

**Two-Year Post-Hurricane Matthew Field Study in Lumberton, North Carolina  
Business Recovery Survey**

**U.S. Department of Commerce  
National Institute of Standards and Technology  
Generic Clearance for Community Resilience Data Collections  
OMB CONTROL NO. 0693-0078  
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For each proposed request using this generic clearance, NIST will submit the actual instrument and related documents (letters, emails to respondents, scripts, etc.), as well as proposed statistical methods to be employed to OMB along with responses to the following questions:

**1. Explain who will be surveyed and why the group is appropriate to survey.**

Businesses that are registered and functioning in flood vulnerable areas of Lumberton, NC is the population from which the sample will be taken in this collection. Flood vulnerable includes: areas of town that experienced inundation when the levee failed during Hurricane Matthew plus a buffer of 100 meters and areas of town included in the 100-year flood plain. This sample was identified in preparation for the January 2018 Lumberton field study.

The instrument is written to access the continued recovery of businesses in Lumberton following Hurricane Matthew (October 2016), which were primarily affected due to flooding from the event. From a household survey conducted in December 2016, we are aware that the structural damage from Hurricane Matthew was significant in its impact to the population in terms of leading to dislocation and associated social and economic impacts. The damage to commercial structures was not insignificant and was informally observed by the team at that point in time.

The Center of Excellence (CoE) field studies team in conjunction with NIST researchers conducted a quick response field study in Lumberton, North Carolina, which experienced major flooding damage due to Hurricane Matthew in early October 2016. The purpose of this field study was to explore the interconnectivity between structural damage (buildings, roads, bridges, power, water) school closures and student displacement, and housing dislocation and evacuation patterns. In January 2018 a one-year post-Hurricane Matthew Business Recovery Survey was conducted in addition to further exploration of the structural damage, school closures, and housing dislocation and recovery patterns. At that time many business survey respondents had not yet completed recovery from Hurricane Matthew. The goal of this current survey collection is to determine the status of recovery for these businesses. Furthermore, the 2018 Hurricane Florence, which resulted in another significant flood event, did have an informally reported structural and financial effects on these businesses. Thus, continuing to assess long-term recovery of these businesses is vital to the longitudinal Lumberton field study. The information collected in this business interruption survey instrument will augment findings from January 2018, at which time, business interruption was first addressed specifically in the survey tool and

field work. The data from this survey will contribute to the business interruption modeling in the IN-CORE community resilience modeling environment.

There is minimal primary data on business interruption following a large-scale natural hazard event, especially in the period of mid-term recovery (~12-18 months following the event). Additionally, there is minimal primary data on longitudinal business recovery to understand factors that affect long-term recovery and sustainability of businesses affected by hurricane events. Lumberton provides a unique case for analyzing business medium- and long-term recovery in the face of multiple hurricane events (i.e., Hurricane Matthew – 2016 and Hurricane Florence—2018). The survey respondents are either owners or managers of businesses in Lumberton who were surveyed in the one-year Post-Hurricane Matthew survey in January 2018; some of these businesses will have been directly affected by Hurricane Matthew and/or Hurricane Florence and related utility outages, while others were not. It is important that these businesses be surveyed within the timeframe of 18-24 months post-Hurricane Matthew and 6-12 months post-Hurricane Florence. At this point in time, owners and managers will still retain information about recovery activities from Hurricane Matthew immediately before Hurricane Florence hit the community and immediately after Hurricane Florence, which can be meaningfully recorded and collected for data analysis. At each establishment, one individual familiar with the recovery efforts will be surveyed — either 1) the owner or 2) the manager (in some cases the same individual will both own and manage a business). In cases where there is the potential to talk to both the owner and manager, it is preferable to speak to the individual who owns the business since this person is likely to know the most about the history of the business and the full recovery process.

PII is collected in this instrument, but information is not retrieved by personal identifiers in the system. Although this is not a Privacy Act System of Records, appropriate notice is given to the participant of the survey.

## **2. Explain how the survey was developed including consultation with interested parties, pretesting, and responses to suggestions for improvement.**

This survey instrument was developed by the NIST-funded Resilience Center of Excellence (CoE) in collaboration with NIST researchers. The main structure of the instrument follows a series of business surveys that have been conducted in Galveston, Texas and surrounding areas for over five years by researchers in the CoE. In that sense, most of questions have been thoroughly vetted in the field, as has the proposed data collection methodology.

During development, the survey instrument was reviewed by researchers interested in business interruption and recovery on both the CoE team and at NIST, specifically in the Applied Economics Office (AEO) of NIST's Engineering Laboratory (EL). This iterative collaboration created a relatively brief and thorough tool to access sources of business interruption and how recovery and mitigation (short- and long-term) were sought.

During the quick response field study conducted by the CoE in December 2016, several best practices and lessons learned emerged that are applicable to this proposed business interruption survey tool. Also during that time (December 2016) some informal conversations with businesses closed following Hurricane Matthew took place. Finally, analysis of the one-year post-Hurricane Matthew survey (January 2018) conducted by the CoE in collaboration with NIST researchers has formed the basis for this current tool and key lessons learned from that collection are being employed. Furthermore, a literature review (Webb and Gilbert, 2017) of the business interruption literature was carefully reviewed during development of the survey tool.

**3. Explain how the survey will be conducted, how customers will be sampled if fewer than all customers will be surveyed, expected response rate, and actions your agency plans to take to improve the response rate.**

The business sample for this collection is the same as the one-year post-Hurricane Matthew business survey collection, as the goal is to capture longitudinal recovery over time for the same business locations. There are records indicating 2,017 for-profit businesses in Lumberton in 2016 (pre-Hurricane Matthew); in this survey, non-profits, government agencies, and other business that do not generate profit were excluded. The sampled businesses are taken from the areas of Lumberton recorded to have been inundated with flooding after Hurricane Matthew. Additionally, businesses that fall within a 100-meter buffer around the inundation area have been included in the sample. The FEMA 100-year floodplain was also identified and businesses have been taken from this area for the sample. The total sample number of businesses is 350. All businesses that were inside a 100-meter buffer around the inundation area were included in the sample (n=218). From there, we drew a random sample of businesses in the northern portion of the FEMA floodplain to reach the desired sample of 350 for-profit businesses.

The sample will be spatially and temporally ordered to make the field work as efficient, logical, and safe as possible. The primary sample units are housing units/households located in various forms of housing structures (single family, single family attached, duplexes, multi-family structures of various forms).

The survey will be administered as a paper survey and in most cases the owner (or manager) of the business will fill-in the survey by-hand. The tool is expected to take a maximum of 15 minutes to complete. The respondent will have access to the survey in some cases for up to half a day — the researcher will explain the survey and in many cases, leave it with the respondent for a period of time. This way, the respondent has time to organize completing the survey at a time during the day that is most convenient to her/his work schedule.

The response rate expected is 60-70%, based on response rates from the one-year post-Hurricane Matthew business survey collection. It should be noted that responding to any or all the survey is considered as a survey response. All questions are optional; thus, we expect that some businesses will answer only a portion of the questions. Assuming a 100% response rate, the total burden hours would be 87.5 hours (350 businesses X 15 minutes survey time/business).

Although resources (staff, time, and funds) will be limiting factors, several actions will be taken to improve the outcomes of the field study data collection. To ensure a higher response rate, the team will:

- Train surveyors for maximum efficiency in the field,
- Concentrate surveying on weekdays and working hours,
- Make repeat visits to businesses (if they were not open at the time of the initial visit),
- Arrange scheduled follow up times for households not available for surveying during initial visit (if willing to participate),
- And, adjust the field work plan and team composition based upon daily evaluation of results.

Additionally, in order to improve response rates, ahead of the in-person interaction in Lumberton, researchers plan to place a phone call to businesses in the sample to be surveyed to ensure that these businesses are still in the recorded location and to find out any pertinent information that may affect a visit (e.g., changes in opening hours and times when the owner or manager are present). During this call, the survey will not be introduced; the purpose is to simply check opening hours and other pertinent information about the business. This type of method has worked well with the Galveston business interruption survey work (noted above) in order to yield higher in-person response rates.

Calling ahead of the survey may allow the researchers to sort out the error in the sample ahead of going to Lumberton (e.g., businesses in the sample that were not there at the time of the flooding or have the wrong address associated with the business). In this way, the on-the-ground research time will be better spent and less time will be taken from the businesses during the in-person discussion.

Furthermore, we can include an informational sheet about the Lumberton project, specifically, and the NIST CoE's community resilience work, generally. In past research by members of this research team this has been an effective approach.

#### **4. Describe how the results of the survey will be analyzed and used to generalize the results to the entire customer population.**

It is expected that the findings of this survey will inform the understanding of the CoE field studies team in conjunction with NIST researchers in terms of business interruption and best practices and circumstances for recovery over medium- and long-term timeframes and when businesses face multiple extreme flooding events (i.e., Hurricanes Matthew and Florence).

The data will be analyzed as a case study in the specific context of Lumberton, NC and the existing social, economic, and built infrastructure elements to the community. Statistical analysis will be used to determine trends and correlations in the data, as well as relationships between factors that contributed to business disruption and/or business recovery. There are four main survey sections in the tool that relate to both Hurricanes Matthew and Florence: 1. damage and business interruption, 2. business information (e.g., ownership or rental), 3. recovery finance, and 4. mitigation actions. Analyzing these types of data singularly and in conjunction is expected to

extend understanding of business interruption in general and across sectors. Of particular interest to the NIST AEO researchers is enhanced understanding the effect of utilities (if and when they are restored) in business re-opening and overall recovery as well as the financial recovery and mitigation actions taken by businesses. Lumberton is a key case study for these areas of inquiry due to the longitudinal nature of the CoE and NIST collaboration on a longitudinal field study and the fact that businesses have been struck by two large hurricanes in the last three years (i.e., Hurricanes Matthew and Florence).

There is not a great deal of research conducted to date with primary research concerning business interruption following a large scale natural disaster and the ensuing recovery. Nor are there a great deal of geographic areas studied in detail that were affected by multiple extreme hurricane hazards in relatively quick succession. The data from this collection will contribute to the business interruption modeling in the IN-CORE community resilience modeling environment.

The data will also be used to inform conceptual and quantitative modeling of the community as a system, including interdependencies between housing, business, and school recovery, the timing of aspects of community recovery, and the resources available versus those needed.

Furthermore, it is expected that administering the survey tool will provide useful information on best practices for general field research on business interruption from a natural disaster.