0%	\$30,000	0%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$200,000	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$557,100,000	N/A	\$10,000	0%	\$20,000	0%	\$2,700,000	0%	\$30,000	0%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.23 Town Of Maynard Summary (CID 250204)

The following pages include Flood Risk data for the Town Of Maynard.

#### 2.5.23.1. *Overview*

The Town Of Maynard is located in Middlesex County. The Assabet River flows through Maynard from west to east, spanned by seven road bridges and one foot bridge. Maynard borders the towns of Acton, Concord, Sudbury and Stow. The information below provides an overview of the Town Of Maynard as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Maynard	250204	11,583	100	5.4	100	Y	N/A	Y

- Participating in Maynard MA Hazard Mitigation Plan, which expires on 2/23/2017.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 18 policies totaling approximately \$5,982,500

Data provided below only includes areas within the Town Of Maynard, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.23.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Maynard were updated due to new engineering analysis performed on Assabet River, Fort Pond Brook Branch 1, and Pratts Brook Tributary 3. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.6	0.1	0.0	0.0
Within Floodway	0.1	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Maynard, the figures in this table only represent information within the Town Of Maynard.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Maynard’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,159,600,000	2%	\$5,400,000	0%	\$8,900,000	1%	\$10,800,000	1%	\$13,700,000	1%	\$1,100,000	0%
Commercial Building/Contents	\$293,400,000	0%	\$16,500,000	6%	\$20,300,000	7%	\$23,300,000	8%	\$26,200,000	9%	\$3,100,000	1%
Other Building/Contents	\$177,900,000	0%	\$4,500,000	3%	\$5,800,000	3%	\$7,000,000	4%	\$8,400,000	5%	\$1,400,000	1%
Total Building/Contents <sup>2</sup>	\$1,630,900,000	2%	\$26,400,000	2%	\$34,900,000	2%	\$41,100,000	3%	\$48,300,000	3%	\$5,600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$800,000	N/A	\$1,100,000	N/A	\$1,300,000	N/A	\$1,500,000	N/A	\$400,000	N/A
<b>TOTAL<sup>4</sup></b>	\$1,630,900,000	N/A	\$27,100,000	2%	\$35,900,000	2%	\$42,200,000	3%	\$49,500,000	3%	\$6,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.24 Town Of Natick Summary (CID 250207)

The following pages include Flood Risk data for the Town Of Natick.

### 2.5.24.1. *Overview*

The Town Of Natick is located along the southeastern border of Middlesex County. The four municipalities within Middlesex County that border (counterclockwise from north) it are: Weston, Wayland, Framingham, and Sherborn. The information below provides an overview of the Town Of Natick as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Natick	250207	32,074	40	16.0	40	Y	N/A	Y

- Participating in Natick, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 6/10/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 78 policies totaling approximately \$21,517,400
- NFIP-recognized repetitive loss properties = 11

Data provided below only includes areas within the Town Of Natick, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.24.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Natick were updated due to new engineering analysis performed on Beaverdam Brook, Cochituate Brook, Course Brook, Course Brook Tributary 1, Crooked Spring Brook and the redelineation of Beaverdam Brook, and Snake Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.4	0.2	0.1	0.2
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Natick, the figures in this table only represent information within the Town Of Natick.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Natick’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,958,500,000	3%	\$100,000	0%	\$2,000,000	0%	\$9,400,000	0%	\$9,100,000	0%	\$40,000	0%
Commercial Building/Contents	\$1,134,900,000	2%	\$1,100,000	0%	\$6,600,000	1%	\$9,900,000	1%	\$12,900,000	1%	\$200,000	0%
Other Building/Contents	\$371,900,000	1%	\$200,000	0%	\$1,000,000	0%	\$2,800,000	1%	\$2,400,000	1%	\$30,000	0%
Total Building/Contents <sup>2</sup>	\$3,465,300,000	5%	\$1,400,000	0%	\$9,600,000	0%	\$22,100,000	1%	\$24,400,000	1%	\$300,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$30,000	N/A	\$400,000	N/A	\$500,000	N/A	\$700,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$3,465,300,000	N/A	\$1,400,000	0%	\$10,000,000	0%	\$22,500,000	1%	\$25,000,000	1%	\$300,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.25 Town Of Northborough Summary (CID 250321)

The following pages include Flood Risk data for the Town Of Northborough.

#### 2.5.25.1. *Overview*

The Town Of Northborough is located along the central eastern border of Worcester County. It is bordered by Southborough to the southeast, Marlborough due east, Berlin to the north, Boylston to the northwest, Shrewsbury to the west, and Westborough to the south. The information below provides an overview of the Town Of Northborough as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Northborough	250321	16,273	100	18.7	100	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 82 policies totaling approximately \$17,354,300

Data provided below only includes areas within the Town Of Northborough, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.25.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Northborough were updated due to new engineering analysis performed on Assabet River, Assabet River Tributary 7, Assabet River Tributary 10, Assabet River Tributary 11, Assabet River Tributary 12, Barefoot Brook, Chauncey Lake, Cold Harbor Brook, Cold Harbor Brook Tributary 1, Cooledge Brook, Cooledge Brook Tributary, Hop Brook, Hop Brook Tributary 1, Howard Brook, Howard Brook Tributary, Road Brook Tributary 2, Road Brook Tributary 2.1, Road Brook Tributary 2.2, Stirrup Brook, Stirrup Brook Tributary 1, Stirrup Brook Tributary 2, Stirrup Brook Tributary 3 and the redelineation of Assabet River, Cold Harbor Brook, and Howard Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	2.5	0.3	0.3	-0.1
Within Floodway	0.2	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Northborough, the figures in this table only represent information within the Town Of Northborough.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Northborough’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,576,300,000	2%	\$16,200,000	1%	\$18,900,000	1%	\$27,900,000	2%	\$24,700,000	2%	\$300,000	0%
Commercial Building/Contents	\$601,400,000	1%	\$14,200,000	2%	\$16,400,000	3%	\$26,000,000	4%	\$19,800,000	3%	\$1,000,000	0%
Other Building/Contents	\$258,200,000	0%	\$1,700,000	1%	\$2,200,000	1%	\$6,400,000	2%	\$3,300,000	1%	\$90,000	0%
Total Building/Contents <sup>2</sup>	\$2,435,800,000	3%	\$32,100,000	1%	\$37,500,000	2%	\$60,300,000	2%	\$47,900,000	2%	\$1,400,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$700,000	N/A	\$700,000	N/A	\$1,500,000	N/A	\$900,000	N/A	\$40,000	N/A
<b>TOTAL<sup>4</sup></b>	\$2,435,800,000	N/A	\$32,600,000	1%	\$38,000,000	2%	\$61,300,000	3%	\$48,600,000	2%	\$1,400,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.26 Town Of Sherborn Summary (CID 250212)

The following pages include Flood Risk data for the Town Of Sherborn.

### 2.5.26.1. Overview

The Town Of Sherborn is located along the south-eastern border of Middlesex County. The town is located 18 miles (29 km) southwest of Boston. It shares borders with Natick, Framingham, Ashland, and Holliston within Middlesex County. The information below provides an overview of the Town Of Sherborn as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Sherborn	250212	4,566	20	16.1	20	Y	N/A	N/A

- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 5 policies totaling approximately \$1,505,000

Data provided below only includes areas within the Town Of Sherborn, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.26.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Sherborn were updated due to new engineering analysis performed on Course Brook, Course Brook Tributary 1, and Tributary A To Course Brook. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.1	0.1	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Sherborn, the figures in this table only represent information within the Town Of Sherborn.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Sherborn's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$95,700,000	0%	\$20,000	0%	\$90,000	0%	\$100,000	0%	\$900,000	1%	\$0	N/A
Commercial Building/Contents	\$13,800,000	0%	\$30,000	0%	\$60,000	0%	\$100,000	1%	\$300,000	2%	\$0	N/A
Other Building/Contents	\$6,500,000	0%	\$10,000	0%	\$20,000	0%	\$40,000	1%	\$100,000	2%	\$0	N/A
Total Building/Contents <sup>2</sup>	\$116,000,000	0%	\$60,000	0%	\$200,000	0%	\$300,000	0%	\$1,300,000	1%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$10,000	N/A	\$10,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$116,000,000	N/A	\$60,000	0%	\$200,000	0%	\$300,000	0%	\$1,300,000	1%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.27 Town Of Shrewsbury Summary (CID 250332)

The following pages include Flood Risk data for the Town Of Shrewsbury.

#### 2.5.27.1. *Overview*

The Town Of Shrewsbury is located in Worcester County. Shrewsbury is a suburb of both Boston and Worcester, about 45 minutes from Boston and 10 minutes to downtown Worcester. Shrewsbury is located in Central Massachusetts, bordered on the west by Worcester, separated by Lake Quinsigamond. To the north are Boylston and Interstate 290. The south side is bounded by Grafton. Northborough and Westborough are to the east. A small parcel of land on the northwest side is bordered by West Boylston. The information below provides an overview of the Town Of Shrewsbury as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Shrewsbury	250332	31,626	37	21.8	37	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 67 policies totaling approximately \$17,370,100

Data provided below only includes areas within the Town Of Shrewsbury, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.27.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Shrewsbury were updated due to new engineering analysis performed on Assabet River, Hop Brook, Hop Brook Tributary 4, Hop Brook Tributary 4.1, Rawson Hill Brook and the redelineation of Rawson Hill Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.4	0.1	0.1	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Shrewsbury, the figures in this table only represent information within the Town Of Shrewsbury.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Shrewsbury’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,473,200,000	2%	\$5,200,000	0%	\$9,000,000	1%	\$10,900,000	1%	\$12,300,000	1%	\$0	N/A
Commercial Building/Contents	\$356,000,000	1%	\$1,300,000	0%	\$1,900,000	1%	\$2,400,000	1%	\$2,300,000	1%	\$0	N/A
Other Building/Contents	\$114,600,000	0%	\$400,000	0%	\$600,000	1%	\$700,000	1%	\$800,000	1%	\$0	N/A
Total Building/Contents <sup>2</sup>	\$1,943,800,000	3%	\$6,900,000	0%	\$11,500,000	1%	\$14,000,000	1%	\$15,300,000	1%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$60,000	N/A	\$80,000	N/A	\$100,000	N/A	\$100,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$1,943,800,000	N/A	\$7,000,000	0%	\$11,600,000	1%	\$14,100,000	1%	\$15,400,000	1%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type

## 2.5.28 Town Of Southborough Summary (CID 250333)

The following pages include Flood Risk data for the Town Of Southborough.

### 2.5.28.1. *Overview*

The Town Of Southborough is located along the central eastern border of Worcester County. Southborough is located in eastern Massachusetts, bordered by Hopkinton on the south, Framingham and Ashland on the east, Westborough and Northborough on the west, and Marlborough on the north. The information below provides an overview of the Town Of Southborough as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Southborough	250333	11,158	100	15.5	100	Y	N/A	Y

- Participating in Southborough, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 12/9/2015.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 31 policies totaling approximately \$8,315,300

Data provided below only includes areas within the Town Of Southborough, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.28.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Southborough were updated due to new engineering analysis performed on Angelica Brook, Road Brook, Road Brook Tributary 2, Stony Brook, Sudbury Reservoir, Sudbury River, Sudbury River Split 1, Sudbury River Tributary 12A, Tributary 1 To Stony Brook, Tributary 2 To Stony Brook and the redelineation of Sudbury River Tributary 12, and Tributary 2 To Stony Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	2.4	0.2	0.1	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Southborough, the figures in this table only represent information within the Town Of Southborough.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Southborough’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,073,200,000	2%	\$2,300,000	0%	\$3,600,000	0%	\$6,200,000	1%	\$7,300,000	1%	\$60,000	0%
Commercial Building/Contents	\$427,400,000	1%	\$2,600,000	1%	\$4,100,000	1%	\$7,000,000	2%	\$6,700,000	2%	\$100,000	0%
Other Building/Contents	\$282,600,000	0%	\$6,700,000	2%	\$8,700,000	3%	\$11,600,000	4%	\$13,000,000	5%	\$100,000	0%
Total Building/Contents <sup>2</sup>	\$1,783,200,000	3%	\$11,600,000	1%	\$16,500,000	1%	\$24,800,000	1%	\$27,000,000	2%	\$300,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$800,000	N/A	\$900,000	N/A	\$1,200,000	N/A	\$1,300,000	N/A	\$30,000	N/A
<b>TOTAL<sup>4</sup></b>	\$1,783,200,000	N/A	\$11,700,000	1%	\$16,700,000	1%	\$25,100,000	1%	\$27,400,000	2%	\$300,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.29 Town Of Stow Summary (CID 250216)

The following pages include Flood Risk data for the Town Of Stow.

### 2.5.29.1. *Overview*

The Town Of Stow is located along the central eastern border of Middlesex County. Stow borders the towns of Harvard, Boxborough, Acton, Maynard, Sudbury, Hudson, and Bolton. The information below provides an overview of the Town Of Stow as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Stow	250216	7,495	100	18.0	100	Y	N/A	Y

- Participating in Stow, MA Hazard Mitigation Plan, which expires on 2/4/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 19 policies totaling approximately \$4,853,100

Data provided below only includes areas within the Town Of Stow, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.29.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Stow were updated due to new engineering analysis performed on Assabet Branch No. 4, Assabet River, Branch Of Elizabeth Brook 1, Elizabeth Brook 1, Elizabeth Brook 1 Tributary 1, Fort Pond Brook Tributary 1, Great Brook, Heath Hen Meadow Brook, Heath Hen Meadow Brook Split 1, Heath Hen Meadow Brook Tributary 1, Heath Hen Meadow Brook Tributary 2, Heath Hen Meadow Brook Tributary 3, Heath Hen Meadow Brook Tributary 4, Heath Hen Meadow Brook Tributary 5, Pratts Brook Tributary 3, Tributary C To Hop Brook North Tributary 1 and the redelineation of Assabet Branch No. 4, Boons Pond, Branch Of Assabet River, Branch Of Elizabeth Brook 1, Elizabeth Brook 1, and Great Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	2.9	0.5	0.5	0.0
Within Floodway	0.5	0.1	0.0	0.1

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Stow, the figures in this table only represent information within the Town Of Stow.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Stow’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$816,300,000	1%	\$1,800,000	0%	\$4,800,000	1%	\$9,300,000	1%	\$10,200,000	1%	\$200,000	0%
Commercial Building/Contents	\$149,200,000	0%	\$2,200,000	1%	\$3,200,000	2%	\$4,900,000	3%	\$4,400,000	3%	\$400,000	0%
Other Building/Contents	\$133,500,000	0%	\$2,200,000	2%	\$3,200,000	2%	\$5,100,000	4%	\$4,500,000	3%	\$400,000	0%
Total Building/Contents <sup>2</sup>	\$1,099,000,000	2%	\$6,300,000	1%	\$11,100,000	1%	\$19,400,000	2%	\$19,100,000	2%	\$900,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$300,000	N/A	\$400,000	N/A	\$600,000	N/A	\$500,000	N/A	\$60,000	N/A
<b>TOTAL<sup>4</sup></b>	\$1,099,000,000	N/A	\$6,600,000	1%	\$11,500,000	1%	\$19,900,000	2%	\$19,600,000	2%	\$1,000,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.30 Town Of Sudbury Summary (CID 250217)

The following pages include Flood Risk data for the Town Of Sudbury.

#### 2.5.30.1. *Overview*

The Town Of Sudbury is located in Middlesex County. Sudbury is bordered by Wayland on the east; Framingham on the south; Hudson, Maynard, Marlborough, and Stow on the west; Concord on the northeast; and Acton on the north. The information below provides an overview of the Town Of Sudbury as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Sudbury	250217	20,680	100	24.7	100	Y	N/A	Y

- Participating in Sudbury, MA Multi-Hazard Mitigation Plan (NorthWest), which expires on 6/10/2016.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 68 policies totaling approximately \$18,536,800
- NFIP-recognized repetitive loss properties = 9

Data provided below only includes areas within the Town Of Sudbury, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.30.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Sudbury were updated due to new engineering analysis performed on Pantry Brook Tributary 1, Sudbury River, Tributary C To Hop Brook North, Tributary D To Hop Brook North and the redelineation of Cold Brook, Dudley Brook, Hop Brook, Landham Allowance Brook, Mineway Brook, Pantry Brook, Run Brook, Tributary A To Cold Brook, Tributary A To Dudley Brook, Tributary A To Hop Brook, Tributary A To Pantry Brook, Tributary B To Hop Brook, Tributary C To Hop Brook, and Tributary D To Hop Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	3.8	0.4	0.2	0.2
Within Floodway	0.5	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Sudbury, the figures in this table only represent information within the Town Of Sudbury.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Sudbury’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$2,382,000,000	3%	\$7,400,000	0%	\$15,900,000	1%	\$19,300,000	1%	\$33,200,000	1%	\$100,000	0%
Commercial Building/Contents	\$672,700,000	1%	\$9,000,000	1%	\$14,300,000	2%	\$21,600,000	3%	\$24,000,000	4%	\$1,200,000	0%
Other Building/Contents	\$198,300,000	0%	\$4,800,000	2%	\$8,000,000	4%	\$10,100,000	5%	\$13,500,000	7%	\$300,000	0%
Total Building/Contents <sup>2</sup>	\$3,253,000,000	5%	\$21,200,000	1%	\$38,300,000	1%	\$51,000,000	2%	\$70,700,000	2%	\$1,600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,200,000	N/A	\$1,700,000	N/A	\$2,200,000	N/A	\$2,100,000	N/A	\$90,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,253,000,000	N/A	\$22,100,000	1%	\$39,500,000	1%	\$52,600,000	2%	\$72,000,000	2%	\$1,700,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.31 Town Of Tewksbury Summary (CID 250218)

The following pages include Flood Risk data for the Town Of Tewksbury.

#### 2.5.31.1. *Overview*

The Town Of Tewksbury is located along the northeastern border of Middlesex County. The Merrimack River forms part of the northern boundary of Tewksbury, and the Shawsheen River runs through the southern end of town as well. Tewksbury is bordered by the city of Lowell to the northwest, Dracut to the north (unreachable across the Merrimack), Andover to the northeast, Wilmington to the southeast, and Billerica to the southwest. The information below provides an overview of the Town Of Tewksbury as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Tewksbury	250218	28,828	5	21.1	5	Y	10	Y

- Participating in Northern Middlesex Region, MA Pre-Disaster Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 114 policies totaling approximately \$27,741,100
- NFIP-recognized repetitive loss properties = 21

Data provided below only includes areas within the Town Of Tewksbury, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.31.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Tewksbury were updated due to new engineering analysis. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.0	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Tewksbury, the figures in this table only represent information within the Town Of Tewksbury.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Tewksbury’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$123,100,000	0%	\$0	0%	\$40,000	0%	\$50,000	0%	\$60,000	0%	\$0	0%
Commercial Building/Contents	\$21,600,000	0%	\$0	0%	\$10,000	0%	\$10,000	0%	\$10,000	0%	\$0	0%
Other Building/Contents	\$31,300,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%
Total Building/Contents <sup>2</sup>	\$175,900,000	0%	\$0	0%	\$50,000	0%	\$60,000	0%	\$70,000	0%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$175,900,000	N/A	\$0	0%	\$50,000	0%	\$60,000	0%	\$70,000	0%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 2.5.32 Town Of Upton Summary (CID 250340)

The following pages include Flood Risk data for the Town Of Upton.

### 2.5.32.1. Overview

The Town Of Upton is located along the southeastern border of Worcester County. Upton is bordered by: Hopkinton on the northeast, Westborough on the north, Milford on the east, Mendon on the south, Grafton on the west, Hopedale on the southeast, Northbridge on the southwest. The information below provides an overview of the Town Of Upton as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Upton	250340	5,642	3	21.8	3	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 11 policies totaling approximately \$2,891,500

Data provided below only includes areas within the Town Of Upton, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

### 2.5.32.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Upton were updated due to new engineering analysis. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.0	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Upton, the figures in this table only represent information within the Town Of Upton.*

Section 2 of this report provides more information regarding the source and methodology used to develop this table.

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Upton's flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$12,900,000	0%	\$0	0%	\$0	0%	\$0	0%	\$10,000	0%	\$0	N/A
Commercial Building/Contents	\$1,400,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	N/A
Other Building/Contents	\$800,000	0%	\$0	0%	\$0	0%	\$0	0%	\$0	0%	\$0	N/A
Total Building/Contents <sup>2</sup>	\$15,100,000	0%	\$0	0%	\$0	0%	\$10,000	0%	\$10,000	0%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$15,100,000	N/A	\$0	0%	\$0	0%	\$10,000	0%	\$10,000	0%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.33 Town Of Wayland Summary (CID 250224)

The following pages include Flood Risk data for the Town Of Wayland.

#### 2.5.33.1. *Overview*

The Town Of Wayland is located in Middlesex County. Wayland borders Lincoln, Sudbury, Weston, Framingham, and Natick. The information below provides an overview of the Town Of Wayland as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Wayland	250224	15,640	96	15.9	96	Y	N/A	Y

- Participating in Town of Wayland, MA Hazard Mitigation Plan, which expires on 3/16/2017.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 64 policies totaling approximately \$18,053,600
- NFIP-recognized repetitive loss properties = 13

Data provided below only includes areas within the Town Of Wayland, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.33.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Wayland were updated due to new engineering analysis performed on Hazel Brook, Pine Brook, Pond 14, Sudbury River and the redelineation of Hayward Brook, Landham Allowance Brook, Mill Brook 1, Pantry Brook, Pine Brook, Snake Brook, and Wash Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	2.2	0.3	0.3	0.0
Within Floodway	0.5	0.1	0.2	-0.2

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Wayland, the figures in this table only represent information within the Town Of Wayland.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Wayland’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,691,200,000	2%	\$25,600,000	2%	\$37,600,000	2%	\$39,900,000	2%	\$55,100,000	3%	\$100,000	0%
Commercial Building/Contents	\$333,300,000	0%	\$10,700,000	3%	\$15,900,000	5%	\$17,100,000	5%	\$24,300,000	7%	\$500,000	0%
Other Building/Contents	\$144,900,000	0%	\$11,300,000	8%	\$15,400,000	11%	\$15,900,000	11%	\$22,300,000	15%	\$60,000	0%
Total Building/Contents <sup>2</sup>	\$2,169,400,000	3%	\$47,600,000	2%	\$68,900,000	3%	\$73,000,000	3%	\$101,700,000	5%	\$600,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,000,000	N/A	\$1,400,000	N/A	\$1,400,000	N/A	\$1,900,000	N/A	\$10,000	N/A
<b>TOTAL<sup>4</sup></b>	\$2,169,400,000	N/A	\$48,300,000	2%	\$69,800,000	3%	\$73,900,000	3%	\$103,000,000	5%	\$700,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.34 Town Of Westborough Summary (CID 250344)

The following pages include Flood Risk data for the Town Of Westborough.

#### 2.5.34.1. Overview

The Town Of Westborough is located along the eastern border of Worcester County. It is bordered by six towns: Grafton, Hopkinton, Northborough, Shrewsbury, Southborough, and Upton. The information below provides an overview of the Town Of Westborough as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Westborough	250344	20,056	100	21.5	100	Y	N/A	Y

- Participating in Central Massachusetts Regional Plan.
- Past Federal Disaster Declarations for flooding in Worcester County = 14
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 39 policies totaling approximately \$11,174,100

Data provided below only includes areas within the Town Of Westborough, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.34.2. Community Analyses and Results

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Westborough were updated due to new engineering analysis performed on Assabet River, Assabet River Tributary 10, Assabet River Tributary 11, Assabet River Tributary 12, Assabet River Tributary 13, Assabet River Tributary 14, Assabet River Tributary 15, Assabet River Tributary 16, Assabet River Tributary 17, Chauncey Lake, Chauncey Lake Tributary 1, Chauncey Lake Tributary 1.1, Denny Brook, Denny Brook Tributary 1, Jackstraw Brook, Jackstraw Brook Tributary 1, Piccadilly Brook, Road Brook Tributary 2, Road Brook Tributary 2.2, Rutters Brook, Rutters Brook Tributary 1, Rutters Brook Tributary 1.1, Sudbury River, Sudbury River Tributary 13, Sudbury River Tributary 13.2, Sudbury River Tributary 14, Sullivan Brook and the redelineation of Assabet River, Assabet River (Upper Reach), Assabet River Tributary 16, Denny Brook, Piccadilly Brook, and Whitehall Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	4.5	0.3	0.3	0.0
Within Floodway	0.6	0.5	0.0	0.5

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Westborough, the figures in this table only represent information within the Town Of Westborough.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Westborough’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$1,993,600,000	3%	\$5,600,000	0%	\$13,100,000	1%	\$45,800,000	2%	\$24,800,000	1%	\$100,000	0%
Commercial Building/Contents	\$1,143,200,000	2%	\$14,600,000	1%	\$22,000,000	2%	\$31,900,000	3%	\$32,800,000	3%	\$20,000	0%
Other Building/Contents	\$571,100,000	1%	\$5,900,000	1%	\$9,700,000	2%	\$16,500,000	3%	\$17,000,000	3%	\$40,000	0%
Total Building/Contents <sup>2</sup>	\$3,708,000,000	5%	\$26,100,000	1%	\$44,800,000	1%	\$94,200,000	3%	\$74,600,000	2%	\$200,000	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$1,400,000	N/A	\$2,100,000	N/A	\$3,200,000	N/A	\$3,100,000	N/A	\$10,000	N/A
<b>TOTAL<sup>4</sup></b>	\$3,708,000,000	N/A	\$27,200,000	1%	\$46,500,000	1%	\$96,900,000	3%	\$77,300,000	2%	\$200,000	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.35 Town Of Westford Summary (CID 250225)

The following pages include Flood Risk data for the Town Of Westford.

#### 2.5.35.1. *Overview*

The Town Of Westford is located in the northern part of Middlesex County. The town is bordered by Chelmsford to the east, Tyngsborough to the north, Groton to the west, Littleton to the southwest, Acton to the south, and Carlisle to the southeast. The information below provides an overview of the Town Of Westford as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Westford	250225	20,796	34	31.4	34	Y	N/A	Y

- Participating in Northern Middlesex Region, MA Pre-Disaster Mitigation Plan.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 101 policies totaling approximately \$26,233,400

Data provided below only includes areas within the Town Of Westford, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.35.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town of Westford were updated due to new engineering analysis performed on Beaver Brook 2, Butter Brook, Nashoba Brook, Nashoba Brook Tributary 3, Nonsex Brook, Pond Brook, Pond Brook Tributary 1, Pond Brook Tributary 1.1, Pond Brook Tributary 2, Vine Brook, Vine Brook Tributary 1, Vine Brook Tributary 2, Vine Brook Tributary 3, Vine Brook Tributary 4 and the redelineation of Butter Brook, and Tadmuck Swamp Brook. The updated modeling and redelineation produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	1.5	0.3	0.7	-0.4
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Westford, the figures in this table only represent information within the Town Of Westford.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town of Westford’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$679,400,000	1%	\$300,000	0%	\$400,000	0%	\$3,700,000	1%	\$4,500,000	1%	\$0	0%
Commercial Building/Contents	\$480,200,000	1%	\$70,000	0%	\$400,000	0%	\$8,700,000	2%	\$1,400,000	0%	\$0	0%
Other Building/Contents	\$218,300,000	0%	\$0	0%	\$70,000	0%	\$4,400,000	2%	\$500,000	0%	\$0	0%
Total Building/Contents <sup>2</sup>	\$1,378,000,000	2%	\$400,000	0%	\$800,000	0%	\$16,900,000	1%	\$6,400,000	0%	\$0	0%
Business Disruption <sup>3</sup>	\$0	N/A	\$10,000	N/A	\$30,000	N/A	\$800,000	N/A	\$70,000	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$1,378,000,000	N/A	\$400,000	0%	\$900,000	0%	\$17,500,000	1%	\$6,500,000	0%	\$0	0%

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

### 2.5.36 Town Of Weston Summary (CID 250226)

The following pages include Flood Risk data for the Town Of Weston.

#### 2.5.36.1. *Overview*

The Town Of Weston is located along the eastern border of Middlesex County. The four towns within Middlesex County that border Weston are: Newton, Waltham, Lincoln, Wayland, and Natick. The information below provides an overview of the Town Of Weston as of the date of this publication.

Community Name	CID	Total Community Population	Percent of Population in Watershed	Total Community Land Area (sq mi)	Percent of Land Area in Watershed	NFIP	CRS Rating	Mitigation Plan
Town Of Weston	250226	11,483	9	17.3	9	Y	N/A	Y

- Participating in Weston, MA Hazard Mitigation Plan (MAPC), which expires on 2/23/2017.
- Past Federal Disaster Declarations for flooding in Middlesex County = 17
- National Flood Insurance Program (NFIP) policy coverage (policies/values) = 90 policies totaling approximately \$24,814,900
- NFIP-recognized repetitive loss properties = 6

Data provided below only includes areas within the Town Of Weston, which are located within the Concord Watershed, and do not necessarily represent community-wide totals. Section 2 of the Flood Risk Report (FRR) provides more information regarding the source and methodology used to develop the information presented below. Datasets used toward the generation of results of this project are described in Section 7 of the FRR and are found in the Flood Risk Database (FRD).

#### 2.5.36.2. *Community Analyses and Results*

Results for each of the Flood Risk Datasets developed for this Flood Risk Project are summarized below:

- **Changes Since Last FIRM**
  - Special Flood Hazard Area (SFHA) boundaries within the Town Of Weston were updated due to new engineering analysis. The updated modeling produced new flood zone areas and new base flood elevations and leveraged the recently developed LiDAR-based topographic data. The table below summarizes the increases, decreases, and net change of SFHAs for the community.

The table below summarizes the increases, decreases, and net change of SFHAs for the community.

Area of Study	Total Area (mi <sup>2</sup> )	Increase (mi <sup>2</sup> )	Decrease (mi <sup>2</sup> )	Net Change (mi <sup>2</sup> )
Within SFHA	0.5	0.0	0.0	0.0
Within Floodway	0.0	0.0	0.0	0.0

*\*Although the Flood Risk Database may contain Changes Since Last FIRM information outside of Town Of Weston, the figures in this table only represent information within the Town Of Weston.*

*Section 2 of this report provides more information regarding the source and methodology used to develop this table.*

- **Flood Depth and Analysis Grids**

- See the FRD for the following depth and analysis grid data (Section 2 of the FRR provides general information regarding the development of and potential uses for this data):
  - Multi-frequency flood depth grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
  - Percent annual chance of flooding grids
  - Percent chance of flooding over a 30-year period grids
  - Water surface elevation grids (10-, 4-, 2-, 1-, and 0.2-percent-annual-chance flood events)
- Additional information and data layers provided within the FRD should be used to further isolate these and other areas where flood mitigation potential is high. The FRD includes data which may be helpful in planning and implementing mitigation strategies. Properties located in areas expected to experience some depth of water should seriously consider mitigation options for implementation.

- **Hazus Estimated Loss Information**

- The Town Of Weston’s flood risk analysis uses results from a FEMA-performed Hazus analysis which accounts for newly modeled areas in the Flood Risk Project and newly modeled depths for certain flood events. Potential losses were compared with locally provided tax data to estimate loss ratios for multiple scenarios. Additional information and data layers provided within the FRD should be used to further analyze potential losses and areas where they are likely to occur.

	Estimated Potential Losses for Flood Event Scenarios											
	Total Inventory		10% (10-yr)		2% (50-yr)		1% (100-yr)		0.2% (500-yr)		Annualized (\$/yr)	
	Estimated Value	% of Total	Dollar Losses <sup>5</sup>	Loss Ratio <sup>1,6</sup>								
Residential Building/Contents	\$86,600,000	0%	\$0	N/A	\$0	0%	\$0	0%	\$0	0%	\$0	N/A
Commercial Building/Contents	\$10,900,000	0%	\$0	N/A	\$0	N/A	\$0	0%	\$0	0%	\$0	N/A
Other Building/Contents	\$5,700,000	0%	\$0	N/A								
Total Building/Contents <sup>2</sup>	\$103,200,000	0%	\$0	N/A	\$0	0%	\$0	0%	\$0	0%	\$0	N/A
Business Disruption <sup>3</sup>	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A	\$0	N/A
<b>TOTAL<sup>4</sup></b>	\$103,200,000	N/A	\$0	N/A	\$0	0%	\$0	0%	\$0	0%	\$0	N/A

Source: Hazus analysis results stored as the Flood Risk Assessment Dataset in the Flood Risk Database.

<sup>1</sup>Loss ratio = Dollar Losses / Estimated Value

<sup>2</sup>Total Building/Contents Loss = Residential Building/Contents Loss + Commercial Building/Contents Loss + Other Building/Contents Loss.

<sup>3</sup>Business Disruption = Inventory Loss + Relocation Cost + Income Loss + Rental Income Loss + Wage Loss + Direct Output Loss.

<sup>4</sup>Total Loss = Total Building/Contents + Business Disruption

<sup>5</sup>Losses shown are rounded to nearest \$10,000 for values under \$100,000 and to the nearest \$100,000 for values over \$100,000.

<sup>6</sup>Loss Ratios rounded to nearest integer percent.

- **Areas of Mitigation Interest**

- Section 2.2.4 of the FRR provides more information regarding areas of mitigation interest, how they are defined for this analysis, and potential mitigation actions that could be considered for each type.

## 4 Actions to Reduce Flood Risk

In order to fully leverage the Flood Risk Datasets and Products created for this Flood Risk Project, local stakeholders should consider many different flood risk mitigation tactics, including, but not limited to the items shown in the sub-sections below.

### 4.1 Types of Mitigation Actions

Mitigation provides a critical foundation on which to reduce loss of life and property by avoiding or lessening the impact of hazard events. This creates safer communities and facilitates resiliency by enabling communities to return to normal function as quickly as possible after a hazard event. Once a community understands its flood risk, it is in a better position to identify potential mitigation actions that can reduce the risk to its people and property.

The mitigation plan requirements in 44 CFR Part 201 encourage communities to understand their vulnerability to hazards and take actions to minimize vulnerability and promote resilience. Flood mitigation actions generally fall into the following categories:

#### 4.1.1 Preventative Measures

Preventative measures are intended to keep flood hazards from getting worse. They can reduce future vulnerability to flooding, especially in areas where development has not yet occurred or where capital improvements have not been substantial. Examples include:

- Comprehensive land use planning
- Zoning regulations
- Subdivision regulations
- Open space preservation
- Building codes
- Floodplain development regulations
- Stormwater management
- Purchase development rights or conservation easements
- Participation in the NFIP Community Rating System (CRS)

#### 4.1.2 Property Protection Measures

Property protection measures protect existing buildings by modifying the building to withstand floods, or by removing buildings from hazardous locations. Examples include:

- Building relocation

Before Mitigation and After Mitigation



Communities will need to prioritize projects as part of the planning process. FEMA can then help route federal mitigation dollars to fund these projects.

NFIP's CRS is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect the reduced flood risk resulting from community actions meeting the three goals of the CRS: to reduce flood losses, to facilitate accurate insurance rating, and to promote the awareness of flood insurance.

For CRS participating communities, flood insurance premium rates are discounted in increments of 5%; i.e., a Class 1 community would receive a 45% premium discount, while a Class 9 community would receive a 5% discount. (A Class 10 is not participating in the CRS and receives no discount.)

- Acquisition and clearance
- Building elevation
- Barrier installation
- Building retrofit

#### **4.1.3 Natural Resource Protection Activities**

Natural resource protection activities reduce the impact of floods by preserving or restoring natural areas such as floodplains, wetlands, and dunes and their natural functions. Examples include:

- Wetland protection
- Habitat protection
- Erosion and sedimentation control
- Best management practices (BMP)
- Prevention of stream dumping activities (anti-litter campaigns)
- Improved forestry practices such as reforestation or selective timbering (extraction)

#### **4.1.4 Structural Mitigation Projects**

Structural mitigation projects lessen the impact of floods by modifying the environmental natural progression of the flooding event. Structural protection such as upgrading dams/levees for already existing development and critical facilities may be a realistic alternative. However, citizens should be made aware of their residual risk. Examples include:

- Reservoirs, retention, and detention basins
- Levees and floodwalls
- Channel modifications
- Channel maintenance

#### **4.1.5 Public Education and Awareness Activities**

Public education and awareness activities advise residents, business owners, potential property buyers, and visitors about floods, hazardous areas, and mitigation techniques they can use to reduce the flood risk to themselves and their property. Examples include:

- Readily available and readable updated maps
- Outreach projects
- Libraries
- Technical assistance

- Real estate disclosure
- Environmental education
- Risk information via the nightly news

#### 4.1.6 Emergency Service Measures

Although not typically considered a mitigation technique, emergency service measures minimize the impact of flooding on people and property. These are actions commonly taken immediately prior to, during, or in response to a hazard event. Examples include:

- Hazard warning system
- Emergency response plan
- COOP and COG planning
- Critical facilities protection
- Health and safety maintenance
- Post flood recovery planning

For more information regarding hazard mitigation techniques, best practices, and potential grant funding sources, visit [www.fema.gov](http://www.fema.gov) or contact your local floodplain manager, emergency manager, or State Hazard Mitigation Officer.

In Section 3, specific AoMIs were identified. Table 4.1 below identifies possible mitigation actions for each AoMI to consider.

**Table 4-1. Mitigation Actions for Areas of Mitigation Interest**

<b>AoMI</b>	<b>Possible Actions to Reduce Flood Risk</b>
<b>Dams</b>	<i>Engineering assessment            Dam upgrades and strengthening            Emergency Action Plan            Dam removal            Easement creation in impoundment and downstream inundation areas</i>
<b>Levees (accredited and non-accredited) and significant levee-like structures</b>	<i>Generally same as dams above            Purchase of flood insurance for at-risk structures</i>
<b>Coastal Structures</b> <i>Jetties            Groynes            Seawalls            Other structures</i>	<i>Increase coastal setbacks for construction            Habitat restoration programs            Wetland restoration and mitigation banking programs</i>
<b>Stream Flow Pinch Point</b> <i>Undersized culverts or bridge openings</i>	<i>Engineering analysis            Replacement of structure pre- and post-disaster</i>
<b>Past Claims and IA/PA Hot Spots</b>	<i>Acquisition            Elevation            Relocation            Floodproofing</i>

<i>AoMI</i>	<i>Possible Actions to Reduce Flood Risk</i>
<i>Major Land Use Changes (past 5 years or next 5 years)</i>	<i>Higher regulatory standard Stormwater BMPs Transfer of Development rights Compensatory storage and equal conveyance standards</i>
<i>Key Emergency Routes Overtopped During Frequent Flooding Events</i>	<i>Elevation Creation of alternate routes Design as low water crossing</i>
<i>Areas of Significant Riverine or Coastal Erosion</i>	<i>Relocation of buildings and infrastructure Regulations and planning Natural vegetation Hardening</i>
<i>Drainage or Stormwater- Based Flood Hazard Areas, or Areas Not Identified as Floodprone on the FIRM But Known to be Inundated</i>	<i>Identification of all flood hazard areas</i>
<i>Areas of Mitigation Success</i>	<i>N/A</i>

## 4.2 Identifying Specific Actions for Your Community

As many mitigation actions are possible to lessen the impact of floods, how can a community decide which ones are appropriate to implement? There are many ways to identify specific actions most appropriate for a community. Some factors to consider may include the following:

- **Site characteristics.** Does the site present unique challenges (e.g., significant slopes or erosion potential)?
- **Flood characteristics.** Are the flood waters affecting the site fast or slow moving? Is there debris associated with the flow? How deep is the flooding?
- **Social acceptance.** Will the mitigation action be acceptable to the public? Does it cause social or cultural problems?
- **Technical feasibility.** Is the mitigation action technically feasible (e.g., making a building watertight to a reasonable depth)?
- **Administrative feasibility.** Is there administrative capability to implement the mitigation action?
- **Legal.** Does the mitigation action meet all applicable codes, regulations, and laws? Public officials may have a legal responsibility to act and inform citizens if a known hazard has been identified.
- **Economic.** Is the mitigation action affordable? Is it eligible under grant or other funding programs? Can it be completed within existing budgets?

Refer to FEMA Mitigation Planning How To Guide #3 (FEMA 386-3) "Developing the Mitigation Plan - Identifying Mitigation Actions and Implementation Strategies" for more information on how to identify specific mitigation actions to address hazard risk in your community.

FEMA in collaboration with the American Planning Association has released the publication, "Integrating Hazard Mitigation into Local Planning." This guide explains how hazard mitigation can be incorporated into several different types of local planning programs. For more information go to [www.planning.org](http://www.planning.org), or <http://www.fema.gov/library>.

- **Environmental.** Does the mitigation action cause adverse impacts on the environment or can they be mitigated? Is it the most appropriate action among the possible alternatives?

Your local Hazard Mitigation Plan is a valuable place to identify and prioritize possible mitigation actions. The plan includes a mitigation strategy with mitigation actions that were developed through a public and open process. You can then add to or modify those actions based on what is learned during the course of the Risk MAP project and the information provided within this FRR.

### 4.3 Mitigation Programs and Assistance

Not all mitigation activities require funding (e.g., local policy actions such as strengthening a flood damage prevention ordinance), and those that do are not limited to outside funding sources (e.g., inclusion in local capital improvements plan, etc.). For those mitigation actions that require assistance through funding or technical expertise, several state and federal agencies have flood hazard mitigation grant programs and offer technical assistance. These programs may be funded at different levels over time or may be activated under special circumstances such as after a presidential disaster declaration.

#### 4.3.1 FEMA Mitigation Programs and Assistance

FEMA awards many mitigation grants each year to states and communities to undertake mitigation projects to prevent future loss of life and property resulting from hazard impacts, including flooding. The FEMA Hazard Mitigation Assistance (HMA) programs provide grants for mitigation through the programs listed in Table 4.2 below.

**Table 4-2. FEMA Hazard Mitigation Assistance Programs**

Mitigation Grant Program	Authorization	Purpose
Hazard Mitigation Grant Program (HMGP)	Robert T. Stafford Disaster Relief and Emergency Assistance Act	Activated after a presidential disaster declaration; provides funds on a sliding scale formula based on a percentage of the total federal assistance for a disaster for long-term mitigation measures to reduce vulnerability to natural hazards
Flood Mitigation Assistance (FMA)	National Flood Insurance Reform Act	Reduce or eliminate claims against the NFIP
Pre-Disaster Mitigation (PDM)	Disaster Mitigation Act	National competitive program focused on mitigation project and planning activities that address multiple natural hazards
Repetitive Flood Claims (RFC)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce flood claims against the NFIP through flood mitigation; properties must be currently NFIP insured and have had at least one NFIP claim



Communities can link hazard mitigation plans and actions to the right FEMA grant programs to fund flood risk reduction. More information about FEMA HMA programs can be found at <http://www.fema.gov/government/grant/hma/index.shtm>.

Mitigation Grant Program	Authorization	Purpose
Severe Repetitive Loss (SRL)	Bunning-Bereuter-Blumenauer Flood Insurance Reform Act	Reduce or eliminate the long-term risk of flood damage to SRL residential structures currently insured under the NFIP

The HMGP and PDM programs offer funding for mitigation planning and project activities that address multiple natural hazard events. The FMA, RFC, and SRL programs focus funding efforts on reducing claims against the NFIP. Funding under the HMA programs is subject to availability of annual appropriations, and HMGP funding is also subject to the amount of FEMA disaster recovery assistance provided under a presidential major disaster declaration.

FEMA’s HMA grants are awarded to eligible states, tribes, and territories (applicant) that, in turn, provide subgrants to local governments and communities (subapplicant). The applicant selects and prioritizes subapplications developed and submitted to them by subapplicants and submits them to FEMA for funding consideration. Prospective subapplicants should consult the office designated as their applicant for further information regarding specific program and application requirements. Contact information for the FEMA Regional Offices and State Hazard Mitigation Officers (SHMO) is available on the FEMA website ([www.fema.gov](http://www.fema.gov)).

#### 4.3.2 Additional Mitigation Programs and Assistance

Several additional agencies including USACE, Natural Resource Conservation Service (NRCS), U.S. Geological Survey (USGS), and others have specialists on staff and can offer further information on flood hazard mitigation. The State NFIP Coordinator and SHMO are state-level sources of information and assistance, which vary among different states.

The Silver Jackets program, active in several states, is a partnership of USACE, FEMA, and state agencies. The Silver Jackets program provides a state-based strategy for an interagency approach to planning and implementing measures for risk reduction.

## 5 Acronyms and Definitions

### 5.1 Acronyms

#### A

AAL	Average Annualized Loss
ALR	Annualized Loss Ratio
<i>AoMI</i>	<i>Areas of Mitigation Interest</i>

#### B

BCA	Benefit-Cost Analysis
BFE	Base Flood Elevation
BMP	Best Management Practices

#### C

CFR	Code of Federal Regulations
COG	Continuity of Government Plan
COOP	Continuity of Operations Plan
CRS	Community Rating System
CSLF	Changes Since Last FIRM

#### D

DHS	Department of Homeland Security
DMA 2000	Disaster Mitigation Act of 2000

#### E

EOP	Emergency Operations Plan
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#### F

FEMA	Federal Emergency Management Agency
FIRM	Flood Insurance Rate Map
FIS	Flood Insurance Study
FMA	Flood Mitigation Assistance
FRD	Flood Risk Database
FRM	Flood Risk Map
FRR	Flood Risk Report
FY	Fiscal Year

#### G

GIS	Geographic Information System
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#### H

HMA	Hazard Mitigation Assistance
HMGP	Hazard Mitigation Grant Program

## I

IA Individual Assistance

## N

NFIA National Flood Insurance Act  
NFIP National Flood Insurance Program  
NRCS Natural Resource Conservation Service

## P

PA Public Assistance  
PDM Pre-Disaster Mitigation

## R

RFC Repetitive Flood Claims  
Risk MAP Mapping, Assessment, and Planning

## S

SFHA Special Flood Hazard Area  
SHMO State Hazard Mitigation Officer  
SRL Severe Repetitive Loss

## U

USACE U.S. Army Corps of Engineers  
USGS U.S. Geological Survey

## 5.2 Definitions

**0.2-percent-annual-chance flood** – The flood elevation that has a 0.2-percent chance of being equaled or exceeded each year. Sometimes referred to as the 500-year flood.

**1-percent-annual-chance flood** – The flood elevation that has a 1-percent chance of being equaled or exceeded each year. Sometimes referred to as the 100-year flood.

**Annualized Loss Ratio (ALR)** – Expresses the annualized loss as a fraction of the value of the local inventory (total value/annualized loss).

**Average Annualized Loss (AAL)** – The estimated long-term weighted average value of losses to property in any single year in a specified geographic area.

**Base Flood Elevation (BFE)** – Elevation of the 1-percent-annual-chance flood. This elevation is the basis of the insurance and floodplain management requirements of the NFIP.

**Berm** – A small levee, typically built from earth.

**Cfs** – Cubic feet per second, the unit by which discharges are measured (a cubic foot of water is about 7.5 gallons).

**Consequence (of flood)** – The estimated damages associated with a given flood occurrence.

**Crest** – The peak stage or elevation reached or expected to be reached by the floodwaters of a specific flood at a given location.

**Dam** – An artificial barrier that has the ability to impound water, wastewater, or any liquid-borne material, for the purpose of storage or control of water.

**Design flood event** – The greater of the following two flood events: (1) the base flood, affecting those areas identified as SFHAs on a community’s FIRM; or (2) the flood corresponding to the area designated as a flood hazard area on a community’s flood hazard map or otherwise legally designated.

**Erosion** – Process by which floodwaters lower the ground surface in an area by removing upper layers of soil.

**Essential facilities** – Facilities that, if damaged, would present an immediate threat to life, public health, and safety. As categorized in Hazus, essential facilities include hospitals, emergency operations centers, police stations, fire stations, and schools.

**Flood** – A general and temporary condition of partial or complete inundation of normally dry land areas from (1) the overflow of inland or tidal waters or (2) the unusual and rapid accumulation or runoff of surface waters from any source.

**Flood Insurance Rate Map (FIRM)** – An official map of a community, on which FEMA has delineated both the SFHAs and the risk premium zones applicable to the community. See also Digital Flood Insurance Rate Map.

**Flood Insurance Study (FIS) Report** – Contains an examination, evaluation, and determination of the flood hazards of a community, and if appropriate, the corresponding water-surface elevations.

**Flood risk** – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. Sometimes referred to as flood vulnerability.

**Flood vulnerability** – Probability multiplied by consequence; the degree of probability that a loss or injury may occur as a result of flooding. Sometimes referred to as flood risk.

**Floodborne debris impact** – Floodwater moving at a moderate or high velocity can carry floodborne debris that can impact buildings and damage walls and foundations.

**Floodwall** – A long, narrow concrete or masonry wall built to protect land from flooding.

**Floodway (regulatory)** – The channel of a river or other watercourse and that portion of the adjacent floodplain that must remain unobstructed to permit passage of the base flood without cumulatively increasing the water surface elevation more than a designated height (usually 1 foot).

**Floodway fringe** – The portion of the SFHA that is outside of the floodway.

**Freeboard** – A factor of safety usually expressed in feet above a flood level for purposes of flood plain management. “Freeboard” tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of the watershed (44CFR§59.1).

**Hazus** – A GIS-based risk assessment methodology and software application created by FEMA and the National Institute of Building Sciences for analyzing potential losses from floods, hurricane winds and storm surge, and earthquakes.

**High velocity flow** – Typically comprised of floodwaters moving faster than 5 feet per second.

**Levee** – A human-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding. (44CFR§59.1)

**Loss ratio** – Expresses loss as a fraction of the value of the local inventory (total value/loss).

**Mudflow** – Mudslide (i.e., mudflow) describes a condition where there is a river, flow or inundation of liquid mud down a hillside usually as a result of a dual condition of loss of brush cover, and the subsequent accumulation of water on the ground preceded by a period of unusually heavy or sustained rain. A mudslide (i.e., mudflow) may occur as a distinct phenomenon while a landslide is in progress, and will be recognized as such by the Administrator only if the mudflow, and not the landslide, is the proximate cause of damage that occurs. (44CFR§59.1)

**Probability (of flood)** – The likelihood that a flood will occur in a given area.

**Risk MAP** – Risk Mapping, Assessment, and Planning, a FEMA strategy to work collaboratively with state, local, and tribal entities to deliver quality flood data that increases public awareness and leads to action that reduces risk to life and property.

**Riverine** – Of or produced by a river. Riverine floodplains have readily identifiable channels.

**Special Flood Hazard Area (SFHA)** – Portion of the floodplain subject to inundation by the 1-percent-annual or base flood.

**Stafford Act** – Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-707, signed into law November 23, 1988; amended the Disaster Relief Act of 1974, PL 93-288. This Act constitutes the statutory authority for most federal disaster response activities especially as they pertain to FEMA and FEMA programs.

**Stillwater** – Projected elevation that flood waters would assume, referenced to National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or other datum, in the absence of waves resulting from wind or seismic effects.

**Stream Flow Constrictions** – A point where a human-made structure constricts the flow of a river or stream.

## 6 Additional Resources

**ASCE 7** – National design standard issued by the American Society of Civil Engineers (ASCE), *Minimum Design Loads for Buildings and Other Structures*, which gives current requirements for dead, live, soil, flood, wind, snow, rain, ice, and earthquake loads, and their combinations, suitable for inclusion in building codes and other documents.

**ASCE 24-05** – National design standard issued by the ASCE, *Flood Resistant Design and Construction*, which outlines the requirements for flood resistant design and construction of structures in flood hazard areas.

National Flood Insurance Program (NFIP), Federal Emergency Management Agency (FEMA), [www.floodsmart.gov](http://www.floodsmart.gov)

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FEMA, 2006c. "Designing for Flood Levels Above the BFE," *Hurricane Katrina Recovery Advisory 8, Hurricane Katrina in the Gulf Coast: Building Performance Observations, Recommendations, and Technical Guidance*, FEMA 549, Appendix E. Washington, DC, July 2006.

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FEMA, 2007b. *Public Assistance Guide*, FEMA 322. Washington, DC, June 2007.

FEMA, 2007c. *Using Benefit-Cost Review in Mitigation Planning*, FEMA 386-5. Washington, DC, May 2007.

FEMA, 2007d. *Design Guide for Improving Critical Facility Safety from Flooding and High Winds: Providing Protection to People and Buildings*, FEMA 543. Washington, DC, January 2007.

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## 7 Data Used to Develop Flood Risk Products

GIS base map information was acquired from the following sources:

- FEMA
- US CENSUS BUREAU

Engineering study information was leveraged from the USGS with coordination from the State of Massachusetts Department of Natural Resources Floodplain Management Program. Mitigation Plans and AoMI information were acquired from local community input as well as significant input from the State of Massachusetts Emergency Management Agency.