



# 2019 National Threat and Hazard Identification and Risk Assessment (THIRA)

Overview and Methodology

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# FEMA

The 2019 National Threat and Hazard Identification and Risk Assessment (THIRA): Overview and Methodology provides an in-depth description of the Federal Emergency Management Agency’s (FEMA) approach to completing a national-level risk assessment. The intended audience is emergency management officials engaged in risk assessment at the community and Federal level, as well as other practitioners in the private sector or academia.

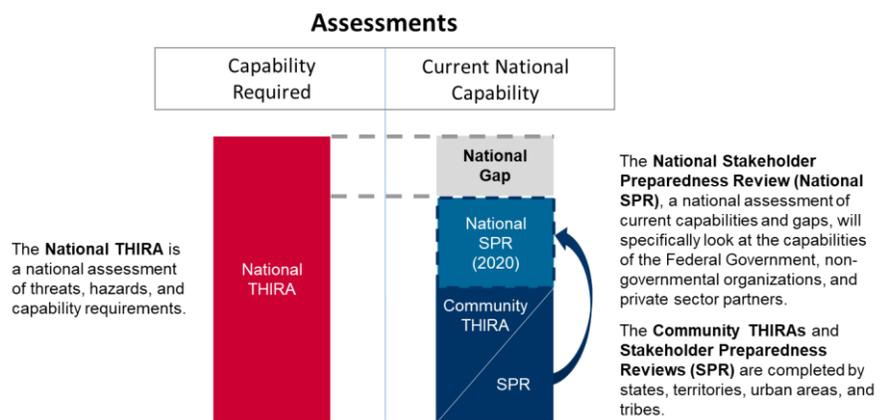
## Executive Summary

### FEMA’s Vision for Assessing National Risk and Capability

Emergency management is a shared responsibility of the whole community. Every year, Federal agencies assist and coordinate with state, local, tribal, and territorial (SLTT)<sup>1</sup> governments and other stakeholders to perform life-saving and life-sustaining activities before, during, and after disasters. While the Nation faces risks from many threats and hazards each year, planning separately for all of them would require an enormous amount of time and resources. Rather than plan for every possible threat and hazard, the Nation has embraced **capabilities-based planning**—building and sustaining core capabilities that can help prevent, protect against, mitigate, respond to, and recover from multiple threats and hazards.<sup>2</sup> Capabilities-based planning is the foundation of the National Preparedness System.

The Disaster Recovery Reform Act of 2018 (DRRA)—enacted after the devastation of the 2017 hurricane season and 2018 California wildfires—emphasizes the importance of capabilities-based planning. Specifically, DRRA requires FEMA to “complete a national preparedness assessment of capability gaps at each level based on tiered, capability-specific performance objectives to enable prioritization of grant funding.”

To meet this requirement, FEMA is developing a suite of assessment products, known collectively as the National Risk and Capability Assessment (NRCA), that will measure risk and capability across the Nation in a standardized and coordinated process. The assessments under the NRCA will synchronize and strengthen preparedness efforts across the emergency management community (see **Figure 1**). By analyzing data on community, Federal, non-governmental, and private-



**Figure 1: The assessments identify the national-level capability needs and gaps to meet catastrophic incidents.**

<sup>1</sup> The term “state, local, tribal, and territorial governments” is used interchangeably with the term “communities” throughout this document.

<sup>2</sup> The core capabilities are listed and defined at <https://www.fema.gov/core-capabilities>.

sector capabilities, FEMA will be able to present a complete analysis of national preparedness. Ultimately, the assessments will help answer the question: “How prepared is the Nation?”

### ***The 2019 National THIRA***

The National Threat and Hazard Identification and Risk Assessment (National THIRA) is a foundational component of this group of assessments. Since 2012, communities have used a standard THIRA methodology to identify and assess the threats and hazards they face. In 2018, this methodology was updated to include new standardized language. The National THIRA applies the updated THIRA methodology and the standardized language at the national level to answer the following key questions:

- Which realistic threats and hazards will be the most challenging for the Nation to manage?
- If they occurred, what impacts would those threats and hazards have on the Nation?
- Based on those impacts, what capabilities will the Nation need to manage the incident?

The National THIRA describes the level of capability that the Nation—including government, private, and non-profit sectors—would need to fully manage the Nation’s threats and hazards of greatest concern while concurrently engaging in response and recovery efforts for ongoing disasters.

**To complete the 2019 National THIRA**, FEMA took the following steps:

- Conducted a literature review of existing government response plans and academic studies to develop a preliminary list of **59** threats and hazards.
- Consulted with subject-matter experts (SMEs) and reviewed a preliminary list of threats and hazards to select **nine scenarios**—consisting of both natural and human-caused incidents—that would most challenge the Nation’s capabilities.
- Developed a set of **29 standardized impacts**, based on in-depth research and stakeholder feedback. These standardized impacts represent key metrics that emergency managers use to understand the magnitude of a disaster, such as fatalities or number of people requiring shelter.
- Finalized **22 specific, quantifiable capability targets**, representing the most critical and measurable elements of selected core capabilities.

The *2019 National THIRA* represents an initial effort to identify the greatest threats and hazards to the Nation, the potential impacts of those threats and hazards to life and property, and the capabilities needed to address those impacts. As FEMA refines its approach to conducting national risk and capability assessments, the National THIRA will continue to evolve and improve. Subsequent iterations of the National THIRA will incorporate the best available information and insights provided by Federal and SLTT stakeholders. Another assessment product, the National Stakeholder Preparedness Review (National SPR), will measure the nation’s preparedness capabilities, analyze gaps between current capability and capability targets, and suggest approaches to address the gaps. In the future, the suite of assessment products—including the National THIRA, National SPR, and community THIRAs/SPRs—will offer a comprehensive, unified assessment of national preparedness.

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## Organization of the 2019 National THIRA

This document contains two main sections and five appendices. The first section—**National THIRA Overview**—provides a conceptual overview of the National THIRA and how it fits into FEMA’s vision for a broader national assessment. Informed by this conceptual overview, the second section—**2019 National THIRA: Methodology and Outputs**—describes the full approach FEMA took to complete the *2019 National THIRA*. This section briefly outlines the steps FEMA has taken to identify the Nation’s realistic worst-case scenarios and their impacts, and how FEMA established capability targets that provide specific capabilities required to manage those impacts. This section also includes a brief description of the outcomes of the *2019 National THIRA*.

The five appendices offer supplemental information that supports the *2019 National THIRA*, elaborating on specific data and processes. **Appendix A: Limitations and Future Research** describes caveats and limits to the use of the *2019 National THIRA*, including data constraints encountered throughout development. This appendix also discusses how future National THIRAs will address those challenges. **Appendix B: Scenario Context Descriptions** includes the context descriptions that FEMA developed for each of the final scenarios,<sup>3</sup> including the Plausible Concurrent Operations. **Appendix C: Standardized Impacts** defines the 29 standardized impacts, which are the metrics that FEMA used to estimate the impacts resulting from the threat and hazard scenarios. **Appendix D: Scenario Chronology** offers visualizations to illustrate the timelines of the incidents included in the Plausible Concurrent Operations, as well as the scenarios used for the *2019 National THIRA*.<sup>4</sup> **Appendix E: Standardized Targets** presents the 22 standardized targets for the Cross-Cutting, Response, and Recovery core capabilities without impacts or timeframe metrics.

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<sup>3</sup> FEMA removed context descriptions and data for two scenarios that FEMA deemed too sensitive for inclusion in the public version of this document.

<sup>4</sup> FEMA removed two scenarios from the chronology that FEMA deemed too sensitive for inclusion in the public version of this document.

## National THIRA Overview

The National THIRA is an important component of the suite of assessment products that will measure risk and capability across the Nation in a standardized and coordinated process. Results from the National THIRA, when combined with data from the other assessments, will help answer fundamental preparedness questions: 1) How prepared is the Nation? 2) What preparedness gaps does the Nation face? and 3) What strategies does the Nation need to develop to address those gaps?

### Components of the Assessments

**Risks and Associated Impacts:** All levels of government use the THIRA process to identify and assess threats and hazards of concern. The National THIRA assesses the impacts of the most challenging threats and hazards facing the Nation.

**Capability Targets:** For communities, the THIRA process uses capability targets to translate the likely impacts of events into goals for community capability. At the national level, the National THIRA establishes capability targets for the Nation to collectively address.

**Current Capabilities:** For communities, the SPR enables the measurement of current capabilities. At the national level, the National SPR will assess the Nation's ability to provide support beyond current community capabilities.

**Gaps:** The SPR process helps all levels of government to identify the current gaps that are preventing them from reaching their capability targets and develop strategies to close those gaps.

The National THIRA contributes to the national assessment by:

- Assessing the impacts of the most challenging threats and hazards facing the Nation;
- Setting national capability targets that identify how much capability the Nation will need; and
- Supporting measurement of national capabilities when combined with the National SPR.

Each of these elements is discussed in more detail below.

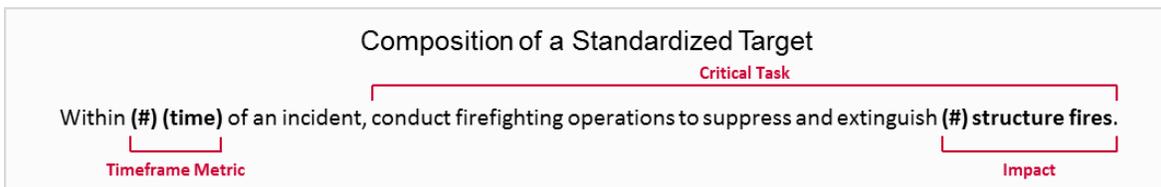
### ***Assessing the impacts of the most challenging threats and hazards***

In the *2019 National THIRA*, FEMA identified threats and hazards that can most challenge the Nation's Cross-Cutting, Response, and Recovery core capabilities. For these threats and hazards, FEMA developed context descriptions by consulting historical data and models to identify potential impacts. These impacts include cascading effects from an incident, as well as conditions that may make threats and hazards especially challenging for the Nation's capabilities, such as the location, magnitude, and time of an incident. Based on these context descriptions, FEMA then estimated the national-level impacts of the identified threats and hazards using language common to emergency managers. This process will help compare impacts across all communities, allowing the Nation to better prepare for threats and hazards.

### Setting national capability targets

The 2019 National THIRA builds on previous assessments of catastrophic national risks, taking the analysis a step further by identifying the capabilities necessary to address those risks. Through extensive collaboration with other Federal partners, FEMA developed standardized target language for the Cross-Cutting, Response, and Recovery core capabilities. These standardized targets also align with FEMA’s Community Lifelines construct, which prioritizes the services that enable continuous operation of business and government functions critical to human health and safety or economic security. With the completion of the National THIRA, all levels of government, including the Federal Government, will use this same standardized target language to complete the THIRA.

Each standardized target describes a **critical task**, which collectively reflect the types of activities emergency managers routinely plan for. These critical tasks broadly apply to a wide range of threats and hazards—not only those identified in the THIRA. The Nation’s ability to perform critical tasks helps indicate the Nation’s preparedness. Each standardized target also incorporates **impacts** and **timeframe metrics**. Setting a goal to manage the impact of the threat or hazard in a desired amount of time creates a **capability target** (see **Figure 2**).

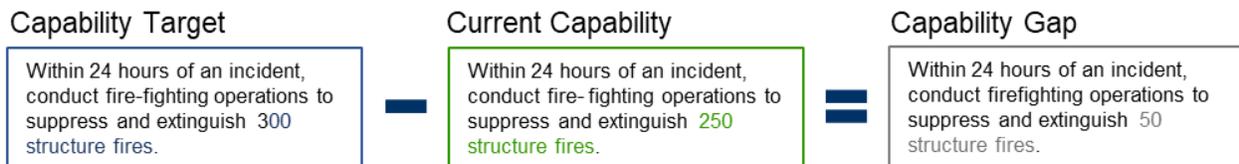


**Figure 2: The basic components of a standardized target.**

The National THIRA will compare the level of capability communities collectively intend to build and sustain to the estimated level of capability the Nation will need to manage a catastrophic threat or hazard. By identifying and understanding resulting gaps in capability, the Nation can strategize on how best to close these gaps. Gap-closing strategies may include increasing community capability or seeking out mutual aid capabilities.

### Supporting measurement of national capabilities

FEMA will be able to combine data from the National THIRA with data from the National SPR to compare estimates of national capabilities to national targets (see **Figure 3**). In the National SPR, FEMA will collect capability data from Federal and other national-level sources, assessing their ability to support communities. FEMA will use the National THIRA and the National SPR to set national targets and measure national capabilities. This process will support building a culture of preparedness by identifying the Nation’s gaps and informing investments to close them.



**Figure 3: Communities establish capability targets and estimate current capabilities using the same language.**

The National THIRA also contributes to improvements across the entire field of risk management by supporting efforts to:

- Incorporate standard risk and capability language into plans;
- Evaluate performance against capability targets to continuously identify gaps between the Nation’s capabilities and those targets; and
- Encourage investments in closing identified capability gaps.

Each of these elements is discussed in more detail below.

### ***Incorporating standard risk and capability language into plans***

Using modeling and historical datasets, the National THIRA will support FEMA’s scenario-based plans. For example, FEMA’s catastrophic plans identify planning factors and incident objectives using the standardized impact language and standardized target language from the National THIRA. The use of standardized impact and target language in FEMA plans will enable FEMA to better coordinate with state and local communities, evaluate performance, and identify and close gaps. Incorporating the National THIRA language and data into response plans will also help FEMA to better evaluate performance against targets during exercises and real-world incidents that follow those same plans.

### ***Evaluating performance against capability targets to continuously identify gaps***

Exercises test a community’s—or the Nation’s—ability to meet its capability targets. Capability targets, when incorporated into planning and used as exercise evaluation criteria, can measure how effectively the tested plan meets the goal and how well the participants perform the tasks in the plan. The after-action and continuous improvement process can validate capabilities already in place and describe areas for improvement. At the national level, the after-action and continuous improvement process can help FEMA and its stakeholders identify how to close capability gaps and bring the Nation closer to meeting the targets established through the National THIRA.

### ***Encouraging investments in closing identified capability gaps***

Identifying gaps between targets and current capability and creating approaches to close those gaps will lead to more efficient and effective preparedness investments. By integrating data from the National THIRA and National SPR, FEMA can use identified gaps between national targets and current capability to inform future strategic planning and budgeting efforts.

# 2019 National THIRA: Methodology and Outputs

The following section provides an overview of the three-step methodology FEMA used to develop the 2019 National THIRA. The THIRA process that FEMA used is consistent with the *Comprehensive Preparedness Guide (CPG) 201, 3rd Edition*, applied at the national level.

## Step 1: Identify Threats and Hazards of Concern

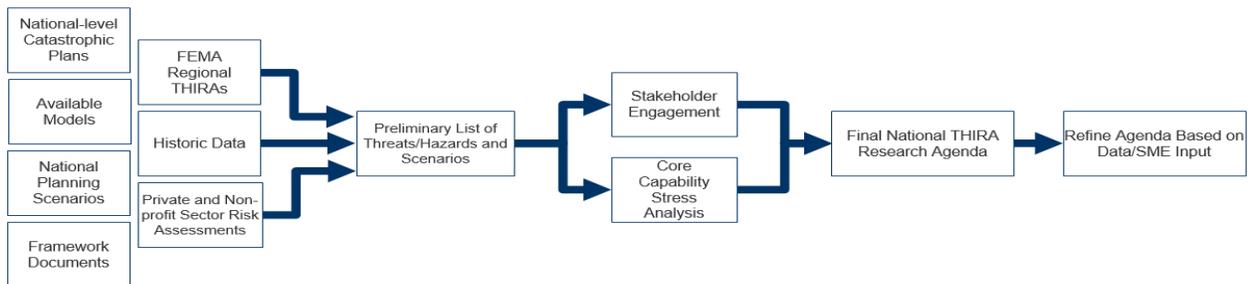
FEMA considered two factors when evaluating which threats and hazards to include in the National THIRA: 1) whether the threat or hazard could realistically affect the Nation; and 2) the challenge the threat or hazard would present to the Nation’s capabilities if it occurred. FEMA ultimately included **nine scenarios** spread across **six threats and hazards** that could realistically occur and challenge the Nation’s capabilities (see **Figure 4**). By having a uniform, prioritized list of the Nation’s realistic worst-case scenarios (see **Appendix B: Scenario Context Descriptions**), Federal agencies and other partner organizations involved in incident management will be better able to coordinate their planning and exercises efforts.



**Figure 4: The output of Step 1 of the THIRA is a list of threats and hazards of concern.**

FEMA developed a research agenda and refined the threat and hazard list in four steps (see **Figure 5**):

1. Conducted a literature review to develop a preliminary list of threats and hazards;
2. Consulted with SMEs to identify the most challenging threats and hazards to the core capabilities;
3. Solicited stakeholder feedback to refine most challenging threats and hazards; and
4. Refined the threat and hazard list based on available data and SME review.



**Figure 5: A visualization of the process that FEMA used to complete Step 1 of the 2019 National THIRA.**

## Literature Review to Develop Preliminary List of Threats and Hazards

The literature review included 55 sources, helping FEMA to identify the threats and hazards that could most challenge the Nation's capabilities.<sup>5</sup> In addition, FEMA engaged with 43 offices and programs across the Federal Government during its research.

FEMA used the results of its research and engagement to develop a preliminary list of threats and hazards that could realistically affect the Nation. FEMA included an incident if:

- A similar incident previously occurred; or
- Experts consider the incident to be a realistic threat or hazard to the Nation; or
- The Federal Government has previously considered the incident realistic or consequential enough to warrant planning and discussion at the Federal level.

FEMA included all incidents identified as realistic in an initial list of 59 threats and hazards. From this point, FEMA hypothesized the worst outcomes possible for each threat and hazard. If the threat or hazard was not bound to a specific location, FEMA selected a location where it would be the most realistic and likely the most challenging. For example, FEMA considered the effects of a major earthquake in the Pacific Northwest due to the proximity of a major fault line in the region. While some of the initial threats and hazards included catastrophic incidents, further research into these incidents did not result in any available modeling data. In place of these catastrophic incidents, FEMA considered similar, but still challenging, incidents that had modeling data available to include such data in the National THIRA scenarios.

## Identification of Most Challenging Threats and Hazards

Next, FEMA narrowed its preliminary list to the threats and hazards most challenging to the Nation's capabilities. This process included the participation of SMEs, including the owners of models and data inventories within other Federal offices, who reviewed the preliminary list and made determinations based on the severity of the threat or hazard.<sup>6</sup> FEMA also considered key functions of each core capability, which helped identify the most catastrophic incidents for each threat or hazard in relation to current national capabilities.

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<sup>5</sup> The list of 55 sources included modeling data of relevant threats and hazards, national-level catastrophic plans, FEMA Region THIRAs, historical data from previous incidents, National Planning Scenarios, private and non-profit sector risk assessments, and National Planning Frameworks.

<sup>6</sup> The initial list of threats and hazards included both generalized threats and hazards and specific threat and hazard scenarios. FEMA provided a preliminary context for a generalized threat or hazard in the following cases:

- 1) If FEMA identified a specific scenario (through the literature review or expert elicitation) as posing a significant challenge; or
- 2) If FEMA considered the generalized threat or hazard significant enough to warrant further investigation, in which case, FEMA included specific scenarios that could plausibly create the most stress for a single capability.

There may be other stressful scenarios that FEMA did not include in this initial list. (For further discussion of this limitation see **Appendix A: Limitations and Future Research.**)

**Solicitation of Stakeholder Feedback to Refine Most Challenging Threats and Hazards**

FEMA shared its list of most challenging threats and hazards with stakeholders<sup>7</sup> and requested their feedback. FEMA finalized the list after receiving stakeholder feedback, which addressed additional threats or hazards that would place a greater strain on the Nation’s capabilities than those already on the list.

**Development of Refined List of Threats and Hazards**

After an expansive literature review, an analysis of the most challenging threats or hazards, and consultation with SMEs and key stakeholders, FEMA developed a refined list of nine scenarios spanning six threats and hazards (shown in **Appendix B: Scenario Context Descriptions**) to include in the National THIRA. In addition to the scenarios, the *2019 National THIRA* includes a set of Plausible Concurrent Operations that represents the ongoing response and recovery operations the Nation would likely be supporting when any of these other catastrophic incidents occur. This set of Plausible Concurrent Operations will help the Nation account for the challenges posed by these ongoing operations and the capabilities and resources required to support them, as it plans for catastrophic incidents. FEMA used information from previous incidents, including five floods, three major hurricanes, and the 2017 California wildfires, to make the Plausible Concurrent Operations realistic. The threats and hazards included in the *2019 National THIRA* can be found below (see **Table 1**); the hazards included in the Plausible Concurrent Operations can be found in **Appendix D: Scenario Chronology**.

**Table 1: Threats and Hazards of Concern Identified for the 2019 National THIRA<sup>8,9</sup>**

Threat/Hazard Type	Threat/Hazard	Area/Region
Natural	Plausible Concurrent Operations <sup>10</sup>	Nationwide
	Earthquake	Washington, Oregon, California, Idaho
		600,000 sq. km in the Midwest/East

<sup>7</sup> FEMA engaged with stakeholders from the following departments and offices: the Department of Agriculture, the Department of Commerce’s National Oceanic and Atmospheric Administration, numerous offices within the Department of Defense (including U.S. Army Corps of Engineers, Defense Threat Reduction Agency, and the Office of the Assistant Secretary of Defense [Preparedness Policy]), the Department of Energy, numerous offices within the Department of Homeland Security (including the Cybersecurity and Infrastructure Security Agency [formerly the National Protection and Programs Directorate], Office of Science and Technology, Countering Weapons of Mass Destruction Office, and the Office of Intelligence and Analysis), the Department of Health and Human Services Office of the Assistant Secretary for Preparedness and Response, the Department of the Interior (including the U.S. Geological Survey), the Department of Justice’s Federal Bureau of Investigation, numerous offices within FEMA (including Office of Response and Recovery, Region VIII, and the Office of Counterterrorism and Security Preparedness), the General Services Administration, Argonne National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratory, the Nuclear Regulatory Commission, and the White House Office of Science and Technology Policy.

<sup>8</sup> FEMA did not identify any technological hazards in the *2019 National THIRA* because it determined these hazards would most likely be secondary hazards to another incident (e.g., a dam failure following an earthquake).

<sup>9</sup> FEMA removed two scenarios from this table that were deemed too sensitive for inclusion in the public version of this document.

<sup>10</sup> More information on Plausible Concurrent Operations is included in **Appendix B: Scenario Context Descriptions**.

Threat/Hazard Type	Threat/Hazard	Area/Region
	Hurricane	Galveston, Texas to the Midwest
		Fort Lauderdale, Florida to Alabama
		Hawaii
	Pandemic	Nationwide
	Space Weather	Nationwide

### Step 2: Give Threats and Hazards Context

Context descriptions allow FEMA to determine why certain threats and hazards are particularly challenging for the Nation to address. They also provide key information that helps FEMA measure the estimated impacts of threats and hazards.

Through Step 2 of the National THIRA (see **Figure 6**), FEMA developed context descriptions for each of the threats and hazards identified in Step 1. Context descriptions, framed as narratives of potential scenarios, indicate what factors would make each threat or hazard especially challenging for the Nation, including location, magnitude, time of an incident, and cascading effects. In Step 2, FEMA also estimated the potential impacts of each scenario.



**Figure 6: The outputs of Step 2 of the THIRA are context descriptions and impact numbers.**

### Development of Context Descriptions

FEMA reviewed plans and modeling data to identify information concerning the time, place, and conditions that made the impacts most severe for the threats and hazards selected in Step 1. FEMA then used that information to draft context descriptions. FEMA considered both historical and modeled incidents to develop context descriptions that were both realistic and catastrophic. For example, in the Cascadia and San Andreas earthquake scenario, FEMA aggregated impacts from an earthquake along the Cascadia subduction zone with an earthquake along the San Andreas fault line. The context descriptions FEMA developed for the *2019 National THIRA* are listed in **Appendix B: Scenario Context Descriptions**.

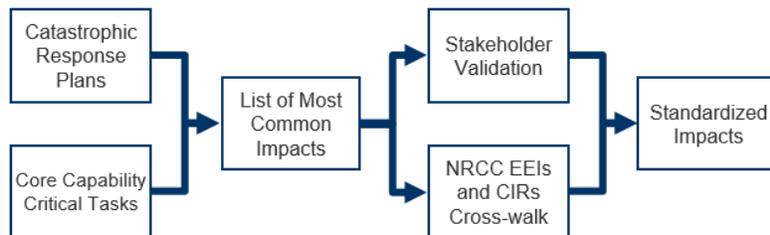
### Estimation of Impacts

Next, FEMA estimated the impacts each scenario would have on the Nation if the threat or hazard occurred. To address a lack of standardization across response plans and models, FEMA developed **standardized language to describe 29 different impacts** that represent metrics commonly used by the emergency management community. The standardized impacts (see **Appendix C: Standardized Impacts**) represent key quantifiable consequences associated with major threats and hazards used to inform capability targets. By focusing on a select set of the most important impact data metrics, FEMA and other members of the emergency management community can ensure that response and recovery plans are more coordinated and systematic.

To estimate impacts, FEMA first conducted a literature review of catastrophic plans to identify the most

common types of impacts. FEMA then compared this list to emergency management doctrine to confirm that the standardized impacts correspond to language used by emergency response officials.<sup>11</sup> FEMA also engaged 43 Federal interagency stakeholders and consulted more than 100 community stakeholders to validate the standardized impacts. Standardized impacts enabled FEMA to compare the impacts of all considered threats and hazards using the same language. Where possible, FEMA also attempted to align the standardized impacts with modeling outputs.

To determine which scenario impacts would be the most challenging for each capability target, FEMA reviewed all 216 models and modeling tools in the Modeling and Data Inventory, which catalogs data and models used across the Federal interagency. FEMA gathered impact data from several interagency models, response plans, and other validated sources, and then collected and analyzed impact data for each threat and hazard scenario and capability target (see **Figure 7**).



**Figure 7: How FEMA developed Standardized Impacts.**

The following table (**Table 2**) represents an example of the impacts FEMA collected for the 2019 National THIRA. The impact data gathered for the purposes of this report demonstrate the unprecedented, extremely challenging nature of the threats and hazards selected. All impact data came from reliable, non-partisan sources, including 1) Federal, regional, or state emergency operations plans, 2) models or data inventories owned or managed by established research institutions (governmental, non-governmental, or academic), or 3) historical verified incident data.

**Table 2: Example impact data collected for the 2019 National THIRA**

Impact Type	Value	Source
Individuals Requiring Medical Care	48,000,000 (outpatient medical care)	U.S. Department of Health and Human Services. (2017). "Pandemic Influenza Plan: 2017 Update" pg. 44
Communities Affected	Lower 48 states	University of Cambridge Centre for Risk Studies. (2016). "Helios Solar Storm Scenario." pg. 23

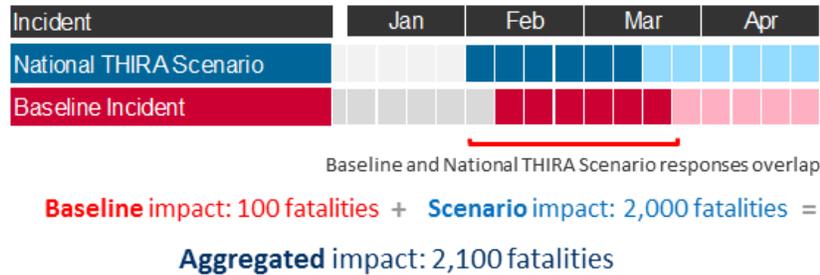
### Plausible Concurrent Operations

National-level incidents do not occur in isolation. FEMA and its Federal partners will almost certainly be engaged in ongoing disaster operations at the time of any catastrophic-level incident. These existing and ongoing commitments increase the total impacts that the Nation must manage. To capture this reality in the National THIRA, FEMA gathered impact data from historical incidents which occurred in recent years, including the three largest hurricanes from the 2017 hurricane season, the 2017 California wildfires, and five major floods from previous years. FEMA added the impact data from these incidents

<sup>11</sup> FEMA compared the list of common impacts to the National Response Coordination Center’s essential elements of information and critical information requirements.

to form a notional baseline of existing operations—Plausible Concurrent Operations—that could be underway at the time a National THIRA scenario occurred.

FEMA added impacts from incidents in the Plausible Concurrent Operations to National THIRA scenario impacts if FEMA deemed they could occur concurrently with the National THIRA scenario. To determine this, FEMA developed a single incident chronology that identified the actual dates the real-world incidents occurred as well as notional dates assigned to the National THIRA scenarios. The chronology also included the approximate response and recovery periods for each disaster, identified by reviewing plans or consulting with SMEs (see **Figure 8**).



**Figure 8: How FEMA combined scenario and baseline impacts to create aggregated impacts for use in capability target building. The example shown is hypothetical.**

Using this chronology, FEMA compared the Plausible Concurrent Operations incidents with the National THIRA scenarios to determine which impacts would notionally occur simultaneously (see **Appendix D: Scenario Chronology**). Where this overlap occurred, FEMA combined the scenario and baseline impacts to create aggregated impacts for use in the capability targets.

### Step 3: Establish Capability Targets

Capability targets include specific and measurable metrics that describe the capabilities the Nation needs to manage potential catastrophic incidents. Additionally, the capability targets establish a benchmark that the emergency management community can use to track progress over time, allowing the Nation to assess how it currently responds to threats and hazards, as well as how it can improve.



**Figure 9: The output of Step 3 of the THIRA is capability targets that use standardized target language.**

For Step 3 of the National THIRA process (see **Figure 9**), FEMA created standard language, that when combined with scenario impact data and operational timeframe metrics, became national capability targets. These targets are specific benchmarks for measuring how prepared the Nation is for the potential impacts of its most challenging threats and hazards.

FEMA developed 22 standardized targets for the *2019 National THIRA*. The standardized targets (see **Appendix E: Standardized Targets**) represent a common set of measures that communities use to conduct a more comprehensive, unified assessment across all levels of emergency management. The

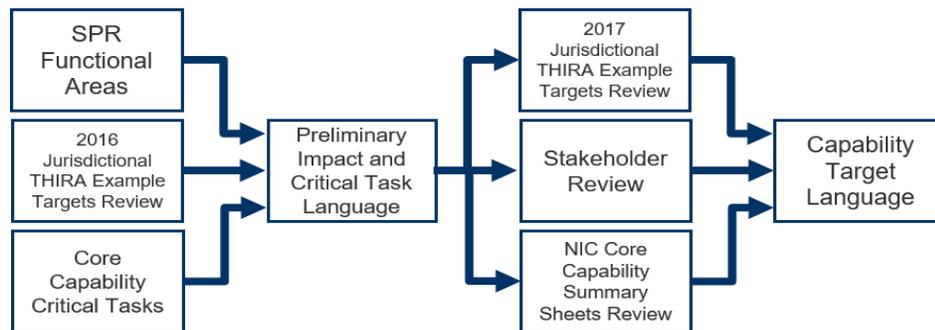
targets in this report demonstrate the massive response and recovery efforts that would be needed to address the catastrophic-level impacts of potential disasters. National targets will allow the emergency management community and all levels of government to better synchronize preparedness efforts and plan for these disasters.

### National THIRA Capability Targets

Capability targets are composed of three parts: (1) an **impact**, which represents the size of the capability requirement; (2) a **critical task**, which represents the specific action needed to achieve the capability target; and (3) a **timeframe metric**, which represents the timeframe in which the action must be performed. Development of the impacts and timeframe metrics for the standardized targets are ongoing.

### Critical Tasks

Each capability target focuses on a critical task of that core capability. The Nation's ability to perform critical tasks through all conditions helps indicate the Nation's preparedness. These critical tasks reflect the types of activities emergency managers routinely plan for and are broadly applicable to a wide range of threats and hazards, not only those identified in the *2019 National THIRA*.



**Figure 10: The process FEMA used to develop capability target language for the *2019 National THIRA*.**

FEMA used a structured approach to draft capability target language based on critical tasks to track the Nation's performance over time, allowing for both current assessments and future projections (see **Figure 10**). FEMA began by reviewing the capability targets that SLTT governments used in previous THIRAs. FEMA then cross-referenced these targets with emergency management doctrine, such as the [Federal Interagency Operational Plans \(FIOPs\)](#) and [National Planning Frameworks](#) to draft preliminary standardized target language.

Once FEMA completed drafting the standardized target language, SMEs from FEMA and other Federal agencies provided feedback. FEMA selected SMEs based on their responsibility for managing the activities associated with addressing the given impact(s) in a target. FEMA also included SMEs if they owned a particular model or dataset that generated data for a standardized impact. In addition, because these standardized targets are the same as the targets that communities will complete as part of the annual THIRA/SPR process, FEMA provided all state and local stakeholders required to complete the THIRA an opportunity to review the standardized language used for the core capability targets.

To determine which critical tasks the 2019 National THIRA standardized targets would address, FEMA asked the same SMEs who provided feedback on the standardized target language to identify the most essential critical tasks for each capability. FEMA finalized targets based on the following criteria:

- **Importance of the critical task:** Does the target measure a specific task or action needed to deliver the capability target?
- **Nationwide applicability:** Is the target relevant to a broad range of communities? For example, would the target be just as useful in a rural community as an urban one?
- **Measurability of the target:** Can the target be meaningfully and quantifiably measured?
- **Operational usefulness:** Can the target guide planning, training, exercises, operations, continuous improvement, and strategic investment?

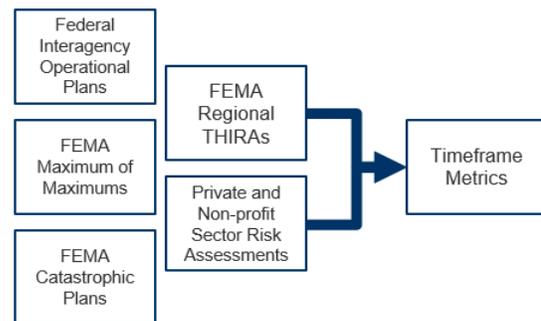
### Standardized Impacts

Each capability target includes a standardized impact. FEMA used the standardized impacts it developed in Step 2 to help define the desired extent to which the Nation should be able to perform each critical task, making each target measurable. Including the standardized impacts in the target language also makes the targets outcome-oriented and establishes a common language for describing and estimating impacts and for managing them.

The National THIRA capability targets describe the level of capability required to manage and address the impacts of the most challenging threats and hazards facing the Nation for 22 critical tasks. FEMA will be able to use these quantifiable targets to track progress over time and convey the preparedness of the Nation in specific, measurable terms.

### Timeframe Metrics

The final component of a capability target is the timeframe metric, which describes the desired timeframe for successful delivery. See **Figure 11** for how FEMA determined suitable metrics for the capability targets. FEMA reviewed FIOPs, Regional THIRAs, FEMA’s maximum of maximums scenario, community THIRAs, private and non-profit sector risk assessments, and national-level catastrophic plans to determine suitable metrics for the standardized targets. FEMA plans to continue to engage with Federal interagency partners to determine suitable timeframe metrics for each target after the release of this document. As a result, the 2019 National THIRA capability targets do not currently include timeframe metrics. Future iterations will incorporate these timeframe metrics.



**Figure 11: The process FEMA used to research potential timeframe metric statements.**

### Future Target Updates

The 2019 National THIRA features targets only for Cross-Cutting, Response, and Recovery core capabilities. FEMA may create additional targets in the future, based on engagement with whole community partners. The 2019 National THIRA: *Overview and Methodology* is a living document that reflects an evolving understanding of the Nation’s preparedness challenges and needs.

## National THIRA Capability Targets

FEMA developed 22 standardized targets for the 2019 National THIRA; two examples are below (Table 3). While there is a single target for most Cross-Cutting, Response, and Recovery core capabilities, FEMA created multiple targets in some cases where the scope of a target was especially broad. Appendix E: Standardized Targets contains the full list of targets. When completed, several capability targets will combine the impacts of a 2019 National THIRA scenario with those of the Plausible Concurrent Operations.<sup>12</sup> This means that the impacts used in some of the targets may be considerably larger.

Table 3: Examples of Standardized Targets

Example Capability Target: Health and Social Services	
SOCI-1	Within (#) (time) of an incident, restore functions at (#) affected healthcare facilities and social service organizations.
Example Capability Target: Natural and Cultural Resources	
NATU-1	Within (#) (time) of an incident, restore (#) damaged natural and cultural resources and historic properties registered in the jurisdiction.

## Conclusion

The 2019 National THIRA is the application of the THIRA process at the national level. As part of the first iteration, FEMA identified nine catastrophic incidents of concern to the Nation and developed 22 capability targets for the Cross-Cutting, Response, and Recovery core capabilities.

As FEMA refines its approach to conducting national risk and capability assessments, the National THIRA will continue to evolve and improve. While grounded in analysis and validated by stakeholder engagement, the 2019 National THIRA reflects an initial snapshot of a continuing assessment. Future iterations of the National THIRA will incorporate the best available information and insights provided by Federal and SLTT stakeholders.

In the future, FEMA’s suite of assessment products—including the National THIRA, National SPR, and community THIRAs/SPRs—will offer a comprehensive, unified assessment of national preparedness built on standardized and coordinated processes. FEMA will use these assessments to support decision-makers in prioritizing national preparedness efforts and activities, providing the best possible picture of national preparedness needs.

<sup>12</sup> Combining the impacts of a National THIRA scenario with those of a set of Plausible Concurrent Operations is intended to more accurately reflect the challenges the Nation would need to address if one of the National THIRA scenarios actually occurred.

## Appendix A: Limitations and Future Research

FEMA identified several limitations as it developed the *2019 National THIRA*, which are discussed below. These limitations complicated efforts to create capability targets. As FEMA develops future iterations of the National THIRA, it will address these issues, enabling FEMA to improve risk management and better understand and strengthen national capabilities.

### ***National preparedness assessment is limited by a lack of standardization***

The literature review of various catastrophic plans, risk assessments, and models made up a major component of the *2019 National THIRA*'s development. During this review, FEMA found very little standardization in the language used in the emergency management community to describe impacts and capabilities. As a result, risk analysis and measurement of national preparedness across the Nation is a challenge. Furthermore, limited standardized language between preparedness assessments and operations makes it challenging to use preparedness data to support disaster operations.

To address this, FEMA developed standardized impacts used to collect data for the *2019 National THIRA*. These standardized impacts should be integrated into plans, modeling efforts, and emergency management doctrine. Standardization of impact language will enable FEMA to better coordinate with state and local communities, evaluate performance, and identify and close preparedness capability gaps.

It is also important to recognize that there is a fundamental trade-off when language is standardized. Standardized language necessarily focuses on common areas of interest, maximizing its value as an indicator across a wide area; however, standard language does not incorporate unique regional geographic, demographic, and threat- and hazard-based concerns. One risk of using standard language is that it can lead to an inaccurate presumption that an impact or capability that cannot be measured in a standard way is not critical or valuable. FEMA's assessments recognize this balance, through the community THIRA and SPR process, by establishing standard language across all communities while also empowering communities to add their own quantitative or qualitative impacts, capabilities, and gaps to capture the nuances necessary to understand their community's risks and capabilities.

While the *2019 National THIRA* presented a potential long-term solution to these challenges, the lack of standardization has directly affected the data available to inform the *2019 National THIRA* and has limited its analysis.

### ***Assumptions in existing plans and models often do not account for ongoing incidents or after-effects***

To develop the *2019 National THIRA*, FEMA reviewed existing catastrophic plans and modeling data. During this process, FEMA found that plans and data models make assumptions that may lead to FEMA or other emergency management agencies underestimating the capabilities required to support national preparedness. These assumptions include: 1) **follow-on incidents do not result in significant impacts**, and; 2) **major, complex incidents occur in isolation**.

**Many plans and models assume follow-on events do not have significant impacts:** Many major incidents result in significant after-effects or cascading events, but the consequences of these events are often not included in impact estimates. For example, aftershocks often accompany major earthquakes, and these follow-on events can cause weakened buildings to collapse or cause landslides. These events

inevitably result in additional impacts, such as more fatalities or increased mass care demands. It is very difficult to model the impacts of cascading effects; as a result, models frequently focus only on what they can measure, which is typically the initial impact. These modeling limitations often trickle down into planning assumptions. The impact data from the plans and models that inform the New Madrid earthquake scenario in the *2019 National THIRA* do not factor in additional impacts from successive aftershocks.

Understanding the realistic impacts of an incident and the timing of those cascading events is critical for both preparedness and operations. Underestimated impacts can lead to under-developed capabilities and plans, which can then lead to ineffective decision-making.

As another example, hurricane plans and models may not account for follow-on hurricane or flooding activity, which may result in greater impacts and slow response operations. In 2017, Hurricanes Irma and Maria struck Puerto Rico and the U.S. Virgin Islands within two weeks of each other. In addition, Hurricane Jose complicated response operations by slowing transport of food and water. This series of hurricanes provided challenges that would not be accounted for in a model that viewed only one hurricane occurring in isolation.

The National THIRA provides a framework for FEMA to review the data that drives planning and modeling efforts across the Nation. Standardized targets and impacts allow FEMA to break down each reviewed plan, model, and real-world incident into concrete, measurable pieces. FEMA can then compare across incidents, helping to expose outdated assumptions, data gaps, and other areas for improvement.

**Many plans and models assume that major, complex incidents occur in isolation:** Many plans and models assume that all existing resources are available to manage a single incident. In practice, these resources may be unavailable due to another incident or other circumstances. This requires FEMA and its partners to stretch capabilities across multiple ongoing incidents, reducing the ability to respond to any one incident.

This assumption tested the Nation's preparedness capabilities during 2017, when three major hurricanes made landfall in the continental United States and its Caribbean territories within a one-month timeframe. FEMA coordinated deployment of over 31,000 personnel in support of these incidents and several major wildfires in California, covering 270,000 square miles. This unparalleled demand for resources across multiple complex incidents demonstrated to FEMA the need for capacity-building beyond what a single, worst-case incident would require.

FEMA applied the lessons of the 2017 hurricane season to the *2019 National THIRA* by introducing and incorporating the Plausible Concurrent Operations into its impact estimates. By combining the impacts of several major incidents and a National THIRA scenario, FEMA can produce demanding, but realistic, capability targets for response and recovery operations. Few plans and models, if any, have accounted for the additional demands that consume critical resources. To ensure swift delivery of core capabilities, future planning products and models should include these types of concurrent demands in their planning assumptions.

### ***The National THIRA is a new initiative that will be rolled out over multiple years***

The THIRA process requires the insights and knowledge of SMEs to develop scenarios and targets and identify models to estimate impacts. While SMEs from 43 Federal offices and programs and the

National Labs contributed input and feedback to the *2019 National THIRA* process, FEMA was unable to engage with some relevant offices and members of academia. As a result, the *2019 National THIRA* may not include some key information that could have improved the scenarios, impacts, or targets. FEMA will continue to engage with its partners for future iterations of the National THIRA to ensure it uses the best possible data to develop scenarios, impacts, and targets.

### ***The National THIRA scenarios are not an exhaustive list of all risks to the Nation***

To ensure a focused research agenda for the *2019 National THIRA*, FEMA identified the fewest number of scenarios necessary to most challenge the Nation's Cross-Cutting, Response, and Recovery core capabilities. Doing so allowed FEMA to engage in greater depth with stakeholders and interagency partners and define the tasks and capabilities required to support national all-hazard preparedness.<sup>13</sup> Consequently, FEMA may have excluded scenarios from the *2019 National THIRA* that could just as plausibly challenge the core capabilities. By focusing on building and sustaining broadly applicable capabilities, the Nation can help to ensure it is prepared to address the impacts of a wide range of threats and hazards.

### ***The National THIRA does not limit impact analysis to the most likely threats or hazards***

The threats or hazards in the *2019 National THIRA* are not those most likely to occur, but rather those that could both realistically occur and challenge the core capabilities of the Nation.<sup>14</sup> FEMA used conventional risk assessments<sup>15</sup> as a major source of data for the *2019 National THIRA*, and supplemented them with other sources and SME expertise to translate scenarios into capability targets that identify the level of preparedness the Nation must achieve to address its risk. Other risk assessments often balance threat or hazard likelihood and the potential consequences to determine which threats and hazards to include in the assessment. In contrast, the THIRA methodology puts an emphasis on potential consequences that would challenge capabilities and expose gaps.

**FEMA did not require the selected threat and hazard scenarios to meet a specific likelihood or frequency threshold to be included in the *2019 National THIRA*.** Rather, FEMA relied upon expert opinion and stakeholder feedback to determine whether the threats and hazards selected struck an appropriate balance between likelihood and consequence. FEMA made this choice, in part, because many realistic and challenging scenarios lack authoritative or widely available likelihood information. For example, the likelihood of a human-caused incident within a major city is difficult to determine, but historically speaking, far less common than many natural incidents, such as flooding or tornado outbreaks. Despite the relatively high likelihood of the natural incidents, some human-caused incidents

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<sup>13</sup> See section 645(b)(2) of the Post-Katrina Emergency Management Reform Act of 2006 (6 USC §745(b)(2)).

<sup>14</sup> CPG 201, 3<sup>rd</sup> ed., 12.

<sup>15</sup> Such as reports provided by and developed in coordination with the DHS Office of Cyber and Infrastructure Analysis (OCIA).

are still considered by interagency experts as a realistic threat to the Nation, and would pose a more serious challenge to many core capabilities.

By not limiting its scope to only the most likely threats and hazards, the *2019 National THIRA* provides a unique and important perspective on the scope of the risks faced by the Nation and the capabilities required to meet the challenges they pose. The National THIRA provides a foundation for FEMA to better understand what will be required of the Nation in the face of catastrophe, translating realistic, high-consequence risks into a series of defined, quantifiable targets. These targets can then guide FEMA's planning, assessments, and investments,<sup>16</sup> and help determine over time whether the Nation's capability is growing to meet the most challenging circumstances it might face in the future.

### ***The National THIRA considers immediate local impacts***

The plans and modeling data used to inform the *2019 National THIRA* did not take into account the national cascading effects of the scenarios. Only challenges faced locally as a result of the Plausible Concurrent Operations and National THIRA incidents are included in this report. Therefore, cascading effects that the Nation would likely face as a result of the threats and hazards in the *2019 National THIRA*, such as national supply chain disruptions, resource scarcity, and psychological impacts, among others, are not accounted for in the report's findings.

### ***Future National THIRAs will seek to identify and incorporate new authoritative data sources***

Future versions of the National THIRA will seek to remedy data limitations by identifying additional data products and conducting new primary research to provide FEMA with a larger pool of data to choose from. This will ensure capability targets can be better informed by the best possible data. FEMA plans to engage the interagency in a discussion on how to develop new models to determine threat and hazard impacts to fill the data gaps identified during the development of the *2019 National THIRA*. FEMA also plans to use the standardized impact and target language developed as part of the National THIRA to assist in prioritizing and standardizing modeling and data requests across the interagency.

### ***The National THIRA does not incorporate Continuity of Government Concepts***

Resiliency is particularly important for critical services and essential functions of Federal and SLTT governments, as well as for non-governmental organizations across the whole community. Continuity planning improves community preparedness and the ability to perform these critical services and essential functions under any circumstance. The *2019 National THIRA* does not contain continuity of government concepts in its assessment; however, FEMA will consider incorporating continuity doctrine into the National SPR.

### ***The elements of the Plausible Concurrent Operations were selected in part to offset data gaps***

As mentioned above, the primary motivation for incorporating the set of Plausible Concurrent Operations was to provide a more realistic picture of the complexity of response and recovery

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<sup>16</sup> While not included in this assessment, probability of an incident does play a role in understanding how best to prioritize investments in closing gaps. Future analysis will, to the extent possible, consider how often a capability will be used when making investment recommendations.

operations. Essentially, FEMA wished to account for the likelihood that national capabilities will be partially deployed due to ongoing operations at the time of an incident. However, the specific incidents comprising the Plausible Concurrent Operations do not represent the demands of a “typical year.” Rather, they were chosen in part to adjust for data gaps that are likely to under-represent the impacts of the *2019 National THIRA* scenarios.

There are two primary categories of data gaps, which in FEMA’s view, may lead to an underestimation of impacts in the National THIRA scenarios.

- **Incomplete data:** Both the baseline and National THIRA scenarios are missing standardized impact data points. While the Plausible Concurrent Operations include eight incidents, they will, in most cases, only include impact data from a smaller number of those incidents. Some *2019 National THIRA* scenarios are also missing data for standardized impacts that would likely occur as a result of the scenario.
- **Incomplete scenarios:** The modeling for many of the National THIRA scenarios does not include cascading and future incidents. For example, earthquake scenario models typically do not include aftershocks or the resulting impacts, while hurricane models typically only report impacts to one city or state. Not including follow-on incidents like these is likely to result in underestimation of some impacts, and others may be unaccounted for or unmeasured.

FEMA only combined response and recovery impacts from the Plausible Concurrent Operations to a *2019 National THIRA* scenario if they occurred during the same timeframe (see **Appendix D: Scenario Chronology**). This means that depending on when a National THIRA scenario occurs, it may include impacts from many or few of the incidents comprising the Plausible Concurrent Operations.

While the *2019 National THIRA* does not assess the simultaneous occurrence of threats and hazards, the grouping of incidents in the Plausible Concurrent Operations reflects the reality that individual incidents are not evenly distributed during the year. For example, incidents that occur during the peak of hurricane season are more likely to be accompanied by other ongoing incidents. Because of this, scenarios that occur during the height of hurricane season are significantly more likely to include multiple Plausible Concurrent Operations incidents. Future iterations of the Plausible Concurrent Operations will better reflect natural co-occurrence.

## Appendix B: Scenario Context Descriptions

### Plausible Concurrent Operations

The Plausible Concurrent Operations for the 2019 National THIRA draw impacts from response and recovery operations for the following real-world incidents. Several of these incidents represent ongoing disasters that FEMA was already supporting during 2017, and do not represent an average year:

- Colorado Flooding, 2013 (DR-4145)
- South Carolina Flooding, 2015 (DR-4241)
- West Virginia Flooding, 2016 (DR-4273)
- Texas Flooding, 2016 (DR-4269)
- Louisiana Flooding, 2016 (DR-4277)
- Hurricane Harvey, 2017 (DR-4332 (Texas) and DR-4345 (Louisiana))
- Hurricane Irma, 2017 (DR-4337 (Florida), DR-4338 (Georgia), and DR-4346 (South Carolina))
- Hurricane Maria, 2017 (DR-4340 [U.S. Virgin Islands] and DR-4339 [Puerto Rico])
- California Wildfires, 2017 (DR-4344)

### Cascadia and San Andreas Earthquake Scenario

On a weekday morning in early February, the 700-mile-long Cascadia subduction zone fault, located in Washington, Oregon, and northern California, experiences a complete rupture, resulting in a 9.0 magnitude earthquake. The impact of the initial earthquake results in numerous fatalities and injuries. Hundreds of thousands of people are evacuated from areas at risk of a potential tsunami triggered by the earthquake, and many individuals seek emergency shelter. Search and rescue teams are deployed immediately. Broken gas lines ignite fires in many damaged buildings, possibly adding to the number of fatalities and injuries. In addition to the ground shaking from the earthquake and after-shocks, second-order impacts of sinkholes and landslides remain hazards. Across the region, there are damaged potable water facilities, wastewater facilities, electric power facilities, and telecommunications facilities. Millions of tons of debris need to be cleared in order for first responders to reach the disaster zones. A few months later in April, there is a related incident of a 7.8 earthquake along the Northern San Andreas fault line in California, causing thousands of fatalities, billions in economic loss, and major damage to critical infrastructure.

### New Madrid Earthquake Scenario

In the early morning hours of a weekday in early February, a 7.7 magnitude earthquake occurs along all three segments of the New Madrid Seismic Zone, with an epicenter on the Arkansas-Tennessee border. This earthquake results in serious damage to the built environment<sup>17</sup> across eight states. Most people are in their homes at the time of the earthquake, so there are thousands of fatalities and many individuals need medical care. Millions of individuals require short-term shelter and a larger number are displaced from their homes. Infrastructure services—such as emergency services, hospitals, and mortuaries—are damaged at a time when they are most needed, and damage to key infrastructure sectors results in

<sup>17</sup> The built environment refers to the buildings and structures constructed by human beings.

cascading impacts in other infrastructure sectors, resulting in degradation of infrastructure services across the region. There is significant damage to transportation infrastructure in the area, including damage to airports and port facilities along the Mississippi River, causing delays in both response-related resources reaching the impacted area and cross-country ground transportation.

### **Texas Hurricane Scenario**

On a weekday in mid-September, a Category 5 hurricane makes landfall near Galveston, Texas and continues northward into the Midwest. The hurricane has maximum sustained winds of 157 mph and a storm surge of 25 feet. High-speed winds knock over trees, affecting power lines, especially as the ground becomes inundated from heavy rainfall. Galveston and Houston experience widespread power outages that extend into Texas, Louisiana, and parts of the Midwest as the hurricane moves north. The affected area measures in the hundreds of thousands of square miles—damaging critical infrastructure facilities and hazardous materials holding and refining facilities. Significant damage to port facilities and rail networks from storm surge slow transport of goods into and out of the area. The hurricane results in billions in direct and indirect economic losses.

### **Florida Hurricane Scenario**

In the early morning hours on a weekday in mid-September, a Category 5 hurricane makes landfall over Fort Lauderdale on the southern coast of Florida and continues northwest across the State, exiting into the Gulf of Mexico before making landfall again over Mobile, Alabama. The hurricane has maximum sustained winds of 165 mph and is accompanied by a storm surge of 21 feet. Before landfall, the governors of Florida and Alabama issue evacuation notices for the millions of people in the expected impact zone. The hurricane results in direct and indirect economic losses in the billions of dollars. Miami experiences the greatest damage. Debris and flooding make many major interstate and state highways impassible, and they will need to be cleared before residents can return home and businesses can reopen.

### **Hawaii Hurricane Scenario**

In late August, a Category 4 hurricane approaches Hawaii from the southeast and moves northward at a slow rate (approximately 10 mph) toward the largest island of Hawaii. The storm then changes course westward, impacting the entire State over a period of 36 to 48 hours. Wind gusts up to 160 mph cause some homes to lose roofs and exterior walls, resulting in the displacement of hundreds of thousands of people and forcing a substantial number of them to seek shelter. Fallen trees, power lines, and debris isolate residential areas and hinder movement of response personnel. Critical infrastructure facilities—to include power, water, wastewater, and telecommunications—are damaged and will take considerable time to repair given inaccessibility of facilities and a limited supply of repair parts in the State. Numerous ports and airports sustain significant damage and are rendered inoperable, impacting the supply chain and delaying the arrival of response and recovery-related resources from Federal agencies and other partners based in the continental United States.

### **Pandemic Scenario**

In early October, the Centers for Disease Control and Prevention (CDC) reports a new (novel) strain of influenza virus in the National Capital Region. Less than two weeks after the first confirmed case is identified at a local hospital, the illness causes hundreds of fatalities and thousands of people seeking

medical attention. As the virus spreads, approximately 30 percent of the population across the United States and other countries becomes severely ill. Conventional flu vaccines are ineffective against the current strain, and the CDC estimates that a new vaccine could be months away from mass production. Because of the pandemic, social distancing is in widespread effect. Utilities, police, fire, government, and other essential services are disrupted due to social distancing and employee absenteeism. Businesses close, resulting in a large-scale loss of services across the region (e.g. banking, food stores, gas stations). There is a shortage of medical supplies, equipment, beds, and healthcare workers as hospitals are quickly overwhelmed, with up to millions of individuals seeking outpatient medical care and millions more requiring hospitalization. Civil disorder contributes to the high rate of absenteeism and the overcrowding of hospitals and medical centers.

### **Space Weather Scenario**

In the last week of August, NOAA's Space Weather Prediction Center issues an alert due to a large coronal mass ejection approaching Earth's magnetic field, with 15 hours' notice of a severe magnetic storm making impact. In the early morning hours of the next day, transmission systems at substations in major metropolitan areas fail due to a surge of solar activity, causing power grids to go down. Subsequent system imbalances and overloads cause numerous transformers and lines to fail or disconnect. Most of the continental United States is affected by the massive power outage, leaving nearly half of the population in the dark. The space weather causes power system voltage irregularities and triggers false alarms on some protection devices. Critical-asset owners and operators are coordinating to temporarily restore power despite the power disruption caused by the magnetic storm. Radiation from the magnetic storm overwhelms satellite capacity and telecommunications networks, compounding the challenges emergency management personnel face in determining critical needs.

## Appendix C: Standardized Impacts

The standardized impact language represents metrics estimated by FEMA across multiple threats and hazards. This document provides guidance for how FEMA interpreted the standardized impacts (Table 4) while completing the National THIRA. The standardized impacts represent key quantifiable consequences associated with major threats and hazards used to inform capability targets. In Step 2 of the National THIRA, FEMA indicates the context used to interpret the standardized impacts. The estimated impacts from Step 2 provide the basis for creating capability target statements in Step 3 of the THIRA process.

**Table 4: Definitions of Standardized Impacts**

Standardized Impact	Definition
(#) people requiring evacuation	The total number of individuals that may need to be evacuated because of the incident. <sup>18</sup> <b>Note:</b> This number <b>should include</b> the number of people with access and functional needs that require evacuation.
(#) people with access and functional needs (requiring evacuation)	The number of individuals with access and functional needs that may need to be evacuated because of the incident. <b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people requiring evacuation</i> .
(#) miles of road affected	The miles of road that vehicles cannot drive on due to debris or damage resulting from the incident.
(#) businesses closed due to the incident	The number of business—regardless of size— whose operations are interrupted as a result of the incident. This does not include businesses that are damaged but remain largely operational or those that voluntarily close while the incident is ongoing but reopen immediately after.
(#) hazmat release sites	The number of individual sites within their borders that could potentially experience a release of hazardous materials—or require assessment and/or containment efforts—due to the incident. If the impacts to a single facility result in multiple releases within that same site, communities can still consider that one release site. Communities can define hazardous materials according to their own policies and regulations.
(#) fatalities	The number of individuals that lose their lives as a direct result of the incident.
(#) structure fires	The number of individual structure fires that occur as a direct result of the incident. For this purpose, “structures” may include buildings, open platforms, bridges, roof assemblies over open storage or process areas, tents, air-supported and grandstands. <sup>19</sup> This impact should only include fires that require fire management or suppression services to extinguish or control.

<sup>18</sup> All references to impacts caused as a result of “the incident” also include any cascading events caused by the incident. This applies to all standardized impacts in this guidance document.

<sup>19</sup> Definition obtained from the National Fire Protection Association.

Standardized Impact	Definition
<p>(#) affected healthcare facilities and social service organizations</p>	<p>The number of healthcare facilities and social service organizations that are unable, or limited in their ability, to provide healthcare and social service functions as a result of the incident.</p> <p>Communities can determine which facilities they would like to count as healthcare and social service facilities for the purposes of this standardized impact, but they should consider the capabilities and networks required to promote the resilience, independence, health (including behavioral health), and well-being of the whole community in the aftermath of an incident.</p> <p>Some examples of healthcare facilities include:</p> <ul style="list-style-type: none"> <li>▪ Hospitals</li> <li>▪ Urgent Care Facilities</li> <li>▪ Dialysis Centers, etc.</li> </ul> <p>Some examples of social service facilities may include:</p> <ul style="list-style-type: none"> <li>▪ Social Security and Benefit Offices</li> <li>▪ Job Centers</li> <li>▪ Community Centers</li> <li>▪ Shelters and Meal Centers, etc.</li> </ul>
<p>(#) people requiring long-term housing</p>	<p>The total number of individuals who require long-term housing as a result of the incident. Communities can base this on the number of individuals that would be eligible for their own long-term housing program, or the number that would be eligible for long-term housing assistance from FEMA, in addition to taking renters and homeless populations into account.</p> <p><b>Note:</b> This number <b>should include</b> the number of individuals with access and functional needs that require accessible long-term housing.</p>
<p>(#) people with access and functional needs (requiring accessible long-term housing)</p>	<p>The total number of individuals with access and functional needs who require accessible long-term housing.</p> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people requiring long-term housing</i>.</p>
<p>(#) customers (without water service)</p>	<p>The number of homes or businesses (i.e. individual meters) that lose water service because of the incident. This can include instances where the home or business loses all water service or where the water provided to a residency is not potable due to contamination. Communities do not need to consider instances where service loss is very short-term and requires no significant effort to restore.</p>
<p>(#) customers (without wastewater service)</p>	<p>The number of homes or businesses (i.e. individual meters) that lose wastewater service because of the incident. Communities do not need to consider instances where service loss is very short-term and requires no significant effort to restore.</p>

Standardized Impact	Definition
(#) customers (without communication service)	The number of homes, businesses, and individual wireless devices <sup>20</sup> that lose communication services because of the incident. This can include a variety of communication services, including but not limited to landline phone service, cellular service, and the internet. Communities do not need to consider instances where service loss is very short-term and requires no significant effort to restore.
(#) customers (without power service)	The number of homes and businesses (i.e. individual meters) that lose power because of the incident. Even if a home or business has a back-up generator, communities should still consider them to be without power, as their power will still need to be restored. Communities do not need to consider instances where power loss is very short-term and requires no significant effort to restore.
(#) people requiring shelter	<p>The number of individuals that require sheltering in the aftermath of an incident. This number should be the peak number of individuals that require sheltering at the same time, not the total number of individuals that might require shelter over the entire course of disaster response and recovery.</p> <p><b>Note:</b> This <b>should include</b> the number of individuals with access and functional needs that require shelter.</p>
(#) people with access and functional needs (requiring accessible shelter)	<p>The number of individuals with access and functional needs that require sheltering in the aftermath of an incident. This number should be the peak number of individuals with access and functional needs that require sheltering at the same time, not the total number of people that might require shelter over the entire course of disaster response and recovery.</p> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people requiring shelter</i>.</p>
(#) people requiring food and water	<p>The total number of individuals that require food and water services from fixed distribution sites (including shelters) and through mobile feeding units, because of the incident. Feeding services include:</p> <ul style="list-style-type: none"> <li>▪ Hot or shelf-stable meals</li> <li>▪ Infant formula</li> <li>▪ Baby food</li> <li>▪ Snacks</li> <li>▪ Beverages</li> <li>▪ Food packages, including options for diverse dietary and cultural needs (e.g., low sodium, low fat, vegetarian/vegan, halal, kosher)</li> </ul> <p><b>Note:</b> This number <b>should include</b> the number of individuals with access and functional needs requiring food and water services.</p>

<sup>20</sup> To be consistent with the other Infrastructure Systems impacts, each impacted customer should be counted once even if they lose more than one communications service, or if one interrupted communications service is used by more than one person. If a jurisdiction is also interested in knowing how many people are without service, they can multiply homes by 2.6 (the average household size in the U.S.) and exclude businesses.

Standardized Impact	Definition
<p>(#) people with access and functional needs (requiring food and water)</p>	<p>The number of individuals with access and functional needs that require food and water services at fixed distribution sites (including shelters) and through mobile feeding units, because of the incident. Feeding services include:</p> <ul style="list-style-type: none"> <li>▪ Hot or shelf-stable meals</li> <li>▪ Infant formula</li> <li>▪ Baby food</li> <li>▪ Snacks</li> <li>▪ Beverages</li> <li>▪ Food packages, including options for diverse dietary and cultural needs (e.g., low sodium, low fat, vegetarian/vegan, halal, kosher)</li> </ul> <p>Communities should consider the number of individuals with special dietary needs, the number of individuals requiring special equipment, the number of individuals requiring feeding assistance, and the number of individuals requiring food delivery.</p> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people requiring food and water</i>.</p>
<p>(#) animals requiring shelter, food, and water</p>	<p>The number of animals that require sheltering, food, and water in the aftermath of an incident.</p>
<p>(#) people requiring rescue</p>	<p>The number of individuals that require any type of search and rescue operations because of the incident. Communities can consider whichever type of search and rescue operations (e.g., urban, inland, waterborne, etc.) are relevant to their community and/or the threat or hazard they are considering.</p>
<p>(#) people requiring temporary, non-congregate housing</p>	<p>The number of individuals requiring temporary lodging after shelters have already closed, or reasonably should have closed, because of the incident. Communities can define how long a person can stay in congregate housing before they are moved to non-congregate housing.</p> <p><b>Note:</b> This number <b>should include</b> the number of individuals with access and functional needs that require temporary, non-congregate housing.</p>
<p>(#) people with access and functional needs (requiring accessible, temporary, non-congregate housing)</p>	<p>The number of individuals with access and functional needs requiring accessible temporary lodging after shelters have already closed, or reasonably should have closed, because of the incident. Communities can define how long a person can stay in congregate housing before they are moved to non-congregate housing.</p> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people requiring temporary, non-congregate housing</i>.</p>

Standardized Impact	Definition
<p>(#) damaged natural and cultural resources and historic properties registered in the jurisdiction</p>	<p>The number of natural and cultural resources that are damaged due to the incident. A resource can be considered “damaged” if it requires basic or significant restoration.</p> <p>Natural and cultural resources include, but are not limited to:</p> <ul style="list-style-type: none"> <li>▪ Historic properties</li> <li>▪ Historic sites</li> <li>▪ Designated wildlife and park lands</li> <li>▪ Public beaches</li> <li>▪ Facilities and landmarks of cultural importance</li> <li>▪ Houses of worship</li> <li>▪ Museums, etc.</li> </ul> <p>At a minimum, communities should consider those cultural and historic resources that they have formally registered as such, through a Federal, state, or local registry. Communities may also include any other natural or cultural resource, regardless of whether it has been registered.</p>
<p>(#) people affected</p>	<p>The total number of individuals that are negatively affected within the incident area. This could include, but is not limited to, people experiencing:</p> <ul style="list-style-type: none"> <li>▪ Direct physical damage to their property</li> <li>▪ Injuries or other medical impacts</li> <li>▪ The loss of utilities or other services</li> <li>▪ The loss of access to work</li> </ul> <p>The individuals affected—whether as a direct result of the incident or any cascading events caused by the incident—do not have to be affected equally, and can include residents, commuters, and visitors.</p> <p><b>Note:</b> This number <b>should include</b> the number of individuals with access and functional needs that are affected, as well as the number of individuals with limited English proficiency.</p>
<p>(#) people with access and functional needs (affected)</p>	<p>The total number of individuals with access and functional needs that are negatively affected within the incident area. The individuals do not have to be affected equally. This could include, but is not limited to, people experiencing:</p> <ul style="list-style-type: none"> <li>▪ Direct physical damage to their property</li> <li>▪ Injuries or other medical impacts</li> <li>▪ The loss of utilities or other services</li> <li>▪ The loss of access to work</li> </ul> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people affected</i>.</p>

Standardized Impact	Definition
<p>(#) people with limited English proficiency affected</p>	<p>The total number of individuals with limited English proficiency that are negatively affected within the incident area. The individuals do not have to be affected equally. This could include, but is not limited to, people experiencing:</p> <ul style="list-style-type: none"> <li>▪ Direct physical damage to their property</li> <li>▪ Injuries or other medical impacts</li> <li>▪ The loss of utilities or other services</li> <li>▪ The loss of access to work</li> </ul> <p>Communities can define limited English proficiency according to their own policies and regulations.</p> <p><b>Note:</b> This impact represents a subset of the total population and should always be smaller than (#) <i>people affected</i>.</p>
<p>(#) jurisdictions affected</p>	<p>The number of jurisdictions that are negatively affected, whether as a direct result of the incident or any cascading events caused by the incident. The jurisdictions do not have to be affected equally and should include those in which some form of response or recovery operations is required. These operations could address:</p> <ul style="list-style-type: none"> <li>▪ Direct impacts, such as physical damage to infrastructure and resources, injuries or other medical impacts to people within the community, or the loss of utilities or other services.</li> <li>▪ Indirect impacts, such as the loss of employees or employment, the loss of mobility, etc.</li> </ul> <p>This number should also include any jurisdiction that provides support or aid to an impacted jurisdiction.</p>
<p>(#) partner organizations involved in incident management</p>	<p>The number of public, private, or non-profit organizations involved in performing, planning, advising, or supporting prevention, protection, mitigation, response, and/or recovery efforts. The different partner organizations do not need to be involved equally, and communities can determine how they wish to count the involvement of different offices within one agency. In addition, the set of relevant partner organizations may change depending on the context of the target.</p>
<p>(#) people requiring medical care</p>	<p>The number of individuals that require medical care for injuries, illnesses, or other medical concerns. This includes <b>both</b> individuals that require medical treatment as a result of the incident <b>and</b> individuals that require medical treatment entirely unrelated to the incident. Communities should limit this to the number of individuals requiring care from a medical professional, and do not need to include individuals who could treat themselves for very minor injuries or conditions.</p>

## Appendix D: Scenario Chronology

The following figure (**Figure 12**) visualizes the timelines of the Plausible Concurrent Operations incidents as well as the scenarios used in the 2019 National THIRA. For the purposes of this figure, “incident period” is the estimated period where all the agencies involved are engaged in response activities, including efforts to save lives, protect property, and meet basic human needs. The capability targets only include baseline impacts if the 2019 National THIRA scenario occurred while there was an active response or recovery phase for the incident. For example, the impacts of the Cascadia/San Andreas and New Madrid earthquakes combined with only a few impacts from the Plausible Concurrent Operations, while the Hawaii hurricane impacts combine with several. Dates for the National THIRA scenarios were selected in the following order of preference:

1. A specific date was identified in the modeling FEMA used to estimate impacts.
2. A specific date was not identified in the modeling FEMA used to estimate impacts but was included in a response plan or Regional THIRA scenario.
3. A time when the incident is most likely to occur (e.g., peak hurricane season).
4. A time when the incident is likely to be the most stressful.

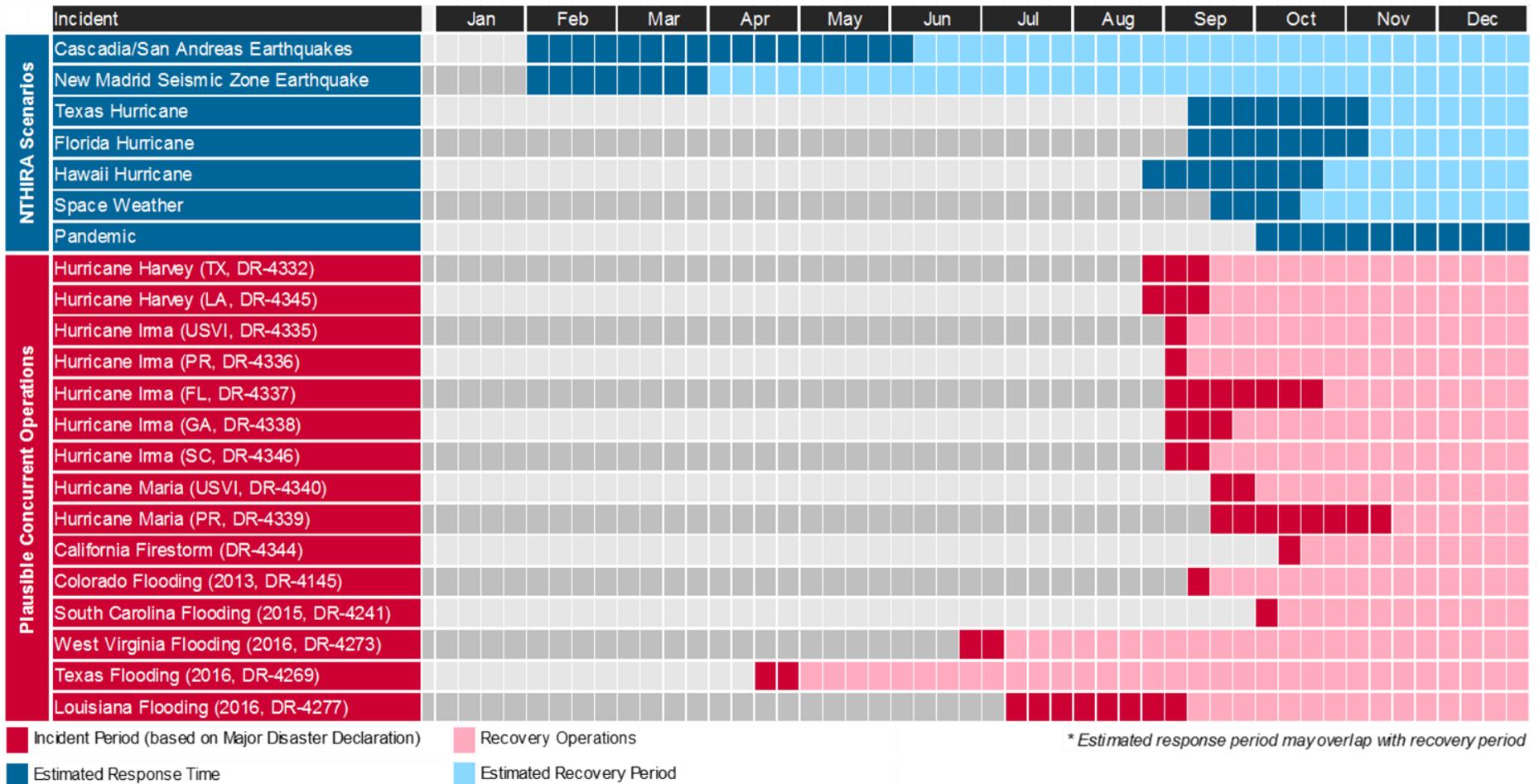


Figure 12: Timelines of Plausible Concurrent Operations incidents.

# Appendix E: Standardized Targets

## Cross-Cutting Standardized Targets

The three Cross-Cutting core capabilities (**Table 5**) are necessary to the success of the other 29 core capabilities. **Planning** allows emergency managers to identify strategic-, operational-, and tactical-level approaches to deliver each core capability, which are then implemented under **Operational Coordination** to ensure that actions are carried out in an organized fashion. Through **Public Information and Warning**, officials deliver clear, actionable, and accessible information about relevant actions being taken to prevent, protect against, mitigate the effects of, respond to, and recover from threats and hazards.

**Table 5: Cross-Cutting Standardized Targets**

Cross-Cutting Standardized Targets	
Public Information and Warning	
<b>PUBL-1</b>	Within <b>(#) (time)</b> notice of an incident, deliver reliable and actionable information to <b>(#) people affected</b> , including <b>(#) people with access and functional needs (affected)</b> and <b>(#) people with limited English proficiency (affected)</b> .
Operational Coordination	
<b>COOR-1</b>	Within <b>(#) (time)</b> of a potential or actual incident, establish and maintain a unified and coordinated operational structure and process across <b>(#) jurisdictions affected</b> and with <b>(#) partner organizations</b> involved in incident management. Maintain for <b>(#) (time)</b> .

## Response Mission Area Standardized Targets

The Response mission area encompasses many of the steps necessary to save lives, protect property and the environment, and meet basic human needs immediately after an incident. The *National Response Framework* lists 15 core capabilities that work together to meet this goal (**Table 6**).

**Critical Transportation** operations include clearing debris from roads, airports, ports, and other transportation nodes to allow survivors to evacuate and response personnel to enter an affected area. After an incident, personnel deliver traditional and atypical **Mass Search and Rescue Operations** to save the greatest number of endangered lives in the shortest time possible. During mass fatality incidents, **Fatality Management Services** provide remains recovery, victim identification, and bereavement counseling. **On-scene Security, Protection, and Law Enforcement**, **Environmental Response/ Health and Safety**, and **Fire Management and Suppression** efforts all work to protect responders, survivors, and the environment. Throughout the response, officials use **Operational Communications** and **Situational Assessment** to share information and make informed decisions.

After an incident, public, private, and non-profit organizations provide **Mass Care Services** and **Public Health, Healthcare, and Emergency Medical Services** to address the basic needs of survivors. **Logistics and Supply Chain Management** ensure that essential commodities, equipment, and services reach affected communities and assist owners and operators of **Infrastructure Systems** in restoring systems and services for the community while transitioning to the recovery phase. A number of these

infrastructure systems are referred to as community lifelines. Lifelines provide indispensable services that enable continuous operation of critical functions and would risk human health and safety or national economic security if compromised or not promptly restored. The four Infrastructure Systems targets focus on major lifelines, such as electrical power, communications, water service, and wastewater service.

**Table 6: Response Mission Area Standardized Targets**

<b>Response Mission Area Standardized Targets</b>	
<b>Infrastructure Systems</b>	
<b>INFR-1</b>	Within <b>(#) (time)</b> of an incident, restore service to <b>(#) customers (without water service)</b> .
<b>INFR-2</b>	Within <b>(#) (time)</b> of an incident, restore service to <b>(#) customers (without wastewater service)</b> .
<b>INFR-3</b>	Within <b>(#) (time)</b> of an incident, restore service to <b>(#) customers (without communication service)</b> .
<b>INFR-4</b>	Within <b>(#) (time)</b> of an incident, restore service to <b>(#) customers (without power service)</b> .
<b>Critical Transportation</b>	
<b>TRAN-1</b>	Within <b>(#) (time)</b> notice of an impending incident, complete the evacuation of <b>(#) people requiring evacuation, including (#) people with access and functional needs</b> (requiring evacuation).
<b>TRAN-2</b>	Within <b>(#) (time)</b> of an incident, clear <b>(#) miles of road affected</b> , to enable access for emergency responders, including private and non-profit.
<b>Environmental Response/Health and Safety</b>	
<b>ENVI-1</b>	Within <b>(#) (time)</b> of an incident, assess, contain, and begin cleaning up hazardous material releases from <b>(#) hazmat release sites</b> .
<b>Fatality Management Services</b>	
<b>FATA-1</b>	Within <b>(#) (time)</b> of an incident, complete the recovery, identification, and mortuary services, including temporary storage services, for <b>(#) fatalities</b> .
<b>Fire Management and Suppression</b>	
<b>FIRE-1</b>	Within <b>(#) (time)</b> of an incident, conduct firefighting operations to suppress and extinguish <b>(#) structure fires</b> .

Response Mission Area Standardized Targets	
Logistics and Supply Chain Management	
LOGI-1	Within (#) (time) of an incident, identify and mobilize life-sustaining commodities, resources, and services to (#) <b>people requiring shelter and (#) people requiring food and water</b> . Maintain distribution system for (#) (time).
Mass Care Services	
CARE-1	Within (#) (time) of an incident, provide emergency sheltering, food, and water for (#) <b>people requiring shelter and (#) people requiring food and water</b> , including (#) <b>people with access and functional needs</b> (requiring accessible shelter) and (#) <b>people with access and functional needs</b> (requiring food and water), and (#) <b>animals requiring shelter, food, and water</b> . Maintain for (#) (time).
CARE-2	Within (#) (time) of an incident, move (#) <b>people requiring temporary, non-congregate housing</b> , including (#) <b>people with access and functional needs</b> (requiring accessible, temporary, non-congregate housing), from congregate care to temporary housing.
Mass Search and Rescue Operations	
SEAR-1	Within (#) (time) of an incident, conduct search and rescue operations for (#) <b>people requiring rescue</b> .
On-scene Security, Protection, and Law Enforcement	
SECU-1	Within (#) (time) of an incident, provide security and law enforcement services to protect emergency responders and (#) <b>people affected</b> .
Operational Communications	
COMM-1	Within (#) (time) of an incident, establish interoperable communications across (#) <b>jurisdictions affected</b> and with (#) <b>partner organizations</b> involved in incident management. Maintain for (#) (time).
Public Health, Healthcare, and Emergency Medical Services	
HEAL-1	Within (#) (time) of an incident, complete triage, begin definitive medical treatment, and transfer to an appropriate facility (#) <b>people requiring medical care</b> .

### Recovery Mission Area Standardized Targets

The Recovery mission area has eight core capabilities that work together to repair and restore infrastructure and services needed to support the physical, emotional, and financial well-being of survivors and disaster areas (Table 7).

The repair and restoration of **Infrastructure Systems** reestablishes essential community services and minimizes health and safety threats. In turn, re-establishing **Health and Social Services** allows for the restoration of healthcare facilities and networks to promote the resilience, independence, health (including behavioral health), and well-being of the whole community. Implementing temporary and permanent **Housing** solutions for displaced residents moves survivors out of emergency shelters and transitions them into long-term recovery. Experts work with the community to preserve, conserve,

rehabilitate, and restore **Natural and Cultural Resources**. In the long-term, communities lead **Economic Recovery** programs to return economic and business activities, including food and agriculture, to a healthy state.

**Table 7: Recovery Mission Area Standardized Targets**

Recovery Mission Area Standardized Targets	
Economic Recovery	
<b>ECON-1</b>	Within <b>(#) (time)</b> of an incident, reopen <b>(#) businesses closed due to the incident</b> .
Health and Social Services	
<b>SOCI-1</b>	Within <b>(#) (time)</b> of an incident, restore functions at <b>(#) affected healthcare facilities and social service organizations</b> .
Housing	
<b>HOUS-1</b>	Within <b>(#) (time)</b> of an incident, <b>(#) people requiring long-term housing</b> , including <b>(#) people with access and functional needs</b> requiring accessible long-term housing, find and secure long-term housing.
Natural and Cultural Resources	
<b>NATU-1</b>	Within <b>(#) (time)</b> of an incident, restore <b>(#) damaged natural and cultural resources and historic properties registered in the jurisdiction</b> .