Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan

Participating Jurisdictions:
Unincorporated Vanderburgh County
City of Evansville
Town of Darmstadt
Evansville Vanderburgh County School Corporation
EXECUTIVE SUMMARY

The purpose of hazard mitigation is to reduce or eliminate the long-term risk to people and property from natural and/or man-made hazards. Vanderburgh County, Indiana, has prepared this local multi-hazard mitigation plan to better protect the people and property of the unincorporated areas of the County, the City of Evansville, the Town of Darmstadt, and the Evansville-Vanderburgh School Corporation from the effects of natural hazard events. The plan update was prepared pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007 to achieve eligibility for the Federal Emergency Management Agency (FEMA) Hazard Mitigation Assistance (HMA) programs.

The planning process for development of this local plan followed a methodology prescribed by FEMA, which began with the formation of a Hazard Mitigation Planning Committee (HMPC) comprised of key stakeholders from the County, local and neighboring jurisdictions, and state and federal agencies. The HMPC conducted a risk assessment that identified and profiled hazards that pose a risk to the County, assessed the vulnerability of each participating jurisdiction to these hazards, and examined the capabilities in place to mitigate them. The County is vulnerable to several hazards that are identified, profiled, and analyzed in this plan. Flood, earthquake, and severe weather are among the hazards that can have a significant impact on the County.

Based upon the risk assessment, the HMPC identified goals and objectives for reducing risk to natural hazards. The goals and objectives of this multi-hazard mitigation plan are to:

**Goal 1: Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.**

**Goal 2: Reduce vulnerability to natural hazards, before and after disaster strikes.**

- Strengthen protection of critical facilities and infrastructure to create a safer, more sustainable community.
- Build and support local capabilities to respond and recover from natural and hazard events.
- Increase the local floodplain management activities and participation in the NFIP.
- Protect community historic/cultural/environmental resources from identified natural man-made hazards

To meet identified goals and objectives, the plan recommends the mitigation actions summarized in the table on the following pages. The HMPC also developed an implementation plan for each
action, which identifies priority level, background information, ideas for implementation, responsible agency, timeline, cost estimate, potential funding sources, and more.

The *Multi-Hazard Mitigation Plan* has been formally adopted by the Vanderburgh County Board and will be updated within a five-year timeframe.
Table I. Mitigation Action Matrix

<table>
<thead>
<tr>
<th>Action</th>
<th>HMPC Priority</th>
<th>Goals Addressed</th>
<th>Hazards Addressed</th>
<th>Address Current Development</th>
<th>Address Future Development</th>
<th>Continued Compliance with NFIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop dedicated website page for multi-hazard mitigation information.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Purchase and install stream gages and water table gages to provide flood warning capabilities.</td>
<td>High</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>3. Explore partnerships to provide retrofitting classes for homeowners, renters, building professionals, and contractors.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4. Coordinate with Vanderburgh County Surveyor to utilize “Section Line Grid” to address and prioritize disaster response and recovery activities.</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5. Develop safe refuge mapping for County.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>6. Coordinate emergency management drills with other agencies and industries in the community.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7. Add to the public awareness campaign information on living “off the grid” for 3 days (“jump kit”) during hazard events.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>8. Add notification/subscription capabilities to Vanderburgh County Emergency Management/Hazard Mitigation website.</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>9. Coordinate with Utilities (Vectran) regarding trees/limbs in streets following hazard event.</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>10. In coordination with the American Red Cross, identify shelter locations with capabilities/infrastructure for large capacity and generator hook-up.</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Participate in multi-agency planning for large special events.</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>12. Identify potential alternatives for east/west arterial transportation to assist with evacuation during a large hazard event.</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>13. Define process for establishing a burn ban within Vanderburgh County.</td>
<td>High</td>
<td>2</td>
<td>Wildfire</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>14. Incorporate saferoom design into new school buildings.</td>
<td>High</td>
<td>2</td>
<td>Tornado</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15. Develop County-Wide Stormwater Master Plan to provide relief from run-off and flooding resulting from rainfall events.</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>16. Based on existing City Stormwater Master Plan, develop formalized policies (level-of-service and extent-of-service) for maintenance of the storm water drainage system.</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>Action</td>
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<tr>
<td>17. Update repetitive loss areas adjacent to the repetitive loss</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td></td>
<td>✓</td>
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<td>properties as new claim information is reported.</td>
<td></td>
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<tr>
<td>18. Encourage purchase of earthquake hazard insurance throughout</td>
<td>Medium</td>
<td>2</td>
<td>Earthquake</td>
<td>✓</td>
<td>✓</td>
<td></td>
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<tr>
<td>Vanderburgh County, including the City of Evansville and the Town</td>
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<td>of Darmstadt.</td>
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<tr>
<td>19. Purchase and distribute NOAA weather radios throughout Vanderburg</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
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<td>ch County, including the City of Evansville and the Town of</td>
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<td>Darmstadt.</td>
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<tr>
<td>20. Expand warning siren coverage into new areas as development and</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
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<td>housing expand.</td>
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<tr>
<td>21. Prepare CRS-compliant Program for Public Information (PPI) to</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>revise and replace current public awareness campaign in coordination</td>
<td></td>
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<td>with the Evansville Vanderburgh School Corporation.</td>
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<tr>
<td>22. Develop public damage reporting app/website to obtain information</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>from the public during hazard events.</td>
<td></td>
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<tr>
<td>23. Review current fire station resilience capabilities to serve as</td>
<td>Medium</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
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<td>“oasis” during mass/expanded incidents.</td>
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<tr>
<td>24. Develop depth grids in coordination with FIRM updates to</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>address roadway access and critical facilities during a flood event.</td>
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<tr>
<td>25. Develop interactive flood inundation mapping for the County in coordination with FIRM updates.</td>
<td>Medium</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>26. Pursue and document CRS activities with ultimate goal of improving CRS class rating.</td>
<td>Medium</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>27. Establish maximum runoff criteria for areas proposed for development.</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>28. Talk with local nurseries to discourage sales of ash trees in private sector.</td>
<td>Medium</td>
<td>2</td>
<td>Infestation</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>29. Obtain dam inundation mapping for future vulnerability analysis and development regulation.</td>
<td>Medium</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>30. Continue efforts to train local contractors and property owners in tree trimming practices.</td>
<td>Low</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>31. Pursue alternative funding sources for structural retrofits to critical facilities.</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>32. Investigate financial incentives for property owners to make seismic retrofits to existing buildings, particularly un-reinforced masonry structures, located within the earthquake hazard area. Pursue alternative funding sources for structural retrofits for critical facilities.</td>
<td>Low</td>
<td>2</td>
<td>Earthquake</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>33. Distribute National Flood Insurance Program information.</td>
<td>Low</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Action</td>
<td>HMPC Priority</td>
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<tr>
<td>34. Coordinate annual meetings of the Vanderburgh County Multi Hazard Mitigation Planning Committee to monitor, evaluate, and update the multi-hazard mitigation plan.</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>35. Retrofit critical facilities to accept alternative energy sources, i.e. solar.</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. Locate and encourage closure of unused private wells.</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Encourage new housing developments to use underground utilities.</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>38. Pursue creek and stream clearing projects and funding.</td>
<td>Low</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>39. Provide equipment and training for confined space entry to perform routine inspections of large diameter storm sewers.</td>
<td>Low</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40. Develop dam maintenance ordinance.</td>
<td>Low</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41. Obtain funding to remove poorly maintained dams.</td>
<td>Low</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42. Work with SWIMGA to develop a surveillance program with private residences with ash trees.</td>
<td>Low</td>
<td>2</td>
<td>Infestation</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
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44 CFR requirement 201.6(c)(5): The local hazard mitigation plan shall include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval of the plan. For multi-jurisdictional plans, each jurisdiction requesting approval of the plan must document that it has been formally adopted.

Note to Reviewers: When this plan has been reviewed and approved, pending adoption, by FEMA Region V, the adoption resolution will be signed and added to Appendix A. A model resolution is provided on the following page.
Model Resolution

Resolution # ______

Adopting the Vanderburgh County
Multi-Hazard Mitigation Plan

Whereas, the County of Vanderburgh, seeking FEMA approval of the Multi-Hazard Mitigation Plan, recognizes the threat that natural and man-made hazards pose to people and property within our community; and

Whereas, undertaking hazard mitigation actions will reduce the potential for harm to people and property from future hazard occurrences; and

Whereas, the U.S. Congress passed the Disaster Mitigation Act of 2000 ("Disaster Mitigation Act") emphasizing the need for pre-disaster mitigation of potential hazards;

Whereas, the Disaster Mitigation Act made available hazard mitigation grants to state and local governments;

Whereas, an adopted Multi-Hazard Mitigation Plan is required as a condition of future funding for mitigation projects under multiple FEMA pre- and post-disaster mitigation grant programs; and

Whereas, Vanderburgh County fully participated in the FEMA-prescribed mitigation planning process to prepare this Multi-Hazard Mitigation Plan; and

Whereas, the Indiana Emergency Management Agency and the Federal Emergency Management Agency Region V officials have reviewed the “Vanderburgh County Multi-Hazard Mitigation Plan”, and approved it contingent upon this official adoption of the participating governing body;

Whereas, Vanderburgh County desires to comply with the requirements of the Disaster Mitigation Act and to augment its emergency planning efforts by formally adopting the Vanderburgh County Multi-Hazard Mitigation Plan.

Whereas, adoption by the governing body for Vanderburgh County demonstrates the jurisdiction’s commitment to fulfilling the mitigation goals and objectives outlined in this Multi-Hazard Mitigation Plan.

Whereas, adoption of this legitimacies the plan and authorizes responsible agencies to carry out their responsibilities under the plan.

Now, therefore, be it resolved, that Vanderburgh County adopts the “Vanderburgh County Multi-Hazard Mitigation Plan” as an official plan; and

Be it further resolved, Vanderburgh County will submit this Adoption Resolution to the Indiana Emergency Management Agency and Federal Emergency Management Agency Region V officials to enable the plan’s final approval.

Passed: ____________

Certifying Official
1 INTRODUCTION AND PLANNING PROCESS

1.1 Purpose

Vanderburgh County and three participating jurisdictions have prepared this update to the local hazard mitigation plan to better protect the people and property of the County from the effects of natural hazard events. This plan demonstrates the community’s commitment to reducing risks from hazards and serves as a tool to help decision makers direct mitigation activities and resources.

The goals of the Vanderburgh County Multi-Hazard Mitigation Plan are the following:

**Goal 1:** Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.

**Goal 2:** Reduce vulnerability to natural hazards, before and after disaster strikes.
- Strengthen protection of critical facilities and infrastructure to create a safer, more sustainable community.
- Build and support local capabilities to respond and recover from natural and hazard events.
- Increase the local floodplain management activities and participation in the NFIP.
- Protect community historic/cultural/environmental resources from identified natural man-made hazards.

This plan was also updated to make Vanderburgh County and participating jurisdictions eligible for certain federal disaster assistance, specifically, the Federal Emergency Management Agency’s (FEMA) Hazard Mitigation Grant Program, Pre-Disaster Mitigation program, and Flood Mitigation Assistance program. This plan has been prepared in compliance with Section 322 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act or the Act), 42 U.S. C. 5165, enacted under Section 104 of the Disaster Mitigation Act of 2000, (DMA 2000) Public Law 106-390 of October 30, 2000, as implemented at CFR 201.6 dated October 2007.

Vanderburgh County and the City of Evansville also participate in the National Flood Insurance Program’s (NFIP) Community Rating System (CRS) and, having more than 10 repetitive loss properties each, are required to prepare and maintain a floodplain management plan (FPM). This multi-hazard mitigation plan addresses the flood hazard and was developed in accordance with the CRS FPM planning requirements.

The CRS program recognizes and encourages community floodplain management activities that exceed the minimum requirements of the NFIP. Under the CRS program, flood insurance
premium rates are discounted to reflect the reduced flood risk resulting from community activities that (1) reduce flood losses, (2) facilitate accurate insurance ratings, and (3) promote the awareness of flood insurance.

Vanderburgh County and the City of Evansville entered the CRS program in 1999 and currently both qualify for a class 8 rating. With the class 8 rating, citizens of Vanderburgh County and the City of Evansville receive a **10-percent** discount on flood insurance premiums. Table 1.1 below presents the relationship of CRS class ratings and insurance premium discounts.

<table>
<thead>
<tr>
<th>CRS Class</th>
<th>Credit Points</th>
<th>Flood Insurance Premium Discount</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>In SFHA¹</td>
</tr>
<tr>
<td>1</td>
<td>4,500+</td>
<td>45%</td>
</tr>
<tr>
<td>2</td>
<td>4,000-4,499</td>
<td>40%</td>
</tr>
<tr>
<td>3</td>
<td>3,500-3,999</td>
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<tr>
<td>4</td>
<td>3,000-3,499</td>
<td>30%</td>
</tr>
<tr>
<td>5</td>
<td>2,500-2,999</td>
<td>25%</td>
</tr>
<tr>
<td>6</td>
<td>2,000-2,499</td>
<td>20%</td>
</tr>
<tr>
<td>7</td>
<td>1,500-1,999</td>
<td>15%</td>
</tr>
<tr>
<td>8</td>
<td>1,000-1,499</td>
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<tr>
<td>9</td>
<td>500-999</td>
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<tr>
<td>10</td>
<td>0-499</td>
<td>0%</td>
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</table>

¹ – SFHA, Special Flood Hazard Area; the floodplain delineated on the FIRM as A Zones and V Zones

In addition to reduced flood insurance rates, Vanderburgh County and the City of Evansville citizens benefit from the CRS program through:

- Enhanced public safety, reduction in damage to property and public infrastructure, avoidance of economic disruption and losses, reduction in human suffering, and protection of the environment provided by the credited flood protection activities.
- Increased outreach activities focused on flood risk enabling citizens to evaluate their individual vulnerabilities, and take action to protect themselves, as well as their homes and businesses.
- Training and technical assistance for Vanderburgh County and the City of Evansville staff in designing and implementing credited flood protection activities.

### 1.2 Background and Scope

Each year in the United States, natural disasters take the lives of hundreds of people and injure thousands more. Nationwide, taxpayers pay billions of dollars annually to help communities, organizations, businesses, and individuals recover from disasters. These monies only partially
reflect the true cost of disasters, because additional expenses to insurance companies and non-governmental organizations are not reimbursed by tax dollars. Many natural disasters are predictable, and much of the damage caused by these events can be alleviated or even eliminated.

Hazard mitigation is defined by FEMA as “any sustained action taken to reduce or eliminate long-term risk to human life and property from a hazard event.” The results of a three-year, congressionally mandated independent study to assess future savings from mitigation activities provides evidence that mitigation activities are highly cost-effective. On average, each dollar spent on mitigation saves society an average of $4 in avoided future losses in addition to saving lives and preventing injuries (National Institute of Building Science Multi-Hazard Mitigation Council 2005).

Hazard mitigation planning is the process through which hazards that threaten communities are identified, likely impacts of those hazards are determined, mitigation goals are set, and appropriate strategies to lessen impacts are determined, prioritized, and implemented. This plan documents Vanderburgh County’s hazard mitigation planning process and identifies relevant hazards and vulnerabilities and strategies the County will use to decrease vulnerability and increase resiliency and sustainability.

The Vanderburgh County Multi-Hazard Mitigation Plan is a multi-jurisdictional plan that geographically covers everything within the County’s jurisdictional boundaries (hereinafter referred to as the planning area). Unincorporated Vanderburgh County and the following communities participated in the planning process:

- City of Evansville,
- Town of Darmstadt, and
- Evansville-Vanderburgh School Corporation.

This plan was updated pursuant to the requirements of the Disaster Mitigation Act of 2000 (Public Law 106-390) and the implementing regulations set forth by the Interim Final Rule published in the Federal Register on February 26, 2002, (44 CFR §201.6) and finalized on October 31, 2007. (Hereafter, these requirements and regulations will be referred to collectively as the Disaster Mitigation Act.) While the act emphasized the need for mitigation plans and more coordinated mitigation planning and implementation efforts, the regulations established the requirements that local hazard mitigation plans must meet in order for a local jurisdiction to be eligible for certain federal disaster assistance and hazard mitigation funding under the Robert T. Stafford Disaster Relief and Emergency Act (Public Law 93-288). Because the planning area is subject to many kinds of hazards, access to these programs is vital.

Information in this plan will be used to help guide and coordinate mitigation activities and decisions for local land use policy in the future. Proactive mitigation planning will help reduce the cost of disaster response and recovery to communities and their residents by protecting critical community facilities, reducing liability exposure, and minimizing overall community
impacts and disruptions. The Vanderburgh County planning area has been affected by hazards in the past and is thus committed to reducing future impacts from hazard events and becoming eligible for mitigation-related federal funding.

1.3 The 10-Step Planning Process

Requirements §201.6(b) and §201.6(c)(1): An open public involvement process is essential to the development of an effective plan. In order to develop a more comprehensive approach to reducing the effects of natural disasters, the planning process shall include:

1) An opportunity for the public to comment on the plan during the drafting stage and prior to plan approval;
2) An opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, and agencies that have the authority to regulate development, as well as businesses, academia, and other private and nonprofit interests to be involved in the planning process; and
3) Review and incorporation, if appropriate, of existing plans, studies, reports, and technical information.

[The plan shall document] the planning process used to develop the plan, including how it was prepared, who was involved in the process, and how the public was involved.

Vanderburgh County recognized the need and importance of a local hazard mitigation plan and initiated its development. The City of Evansville-Vanderburgh County Emergency Management Agency contracted with Amec Foster Wheeler Environment & Infrastructure, Inc., to assist with the facilitation and update of the plan. Amec Foster Wheeler’s role was to:

- Assist in establishing the Hazard Mitigation Planning Committee (HMPC) as defined by the Disaster Mitigation Act (DMA);
- Meet the DMA requirements as established by federal regulations and following FEMA’s planning guidance;
- Support objectives under the National Flood Insurance Program’s Community Rating System and the Flood Mitigation Assistance program,
- Facilitate the planning process;
- Identify the data requirements that HMPC participants could provide and conduct the research and documentation necessary to augment that data;
- Assist in facilitating the public input process; and
- Coordinate the plans reviews with the Mitigation and Recovery Branch, Indiana Department of Homeland Security and FEMA Region V.

Amec Foster Wheeler established the planning process for the Vanderburgh County Multi-Hazard Mitigation Plan using the DMA planning requirements and FEMA’s associated guidance. This guidance is structured around a four-phase process:
1) Organize resources,
2) Assess risks,
3) Develop a mitigation plan, and
4) Implement the plan and monitor progress.

Into this process, a more detailed 10-step planning process used for FEMA’s Community Rating System (CRS) and Flood Mitigation Assistance programs was integrated. Thus, the modified 10-step process used for this plan meets the requirements of five major programs: FEMA’s Hazard Mitigation Grant Program, Pre-Disaster Mitigation program, Community Rating System, Flood Mitigation Assistance Program, and new flood control projects authorized by the U.S. Army Corps of Engineers.

Table 1.2 shows how the CRS 10-step process fits into FEMA’s four-phase process.

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Phase I</strong> Organize Resources</td>
<td>Task 1: Determine the Planning Area and Resources</td>
<td>Step 1. Organize to Prepare the Plan</td>
</tr>
<tr>
<td></td>
<td>Task 2: Build the Planning Team 44 CFR 201.6(c)(1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)</td>
<td>Step 2. Involve the public</td>
</tr>
<tr>
<td></td>
<td>Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) &amp; (3)</td>
<td>Step 3. Coordinate with Other Agencies</td>
</tr>
<tr>
<td><strong>Phase II</strong> Assess Risks</td>
<td>Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) &amp; (iii)</td>
<td>Step 4. Assess the hazard(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 5. Assess the problem(s)</td>
</tr>
<tr>
<td><strong>Phase III</strong> Develop a Mitigation Plan</td>
<td>Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)</td>
<td>Step 6. Set goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 7. Review possible activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 8. Draft an action plan</td>
</tr>
<tr>
<td><strong>Phase IV</strong> Implement the Plan and Monitor Progress</td>
<td>Task 8: Review and Adopt the Plan</td>
<td>Step 9. Adopt the plan</td>
</tr>
<tr>
<td></td>
<td>Task 7: Keep the Plan Current</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task 9: Create a Safe and Resilient Community 44 CFR 201.6(c)(4)</td>
<td>Step 10. Implement, evaluate, revise</td>
</tr>
</tbody>
</table>

1.3.1 Phase 1: Planning Process

Planning Step 1: Organize to Prepare the Plan

The Disaster Mitigation Act of 2000 requires that each jurisdiction participate in the planning process and officially adopt the multi-jurisdictional hazard mitigation plan. A Hazard Mitigation Planning Committee (HMPC) was reconvened for Vanderburgh County and included representatives from each participating jurisdiction, departments of the County and City of Evansville, and other local, state, and federal organizations responsible for making decisions in the plan and agreeing upon the final contents. The agencies or organizations listed in Table 1.3 participated on the HMPC.

Table 1.3 Hazard Mitigation Planning Committee – Participating agencies and organizations

<table>
<thead>
<tr>
<th>Hazard Mitigation Planning Committee Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Evansville-Vanderburgh County Emergency Management Agency</td>
</tr>
<tr>
<td>City of Evansville Engineering Department</td>
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<tr>
<td>City of Evansville Urban Forestry Department</td>
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<tr>
<td>City of Evansville Department of Transportation and Services</td>
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<tr>
<td>Legal Aid Society of Evansville, Inc.</td>
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<tr>
<td>Evansville Police Department</td>
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<td>Evansville Fire Department</td>
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<td>Evansville-Vanderburgh County Area Plan Commission</td>
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<td>Evansville-Vanderburgh County Building Commission</td>
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<td>Evansville-Vanderburgh Levee Authority District</td>
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<td>Vanderburgh County Engineer</td>
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<td>Vanderburgh County Health Department</td>
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<td>Town of Darmstadt</td>
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<td>American Red Cross – Southwestern Indiana Chapter</td>
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<tr>
<td>Deaconess Hospital</td>
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<td>St. Mary’s Medical Center</td>
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</tbody>
</table>

The DMA planning regulations and guidance stress that each local government seeking FEMA approval of their mitigation plan must participate in the planning effort in the following ways:

- Participate in the process as part of the HMPC;
- Detail areas within the planning area where the risk differs from that facing the entire area;
- Identify potential mitigation actions; and
- Formally adopt the plan.

For Vanderburgh County’s planning area’s HMPC, “participation” meant the following:
• Attending and participating in the HMPC meetings;
• Providing requested data (as available);
• Reviewing and providing comments on plan drafts;
• Advertising, coordinating, and participating in the public input process; and
• Coordinating the formal adoption of the plan by the governing boards.

An annual meeting by Area Planning Commission on June 14, 2016, at 10:30 am and was held in the Civic Center on the third-floor conference room. Attendance for the meeting included the following: Ron London, Executive Director of Area Planning, Cliff Weaver Director of Emergency Management Agency Evansville/Vanderburgh County, David Ballew Flood Plain Manager, John Ansbro Senior Planner Area Planning, Alicia Schoening Intern with Emergency Management Agency Evansville/Vanderburgh County. The reason for the meeting was to have a discussion about the CRS grading plan, outreach programs, website for information.

The planning process update officially began with a kick-off meeting in Evansville, IN, on May 31, 2017. The meeting covered the scope of work and an introduction to the DMA requirements.

The HMPC continued to communicate during the planning process with a combination of face-to-face meetings, phone interviews and email correspondence. The meeting schedule and topics are listed in Table 1.4. The sign-in sheets and meeting minutes for each of the meetings are included in Appendix B.

<table>
<thead>
<tr>
<th>Meeting</th>
<th>Topic</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMPC #1</td>
<td>Kickoff meeting: Review of the hazard mitigation planning process and hazard identification</td>
<td>May 31, 2017</td>
</tr>
<tr>
<td>HMPC #2</td>
<td>Review of previous risk assessment; discussion of risk assessment and data needs for plan update; and review of plan goals and objectives</td>
<td>June 27, 2017</td>
</tr>
<tr>
<td>HMPC #3</td>
<td>Update mitigation actions and prioritization; discussion of process to monitor, evaluate, and update plan</td>
<td>June 27, 2017</td>
</tr>
</tbody>
</table>

Based on the area of expertise of each representative participating on the HMPC, Table 1.5 demonstrates each member’s expertise in the six mitigation categories (Prevention, Property Protection, Natural Resource Protection, Emergency Services, Structural Flood Control Projects and Public Information). The Evansville-Vanderburgh County Area Plan Commission Management Agency is responsible for community land use and comprehensive planning and was an active participant on the HMPC and provided data and information to support development of the plan.
<table>
<thead>
<tr>
<th>Community Department/Office</th>
<th>Prevention</th>
<th>Property Protection</th>
<th>Natural Resource Protection</th>
<th>Emergency Services</th>
<th>Structural Flood Control Projects</th>
<th>Public Information</th>
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</table>
Planning Step 2: Involve the Public

At the kick-off meeting, the HMPC discussed options for public involvement. A public outreach strategy was prepared to capture the input of the HMPC and identify tools and activities to engage, educate, and inform the citizens of Vanderburgh County of local multi-hazard mitigation planning efforts for each of the major phases of the mitigation planning process. This outreach includes:

- **Engage** the public and other stakeholders through interactive dialogue including such forums as planning committee meetings, public meetings, workshops and open house events;
- **Educate** the public and other stakeholders through a listen and learn process such as information booths, presentations, and briefings to elected officials; and
- **Inform** the public and other stakeholders through one-way communication such as written outreach materials, websites, and news media.

**ENGAGE**

- A public meeting was held during the draft-plan development and prior to finalizing the plan. Where appropriate, stakeholder and public comments were incorporated into the final plan, including the sections that address mitigation goals and strategies. All press releases and website postings are on file with the City of Evansville-Vanderburgh County Emergency Management Agency. The draft plan is available online at [http://www.evansvillegov.org/city/topic/index.php?topicid=473&structureid=46](http://www.evansvillegov.org/city/topic/index.php?topicid=473&structureid=46).
  - July 12, 2017, Central Library Browning Event, Room B, Open House. This public meeting was held in the evening, separate from the HMPC Kickoff Meeting. This public meeting was held following the HMPC Meeting #3 to gather input from the public and stakeholders on potential mitigation actions.

**EDUCATE**

- **Briefings to Elected Officials** – Vanderburgh County staff coordinated one-on-one meetings with County Board Representatives and/or elected officials, as requested, to provide updates on the mitigation planning process.

- **Questionnaire** - A public participation questionnaire was prepared by Amec Foster Wheeler using the SurveyMonkey web hosting service and was open to the public for four months, see Figure 1.1. The purpose of this questionnaire was to solicit input from the public and stakeholders in Vanderburgh County regarding hazards of concern, areas
of mitigation interest, and related preparedness. The online survey gave individuals that were unable to attend the in-person meetings the opportunity to participate in the planning process. The questionnaire was made available through web links posted on the project information website, circulated via email, and social media outlets. Additionally, hard copies of the questionnaire were distributed at all public meetings and presentations to stakeholders’ groups.

Figure 1.1 – Public Questionnaire

INFORM

- Television and Newspaper Articles – Each HMPC and Public Meeting was announced through press releases to generate interest and support from local television stations and newspapers. Examples include the news story presented by the Evansville Courier & Press:

- Website - A project information website was prepared and hosted by Vanderburgh County for the duration of the planning process with the primary purpose to share information relevant to the Vanderburgh County Multi-Hazard Mitigation Plan. Specific resources to be included on this site include:
  - Meeting schedule, agendas, presentations, and minutes;
– Project information flyer for introduction, risk assessment, and notification of draft document;
– Link to online questionnaire
– Draft Multi-Hazard Mitigation Plan for review/comment; and
– Reference documents and links to planning resources.

The website address is:

» **Project Information Flyer** – A project information flyer was developed and distributed throughout the planning process to provide information on the hazard mitigation planning and opportunities for public involvement. This resource was available on the project information website as well as distributed to local libraries and at public meetings identified in the ‘educate’ process. Specific information to be provided in the flyers includes:
   – What is a Hazard Mitigation Plan?
   – Why is it important to me?
   – What can I do to participate?
   – Planning Status
   – Mitigation Success Stories

» **Social Media** – Vanderburgh County’s social media outlets on Twitter and Facebook were utilized to publish information regarding public meetings, the online questionnaire, and general hazard mitigation planning information.

Documentation of all public outreach activities is included in Appendix B.

**Planning Step 3: Coordinate with Other Agencies**

Early in the planning process, the HMPC determined that data collection, mitigation strategy development, and plan approval would be greatly enhanced by inviting state and federal agencies and organizations to participate in the process. Based on their involvement in hazard mitigation planning, their landowner status in the City, representatives from the following agencies were invited to participate on the HMPC:

- Mitigation and Recovery Branch, Indiana Department of Homeland Security,
- National Weather Service,
- American Red Cross, and
- U.S. Army Corps of Engineers.

The HMPC also used technical data, reports, and studies from the following agencies and groups:

- City of Evansville-Vanderburgh County Emergency Management Agency,
- City of Evansville Engineering Department,
Other Community Planning Efforts and Hazard Mitigation Activities

Coordination with other community planning efforts is also paramount to the success of this plan. Hazard mitigation planning involves identifying existing policies, tools, and actions that will reduce a community’s risk and vulnerability to hazards. Vanderburgh County uses a variety of comprehensive planning mechanisms, such as general plans and ordinances, to guide growth and development. Integrating existing planning efforts and mitigation policies and action strategies into this plan establishes a credible and comprehensive plan that ties into and supports other community programs. The development of this plan incorporated information from the following existing plans, studies, reports, and initiatives as well as other relevant data from neighboring communities and other jurisdictions.

- Evansville-Vanderburgh County Multi-Hazard Mitigation Plan, 2011
- Annual Multi-Hazard Mitigation Plan Progress Report,
- Comprehensive Plan of Evansville and Vanderburgh County,
- City of Evansville-Vanderburgh County Community Comprehensive Hazard Analysis,
- Vanderburgh County, IN Flood Insurance Study, 2011 and
- State of Indiana Standard Hazard Mitigation Plan.

Other documents were reviewed and considered, as appropriate, during the collection of data to support Planning Steps 4 and 5, which include the hazard identification, vulnerability assessment, and capability assessment.

1.3.2 Phase 2: Assess Risks

Planning Steps 4 and 5: Assess the Hazard(s) and Assess the Problem(s)

Amec Foster Wheeler led the HMPC in an exhaustive research effort to identify and document all the hazards that have, or could, impact the planning area. Geographic information systems (GIS) were used to display, analyze, and quantify hazards and vulnerabilities. The HMPC also
conducted a capability assessment to review and document the planning area’s current capabilities to mitigate risk and vulnerability from hazards. By collecting information about existing government programs, policies, regulations, ordinances, and emergency plans, the HMPC could assess those activities and measures already in place that contribute to mitigating some of the risks and vulnerabilities identified. A more detailed description of the risk assessment process and the results are included in Chapter 3 Risk Assessment.

**1.3.3 Phase 3: Develop a Mitigation Plan**

**Planning Steps 6 and 7: Set Goals and Review Possible Activities**

Amec Foster Wheeler facilitated brainstorming and discussion sessions with the HMPC that described the purpose and the process of developing planning goals and objectives, a comprehensive range of mitigation alternatives, and a method of selecting and defending recommended mitigation actions using a series of selection criteria. This information is included in Chapter 4 Mitigation Strategy. Additional documentation on the process the HMPC used to develop the goals and strategy is in Appendix C: Mitigation Alternatives and Prioritization.

**Planning Step 8: Draft an Action Plan**

Based on input from the HMPC regarding the draft risk assessment and the goals and activities identified in Planning Steps 6 and 7, City of Evansville-Vanderburgh County Emergency Management Agency (EMA) produced a complete first draft of the plan. This complete draft was distributed for HMPC review and comment. Other agencies were invited to comment on this draft as well. HMPC and agency comments were integrated into the second draft, which was advertised and distributed to collect public input and comments. EMA integrated comments and issues from the public, as appropriate, along with additional internal review comments and produced a final draft for the Mitigation and Recovery Branch, Indiana Department of Homeland Security and FEMA Region V to review and approve, contingent upon final adoption by the governing boards of each participating jurisdiction. All planning document deliverables are outlined in Table 1.6 below.

**Table 1.6 Planning Deliverables**

<table>
<thead>
<tr>
<th>Deliverable</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>HMPC #1- Meeting Minutes</td>
<td>7/17/2017</td>
</tr>
<tr>
<td>Public Information Flyer #1</td>
<td>5/31/2017</td>
</tr>
<tr>
<td>HMPC #2- Meeting Minutes</td>
<td>7/17/2017</td>
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<tr>
<td>Draft Multi-Hazard Mitigation Plan</td>
<td></td>
</tr>
<tr>
<td>- Chapters 1, 2, and 3</td>
<td></td>
</tr>
<tr>
<td>- Hazard Identification and Risk Assessment Update</td>
<td>8/4/2017</td>
</tr>
<tr>
<td>- Previous Mitigation Actions</td>
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### Deliverable

<table>
<thead>
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<td>7/12/2017</td>
</tr>
<tr>
<td>HMPC #3- Meeting Minutes</td>
<td>7/17/2017</td>
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<tr>
<td>Public Meeting Presentation</td>
<td>7/12/2017</td>
</tr>
<tr>
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<td>7/26/2017</td>
</tr>
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<td>- Chapters 1, 2, 3, 4, and 5</td>
<td></td>
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<tr>
<td>- Appendices A, B, C, and D</td>
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</tr>
</tbody>
</table>

### 1.3.4 Phase 4: Implement the Plan and Monitor Progress

#### Planning Step 9: Adopt the Plan

In order to secure buy-in and officially implement the plan, the plan was adopted by the governing boards of each participating jurisdiction on the dates included in the adoption resolutions in Appendix A: Adoption Resolutions.

#### Planning Step 10: Implement, Evaluate, and Revise the Plan

The true worth of any mitigation plan is in the effectiveness of its implementation. Up to this point in the planning process, all of the HMPC’s efforts have been directed at researching data, coordinating input from participating entities, and developing appropriate mitigation actions. Each recommended action includes key descriptors, such as a lead manager and possible funding sources, to help initiate implementation. An overall implementation strategy is described in Chapter 5 Plan Implementation and Maintenance. A plan update and maintenance schedule and a strategy for continued public involvement are also included in Chapter 5.

Finally, there are numerous organizations within the Vanderburgh County planning area whose goals and interests interface with hazard mitigation. Coordination with these other planning efforts, as addressed in Planning Step 3, is paramount to the ongoing success of this plan and mitigation in Vanderburgh County and is addressed further in Chapter 5.
Chapter 2 provides a profile of the Vanderburgh County planning area and identifies capabilities already in place in the county and the participating jurisdictions to help mitigate hazards addressed in this plan.

2.1 Vanderburgh County Planning Area Profile

Figure 2.1, on the following page, provide a map of the Vanderburgh County planning area.

2.1.1 Geography and Topography

Evansville and Vanderburgh County are located in southwestern Indiana along the banks of the Ohio River, located less than 200 miles away from four major U.S. cities.

- 176 miles southwest of Indianapolis, IN;
- 156 miles north of Nashville, TN;
- 126 miles west of Louisville, KY; and
- 174 miles east of St. Louis, MO

Evansville is a recognized trade center for a three-state area and is located very near to both the Illinois and Kentucky state lines. It is the center of both an Economic Area and a Metropolitan Statistical Area (MSA). The MSA title corresponds to the name of the largest central city in the area. The Economic Area encompasses approximately a 60-mile radius including 27 counties within Indiana, Illinois, and Kentucky.

Vanderburgh County is bordered by three other Indiana counties (Gibson, Posey, and Warrick) and one Kentucky County (Henderson). Vanderburgh County encompasses approximately 154,200 acres. The terrain ranges from rolling hills to level, well-watered farmlands. In addition to the Ohio River, major topographical features include Pigeon Creek. The elevation of Vanderburgh County ranges slightly, from the lowest point of 357 feet above sea level, where Bayou Creek joins the Ohio River, to the highest point of 600 feet above sea level, at a location in the west-central part of the county near St. Joseph.

The State of Indiana is divided into eight major drainage basins. Vanderburgh County is encompassed mainly by the Highland-Pigeon Watershed (Figure 2.2) and partially by the Lower Wabash Watershed. Vanderburgh County is located within the Wabash Lowlands physiographic province of Indiana. The Wabash Lowlands are broad lowlands approximately 500 feet above sea level with sand dunes along larger river valleys. Agricultural crops within this area primarily include corn, soybeans, feed grains, strawberries, melons, and orchards.
Figure 2.1  Vanderburgh County Planning Area
Soils

Soils in Vanderburgh County have been classified with limitations for non-farm development due to soil associations, drainage features, and slope of the land and production of an agricultural commodity. Soils that have slight to moderate limitations are generally located in the northeastern corner of the County, the western half of the County, and the southeastern portion of the City.
Inappropriate development or development on soils with these or stronger limitations could suffer problems such as erosion; increased stormwater runoff and associated flooding or drainage problems; and/or septic systems that do not function properly.

Approximately half of the soils in Vanderburgh County are primarily used for agricultural production. Most of these soils are located on the outskirts of the incorporated area of Evansville, along the county’s boundaries.

**Trees and Forests**

Since 1811 when Evansville was settled, land has continually been cleared for development and agricultural use. Today, only pockets of wooded areas are left. According to the Vanderburgh County Area Planning Commission 2015 Land Use Inventory and the 2015 aerial photos of the City and County, approximately 10.8% of the County land area is covered by forested parcels. Due to the prevalent pattern of growth for Vanderburgh County, this number has decreased by 10.2% over 5 years and is continuing to decrease.

The types of forests that are found in Vanderburgh County are Beech, Gum, Hickory, and Oak hardwoods. The southwestern portion of the County, the northeastern German Township, and the far northeastern corner of the County still have substantial wooded lands and are primarily undeveloped but contain some scattered residential uses.

**Wetlands**

Due to Vanderburgh County’s location in the Ohio River Valley, there is an array of wetland areas such as bottomland swamps, oxbow lakes, and sloughs. Estimates of remaining wetland habitat in the County range up to 5,000 acres. The Vanderburgh Area Planning Commission 2015 Land Use Inventory indicates approximately 1,520 acres of land covered by water in Vanderburgh County.

**Floodplains and Levees**

Vanderburgh County contains portions of three watersheds, the Ohio River and two of its tributaries, Big Creek and Pigeon Creek. Flooding occurs on the banks of these rivers due to prolonged rainfall or backwater flooding. In fact, the entire “hook” at the southern portion of Vanderburgh County along the Ohio River is located within the 100-year floodplain.

After the flood of 1937, Evansville’s most extensive flood, the U.S. Army Corps of Engineers built an extensive levee system that protects portions of Evansville’s floodprone areas from reoccurrence of the damage and disruption experienced in 1937. The project includes 18 miles of earth levee, concrete walls, roadway levees and 20 pumping stations. The levee project was completed in 1992 and is considered to be the most extensive levee project in Indiana. It extends from the Vanderburgh-Warrick County line along Interstate 164 and Veterans Memorial Parkway to the riverfront and on along Pigeon Creek to U.S. 41.
Seismic Zones

Southwestern Indiana is relatively close to two seismic zones: The New Madrid and the Lower Wabash Valley seismic zones. The New Madrid Seismic Zone extends from west-central Mississippi northward past Cape Girardeau, Missouri. Evansville is approximately 160 miles northeast of New Madrid, Missouri, the center of this seismic zone. The Lower Wabash Valley Seismic Zone generally follows the Wabash River from the Ohio River north to Terre Haute, Indiana. The proximity of southwestern Indiana to these known zones of seismicity makes the region especially vulnerable to earthquakes.

Much of the concern about earthquake damage in the Evansville area is based on two seismic hazards: liquefaction and ground motion amplification. The area adjacent to the Ohio River floodway is particularly susceptible to liquefaction and the downtown and incorporated areas of Evansville are particularly susceptible to ground motion amplification. These areas were classified based on subsurface records including: water wells, engineering borings and holes, and differing geologic materials.

2.1.2 Climate

Evansville has a moderate climate and four distinct seasons. Average temperatures range from 23.4 to 89 degrees Fahrenheit. Annual rainfall averages 43.5 inches and annual snowfall averages 13.6 inches.

The prevailing winds in the Evansville area are from the south. Although the southwestern portion of the State of Indiana is 550 miles from the Gulf of Mexico, the weather is influenced by the warm moist air masses from the south. This pattern prevails most of the year although it is occasionally interrupted by cold fronts that slide south during the winter.

Despite these cold periods, the climate overall is more southern than northern. This is frequently seen in the temperature variations between Evansville and Chicago where it is not unusual to have more than a ten-degree difference in the winter. Snowfall varies a great deal from year to year and significant accumulation (6 inches or more) is rare. Average annual climate statistics include:
2.1.3 Population/Demographics

Since its incorporation as a city in Vanderburgh County in 1847, Evansville has grown to become the Indiana’s third largest city, covering 41 square miles and containing a population of 181,877 estimated for 2016. For Population see Table 2.2.

Because a large portion of the population of the area surrounding Evansville is dependent on Evansville as a place to work or live, Evansville is considered the center of the Evansville, Indiana-Kentucky MSA (metropolitan statistical area) that includes Gibson, Posey, Vanderburgh, and Warrick counties in Indiana and Henderson and Webster counties in Kentucky. The Evansville MSA population based upon the 2016 (estimated) census is 311,552, covering an area of 2,291 square miles.

Table 2.2 Vanderburgh County—Population

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>2000</th>
<th>2010</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville</td>
<td>121,582</td>
<td>117,429</td>
<td>119,477</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>1,313</td>
<td>1,407</td>
<td>1,466</td>
</tr>
<tr>
<td>Unincorporated Areas</td>
<td>49,027</td>
<td>60,867</td>
<td>60,778</td>
</tr>
<tr>
<td><strong>Total County</strong></td>
<td><strong>171,922</strong></td>
<td><strong>179,703</strong></td>
<td><strong>181,721</strong></td>
</tr>
</tbody>
</table>

Source: U.S. Census Bureau

In Table 2.2 the year 2016 is the estimated population for the County of Vanderburgh County, this includes Town of Darmstadt and the Unincorporated Areas.

In Table 2.3 below, census demographic and social characteristics for Vanderburgh County are shown for 2011-2015 American Community Survey 5 Year Estimate. In the table, the “Other” was taken from the 2010 Census demographic and social characteristics.
2.1.4 History

Vanderburgh County was settled in the early 1800s and the County was organized on February 1, 1818. The County was named for Henry W. Vanderburgh, a Judge of the Supreme Court of the Indiana Territory. The County is divided into eight Civil Townships as follows: Armstrong, Center, German, Knight, Perry, Pigeon, Scott and Union.

Evansville is the County Seat and it is also unique in that it is the only town in Indiana that has been the County Seat for two counties. Evansville was the County Seat of Warrick County up to September 1, 1814.

2.1.5 Economy/Industry

According to the Indiana Department Workforce Development, the 2016 industries that employed the highest percentage of Evansville metropolitan statistical area’s labor force (full and part-time, non-farm wage and salary employees, and self-employed persons) were, in percentage order; educational services, health care, and social assistance, 21 percent, and manufacturing, 16 percent.

The annual labor force estimates 93,215 in 2016 for Vanderburgh County Indiana. According to the Hoosiers by the Numbers, unemployment rate was 4.1 percent for the year of 2016. The statewide unemployment rate was 4.4 percent for that same period.
Table 2.4 lists selected economic characteristics for Vanderburgh County, the City of Evansville, and the Town of Darmstadt from the U.S. Census Bureau.

### Table 2.4 Vanderburgh County—Economic Characteristics, 2011-2015

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Vanderburgh County</th>
<th>Evansville</th>
<th>Darmstadt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Families below Poverty Level (%)</td>
<td>12.3</td>
<td>16.7</td>
<td>3.3</td>
</tr>
<tr>
<td>Individuals below Poverty Level (%)</td>
<td>16.16</td>
<td>21.0</td>
<td>5.2</td>
</tr>
<tr>
<td>Median Home Value ($)</td>
<td>115,500</td>
<td>89,200</td>
<td>198,800</td>
</tr>
<tr>
<td>Median Household Income ($)</td>
<td>43,046</td>
<td>45,381</td>
<td>88,352</td>
</tr>
<tr>
<td>Per Capita Income ($)</td>
<td>24,961</td>
<td>21,158</td>
<td>43,188</td>
</tr>
<tr>
<td>Population in Labor Force</td>
<td>91,766</td>
<td>59,496</td>
<td>897</td>
</tr>
</tbody>
</table>


The manufacturing industry has the largest sales in the area. There are many nationally known companies that have grown to prominence from their start-up here and maintain their headquarters in the region. Products vary from barge construction, heavy truck assembly, kitchen cabinets, electronic components and specialty chemical catalysts.
Table 2.5 Vanderburgh County—2015 Economic Sectors

<table>
<thead>
<tr>
<th>Occupational Sector</th>
<th>No. of Establishments</th>
<th>Annual Payroll ($1,000)</th>
<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture, forestry, fishing and hunting</td>
<td>2</td>
<td>a</td>
<td>D</td>
</tr>
<tr>
<td>Mining, quarrying, and oil and gas extraction</td>
<td>26</td>
<td>12,438</td>
<td>164</td>
</tr>
<tr>
<td>Utilities</td>
<td>12</td>
<td>D</td>
<td>f</td>
</tr>
<tr>
<td>Construction</td>
<td>427</td>
<td>513,030</td>
<td>7,897</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>247</td>
<td>534,202</td>
<td>11,329</td>
</tr>
<tr>
<td>Wholesale trade</td>
<td>286</td>
<td>472,179</td>
<td>6,766</td>
</tr>
<tr>
<td>Retail trade</td>
<td>780</td>
<td>316,012</td>
<td>12,639</td>
</tr>
<tr>
<td>Transportation and warehousing</td>
<td>150</td>
<td>170,131</td>
<td>4,050</td>
</tr>
<tr>
<td>Information</td>
<td>70</td>
<td>105,521</td>
<td>2,392</td>
</tr>
<tr>
<td>Finance and insurance</td>
<td>301</td>
<td>321,174</td>
<td>4,675</td>
</tr>
<tr>
<td>Real estate and rental and leasing</td>
<td>210</td>
<td>43,037</td>
<td>1,216</td>
</tr>
<tr>
<td>Professional, scientific, and technical services</td>
<td>420</td>
<td>228,185</td>
<td>3,849</td>
</tr>
<tr>
<td>Management of companies and enterprises</td>
<td>39</td>
<td>91,304</td>
<td>1,038</td>
</tr>
<tr>
<td>Administrative and Support and Waste Mang and Remedation Srvs</td>
<td>235</td>
<td>151,908</td>
<td>5,332</td>
</tr>
<tr>
<td>Educational services</td>
<td>65</td>
<td>53,802</td>
<td>2,144</td>
</tr>
<tr>
<td>Health care and social assistance</td>
<td>630</td>
<td>869,280</td>
<td>19,455</td>
</tr>
<tr>
<td>Arts, entertainment, and recreation</td>
<td>70</td>
<td>25,477</td>
<td>1,358</td>
</tr>
<tr>
<td>Accommodation and food services</td>
<td>454</td>
<td>168,130</td>
<td>10,804</td>
</tr>
<tr>
<td>Other services (except public administration)</td>
<td>530</td>
<td>142,652</td>
<td>4,932</td>
</tr>
<tr>
<td>Industries not classified</td>
<td>2</td>
<td>D</td>
<td>a</td>
</tr>
<tr>
<td><strong>TOTAL FOR ALL SECTORS</strong></td>
<td><strong>4,956</strong></td>
<td><strong>4,301,571</strong></td>
<td><strong>100,952</strong></td>
</tr>
</tbody>
</table>

Source: US Census Bureau; [http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t](http://factfinder2.census.gov/faces/nav/jsf/pages/searchresults.xhtml?refresh=t)

- a – 0 to 19 employees;
- f – 500 to 999 employees;
- D – withheld to avoid disclosing data for individual companies; data are included in higher level totals
2.1.6 Agriculture

Agriculture is an economic component in Vanderburgh County. In 2012, there were 275 farms in the County with 76,554 acres, while in 2007 there is an eighteen percent decrease of the number of farms. Cropland makes up 92.2 percent of the land in farms with other uses making up 7.8 percent in Vanderburgh County.

In 2012, overall value of crops sold was $32,541,000 and the value of livestock sales was $3,552,000. Table 2.6 below shows the production quantity and the state rank for the main agricultural products in Vanderburgh County.

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Quantity ($)</th>
<th>State Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grains, oilseeds, dry beans, &amp; dry peas</td>
<td>31,361</td>
<td>74</td>
</tr>
<tr>
<td>Vegetables, melons, potatoes, &amp; sweet potatoes</td>
<td>(D)</td>
<td>(D)</td>
</tr>
<tr>
<td>Fruits, tree nuts, &amp; berries</td>
<td>35</td>
<td>42</td>
</tr>
<tr>
<td>Nursery, greenhouse, floriculture, &amp; sod</td>
<td>284</td>
<td>51</td>
</tr>
<tr>
<td>Cut Christmas trees and short rotation woody crops</td>
<td>(D)</td>
<td>37</td>
</tr>
<tr>
<td>Other crops and hay</td>
<td>(D)</td>
<td>89</td>
</tr>
<tr>
<td>Poultry and eggs</td>
<td>(D)</td>
<td>37</td>
</tr>
<tr>
<td>Cattle and calves</td>
<td>206</td>
<td>91</td>
</tr>
<tr>
<td>Milk from Cows</td>
<td>(D)</td>
<td>74</td>
</tr>
<tr>
<td>Hogs and pigs</td>
<td>736</td>
<td>78</td>
</tr>
<tr>
<td>Sheep, goats, wool, mohair and milk</td>
<td>14</td>
<td>88</td>
</tr>
<tr>
<td>Horses, ponies, mules, burros and donkeys</td>
<td>8</td>
<td>85</td>
</tr>
<tr>
<td>Other animals and other animal products</td>
<td>2</td>
<td>76</td>
</tr>
</tbody>
</table>

Source: U.S. Department of Agriculture, 2012 census of agriculture, Vanderburgh County, IN Profile.

(D) Withheld to avoid disclosing data for individual operations.
2.2 Jurisdictional Descriptions and Capabilities

The mitigation capabilities for each of the jurisdictions participating in the plan are profiled in the section that follows. These profiles include an overview of the jurisdiction and its organizational structure; a description of staff, fiscal, and technical resources; and information regarding existing hazard mitigation capabilities such as adopted plans policies and regulations, if any. The descriptions and capabilities assessments are based on available and applicable data, including information provided by the jurisdictions collected during the planning process.

In the subsections that follow, Sections 2.2.1 and 2.2.2 summarize mitigation capabilities for Vanderburgh County, the City of Evansville and the Town of Darmstadt respectively. Then Section 2.2.3 describes the Evansville Vanderburgh School Corporation.

2.2.1 Vanderburgh County

Overview

The jurisdiction of Vanderburgh County includes all unincorporated areas within the County boundaries. Vanderburgh County has a three-member elected commission as well as the following elected officers of: Assessor, Auditor, Circuit Court, Coroner, County Clerk, Prosecutor’s Office, Recorder, Sheriff, Surveyor, and Treasurer. The Vanderburgh County government includes the following departments:

- Area Plan Commission*
- Building Commission*
- Burdette Park
- Chief Information Officer
- Computer Services*
- County Engineer
- Emergency Management Agency*
- Health Department
- Highway Department
- Joint Central Dispatch*
- Legal Aid Society*
- Public Defender’s Agency
- The Centre
- Solid Waste Management*
- Veterans Services
- Voters Registration
- Weights & Measures*

The departments with an * are joint city/county offices or joint county/city offices.
Land Use and Development Trends

The Evansville-Vanderburgh County Area Planning Commission (APC) reviews all rezoning, variance, and special use petitions for Vanderburgh County, the City of Evansville, and the Town of Darmstadt. Additionally, the APC issues Improvement Location Permits for new structures or other proposed site activity in its administration of the Zoning Ordinance. Development trends since the 2011 Multi-Hazard Mitigation Plan are presented in Table 2.7. Subdivisions approval requests have increased from 40 submissions and 34 approvals in 2011 to 56 submissions and 63 approvals in 2016. Conversely, the number of improvement permits has decreased steadily from 2,334 in 2011 to 1,793 in 2016. Notable residential growth trends include:

- 2013 - Fastest growing residential areas were unincorporated Center and Scott Townships in northeast Vanderburgh County; and Knight and Pigeon Townships in the City of Evansville
- 2014 - Fastest growing residential areas were again unincorporated Center and Scott Townships in northeast Vanderburgh County; and Knight Township in the City of Evansville
- 2015 - Fastest growing residential areas were Knight and Pigeon Townships in the City of Evansville
- 2016 - Knight Township in the City of Evansville continues to be the area that showed the most growth overall mainly due to strong multi-family development; while the area that recorded the highest growth for single family was Center Township within Vanderburgh County.

Table 2.7 Development Trends, Vanderburgh County, City of Evansville, and Town of Darmstadt, 2011-2016

<table>
<thead>
<tr>
<th>Improvement Activity Type</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
<th>2015</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subdivisions Filed</td>
<td>40</td>
<td>39</td>
<td>46</td>
<td>55</td>
<td>54</td>
<td>56</td>
</tr>
<tr>
<td>Subdivisions Recorded</td>
<td>34</td>
<td>48</td>
<td>43</td>
<td>47</td>
<td>47</td>
<td>63</td>
</tr>
<tr>
<td>Improvement Location Permits</td>
<td>2,334</td>
<td>1,929</td>
<td>1,976</td>
<td>1,992</td>
<td>1,881</td>
<td>1,793</td>
</tr>
<tr>
<td>Site Plan Reviews</td>
<td></td>
<td></td>
<td>229</td>
<td>245</td>
<td>225</td>
<td>264</td>
</tr>
<tr>
<td>Rezonings Filed</td>
<td>22</td>
<td>28</td>
<td>46</td>
<td>33</td>
<td>41</td>
<td>41</td>
</tr>
<tr>
<td>Special Uses Filed</td>
<td>38</td>
<td>40</td>
<td>41</td>
<td>35</td>
<td>48</td>
<td>39</td>
</tr>
<tr>
<td>Variances Filed</td>
<td>79</td>
<td>88</td>
<td>80</td>
<td>85</td>
<td>103</td>
<td>104</td>
</tr>
</tbody>
</table>


The number of site plans reviews has remained steady at approximately 240 per year. Site plan reviews included the following commercial building approvals:

- 2013 – 39 new commercial buildings
- 2014 – 55 new commercial buildings
- 2015 – data not available
- 2016 – 57 new commercial buildings
The 2015-2035 Comprehensive Plan of Evansville and Vanderburgh County, details the goals, objectives, and policies for land use in the planning area. As seen in Figure 2.3, agricultural lands make up the largest percentage of land use with 61.5 percent. It is followed by 19.3 percent residential and 10.8 percent in trees.

**Figure 2.3 Vanderburgh County Land Use**

Source: 2015-2035 Comprehensive Plan of Evansville, Darmstadt, and Vanderburgh County

For future land use, the County projects to gain 10,989 units and required on 6.9 square miles by 2035. The largest areas for new future residential use in the Plan are along the proposed University Parkway road project in western Vanderburgh County and the northeastern part of the County.

The largest future area expected primarily for commercial development is the eastside area bounded by Morgan Avenue, I-64, Lloyd Expressway and the Burkhardt Road corridor. Then for industrial use, the Plan projects the long-planned U.S. 41 North corridor between I-64 and Baseline Road as the primary area for industrial growth. A new secondary corridor for industrial development has been added along/between SR 57 and I-164 extending south from the northern County Line to nearly Boonville-New Harmony Road. Another smaller area designated for future industrial is the southeast quadrant of the I-164 and Lynch Road interchange.

Figure 2.4 below shows the projected land use for 2035 in Vanderburgh County. The majority of the figure is colored brown depicting the residential areas of the County.
Figure 2.4  Vanderburgh County 2035 Future Land Use

Source: 2015-2035 Comprehensive Plan of Evansville, Darmstadt, and Vanderburgh County
Technical and Fiscal Resources

Vanderburgh County has staff resources in planning, engineering, and floodplain management. The Evansville-Vanderburgh County Area Plan Commission is designated to carry out land use planning for the County, Evansville and Darmstadt. This board also makes decision on zonings and subdivisions within these jurisdictions, updates the City/County Comprehensive Plan, and enforces zoning and subdivision ordinances.

The County has a joint city-county office for the emergency management agency. There is a Joint Central District that handles all 911 calls. Table 2.8 outlines the County’s personnel resources in 2016.

### Table 2.8 Vanderburgh’s Administrative and Technical Resources

<table>
<thead>
<tr>
<th>Personnel Resources</th>
<th>Yes/No</th>
<th>Department/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planner/Engineer with knowledge of land development/land management practices</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
</tr>
<tr>
<td>Engineer/Professional trained in construction practices related to buildings and/or infrastructure</td>
<td>YES</td>
<td>Area Plan Commission &amp; Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Planner/Engineer/Scientist with an understanding of natural hazards</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
</tr>
<tr>
<td>Personnel skilled in GIS</td>
<td>YES</td>
<td>GIS Department Area Planning Commission</td>
</tr>
<tr>
<td>Full time building official</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Floodplain Manager</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Emergency Manager</td>
<td>YES</td>
<td>EMA (Joint City/County)</td>
</tr>
<tr>
<td>Grant writer</td>
<td>YES</td>
<td>City Controller</td>
</tr>
</tbody>
</table>

Financial tools or resources that the county could potentially use to help fund mitigation activities include the following:

- Community Development Block Grants
- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Impact fees for new development
Existing Plans and Policies

Vanderburgh County has a comprehensive plan, zoning regulations, subdivision regulations, and a floodplain management ordinance.

The County joined the regular phase of the National Flood Insurance Program on February 1, 1980 and also participant in the Community Rating System as a Class 8. They maintain elevation certificates on properties in the floodplain.

Table 2.9 Vanderburgh County Regulatory Tools

<table>
<thead>
<tr>
<th>Regulatory Tool (ordinances, codes, plans)</th>
<th>Y/N</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Plan</td>
<td>YES</td>
<td>2015-2035 Comprehensive Plan of Evansville and Vanderburgh</td>
</tr>
<tr>
<td>Zoning ordinance</td>
<td>YES</td>
<td>City and County Zoning Ordinances govern land use in Evansville and Vanderburgh County</td>
</tr>
<tr>
<td>Subdivision ordinance</td>
<td>YES</td>
<td>Area Planning Commission (Joint City/County)</td>
</tr>
<tr>
<td>Growth management ordinance</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Floodplain ordinance</td>
<td>YES</td>
<td>Building Commission/Floodplain Management (Joint City/County)</td>
</tr>
<tr>
<td>Other special purpose ordinance (steep slope, wildfire)</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Building code</td>
<td>YES</td>
<td>Building Commission/Building Construction (Joint City/County)</td>
</tr>
<tr>
<td>BCEGS Rating</td>
<td>YES</td>
<td>9-Commercial and 9-Residential</td>
</tr>
<tr>
<td>Erosion or sediment control ordinance</td>
<td>YES</td>
<td>Vanderburgh County Engineer</td>
</tr>
<tr>
<td>Stormwater management ordinance</td>
<td>YES</td>
<td>Vanderburgh County Surveyor</td>
</tr>
<tr>
<td>Site plan review committee</td>
<td>YES</td>
<td>Combined City and County departments</td>
</tr>
<tr>
<td>Capital improvement plans</td>
<td>YES</td>
<td>County Council</td>
</tr>
<tr>
<td>Economic development plan</td>
<td>YES</td>
<td>Department of Metropolitan Development</td>
</tr>
<tr>
<td>Local emergency operations plan</td>
<td>YES</td>
<td>Vanderburgh County EMA Plan</td>
</tr>
<tr>
<td>Other special plans (i.e. flood mitigation plan)</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Flood insurance study or other engineering study for streams</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Elevation certificates</td>
<td>YES</td>
<td>Building Commission/Floodplain Management (Joint City/County)</td>
</tr>
</tbody>
</table>
Other Mitigation Activities

Emergency Management Agency

- Participates in the Storm Ready Program sponsored by the National Weather Service. It is a program that encourages advanced planning, education, and awareness of severe weather.

- Owns a Mobile Emergency Operations Center (MEOC) for mobile command and communication support for any disaster or emergency.

- The Radio Amateur Civil Emergency Services (RACES) provides communications assistance by acting as an interface between those emergency services that do not have direct communications or as a replacement communications in situations where "normal" communications may fail. Much of this equipment is mobile or portable and can easily be relocated to an onsite command post.
2.2.2 City and Town

The City of Evansville and the Town of Darmstadt participated in the planning development process. The amount of information regarding mitigation capabilities of these participating jurisdictions varies, but each support the mitigation goals of the planning area overall. A description of each are provided below and in Table 2.14 at the end of this section summarizes the mitigation related capabilities of these jurisdictions.

City of Evansville

Overview

The City of Evansville is located along a bend of the Ohio River and is often referred to as “River City”. It is the largest city in southern Indiana and the 3rd largest in the State. It is a regional metropolitan area for the Illinois-Indiana-Kentucky Tri-State Area.

The City is governed by a Mayor and a nine-member City Council. There are also multiple boards, commissions and committees that allow for public input and participation for the different City agencies and services. Those City services are currently staffed and managed by the following 34 offices and departments:

Administrative Services  Evansville Water & Sewer Utilities
Animal Control*  Fire Department
Area Planning Commission*  GIS
Building Commission*  Human Relations Comm
City Cemeteries  Joint Dispatch Center*
City Clerk’s Office  Legal Aid Society*
City-County Consolidation  Levee Authority
Computer Services*  Mesker Park Zoo & Botanic Garden
Controller’s Office  Police Department
Department of Metropolitan Development  Parks & Recreation
Emergency Management Agency*  Purchasing*
Evansville Metropolitan Planning Organization  Solid Waste*
Engineering  Street Maintenance
Department of Sustainability, Energy & Environmental Quality  Traffic Engineering*
Environmental Protection Agency  Transportation & Services
Evansville Transit  Urban Forestry

Weights and Measures*

The departments with an * are joint city/county offices or joint county/city offices.
Land Use and Development Trends

Development trends since the 2011 Multi-Hazard Mitigation Plan are presented in Section 2.2.1.

The 2015-2035 Comprehensive Plan of Evansville and Vanderburgh County, details the goals, objectives, and policies for land use in the planning area. In Figure 2.5 below, it shows the City of Evansville land use and residential is the largest with 41.7 percent, followed by commercial with 14.0 percent, government with 6.4 percent, parks & recreation with 10.8 percent.

In the future, the County projects to gain 10,989 additional units on 6.9 square miles of land by 2035.

The largest area expected primarily for commercial development is the eastside area bounded by Morgan Avenue, I-64, Lloyd Expressway and the Burkhardt Road corridor. Then for industrial use, the Plan projects the long-planned U.S. 41 North corridor between I-64 and Baseline Road as the primary area for industrial growth. A new secondary corridor for industrial development has been added along/between SR 57 and I-164 extending south from the northern County Line to nearly Boonville-New Harmony Road. Another smaller area designated for future industrial is the southeast quadrant of the I-164 and Lynch Road interchange.

![Figure 2.5 City of Evansville Land Use, 2015](image)

Source: 2015-2035 Comprehensive Plan of Evansville, Darmstadt, and Vanderburgh County

Technical and Fiscal Resources

The City of Evansville has staff resources in planning, engineering, and floodplain management. The Evansville-Vanderburgh County Area Plan Commission is designated to carry out land use planning within these jurisdictions. This board also makes decision on zonings and subdivisions, updates the City/County Comprehensive Plan, and enforces zoning and subdivision ordinances.

Evansville-Vanderburgh County has a joint city-county office for emergency management services and a Joint Dispatch Center that handles all 911 calls. Table 2.10 outlines the City’s personnel resources in 2016.
Table 2.10  Evansville’s Administrative and Technical Resources

<table>
<thead>
<tr>
<th>Personnel Resources</th>
<th>Yes/No</th>
<th>Department/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planner/Engineer with knowledge of land development/land management practices</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
</tr>
<tr>
<td>Engineer/Professional trained in construction practices related to buildings and/or infrastructure</td>
<td>YES</td>
<td>Area Plan Commission &amp; Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Planner/Engineer/Scientist with an understanding of natural hazards</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
</tr>
<tr>
<td>Personnel skilled in GIS</td>
<td>YES</td>
<td>GIS Department</td>
</tr>
<tr>
<td>Full time building official</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Floodplain Manager</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Emergency Manager</td>
<td>YES</td>
<td>EMA (Joint City/County)</td>
</tr>
<tr>
<td>Grant writer</td>
<td>YES</td>
<td>City Controller</td>
</tr>
</tbody>
</table>

Financial tools or resources that the city could potentially use to help fund mitigation activities include the following:

- Community Development Block Grants
- Capital improvements project funding
- Authority to levy taxes for specific purposes
- Fees for water, sewer, gas, or electric services
- Impact fees for new development

Existing Plans and Policies

Evansville has adopted a comprehensive plan, zoning ordinance, and subdivision ordinance that are available to the public on the internet. The building code that the Evansville adheres to is the Indiana Building Code. The Emergency Operations Plan is administered by the Evansville-Vanderburgh County Emergency Management Agency.

The City joined the regular phase of the National Flood Insurance Program on October 15, 1981 and also participant in the Community Rating System as a Class 8 community. They maintain elevation certificates on properties in the floodplain. Table 2.11 below details regulatory tools for the City of Evansville.
Table 2.11  City of Evansville Regulatory Tools

<table>
<thead>
<tr>
<th>Regulatory Tool (ordinances, codes, plans)</th>
<th>Y/N</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Plan</td>
<td>YES</td>
<td>2015-2035 Comprehensive Plan of Evansville and Vanderburgh</td>
</tr>
<tr>
<td>Zoning ordinance</td>
<td>YES</td>
<td>City and County Ordinances/Area Planning Commission (joint City/County)</td>
</tr>
<tr>
<td>Subdivision ordinance</td>
<td>YES</td>
<td>Area Planning Commission (Joint City/County)</td>
</tr>
<tr>
<td>Growth management ordinance</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Floodplain ordinance</td>
<td>YES</td>
<td>Building Commission/Floodplain Management (Joint City/County)</td>
</tr>
<tr>
<td>Other special purpose ordinance (steep slope, wildfire)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Building code</td>
<td>YES</td>
<td>Indiana Building Code</td>
</tr>
<tr>
<td>BCEGS Rating</td>
<td>YES</td>
<td>9-Commercial and 9-Residential</td>
</tr>
<tr>
<td>Erosion or sediment control ordinance</td>
<td>YES</td>
<td>City Engineer</td>
</tr>
<tr>
<td>Stormwater management ordinance</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Site plan review requirements</td>
<td>YES</td>
<td>Combined City and County departments</td>
</tr>
<tr>
<td>Capital improvements plan</td>
<td>YES</td>
<td>City Controller</td>
</tr>
<tr>
<td>Economic development plan</td>
<td>YES</td>
<td>Department of Metropolitan Development</td>
</tr>
<tr>
<td>Local emergency operations plan</td>
<td>YES</td>
<td>Vanderburgh County EMA Plan</td>
</tr>
<tr>
<td>Other special plans (i.e. flood mitigation plan)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flood insurance study or other engineering study for streams</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
</tr>
<tr>
<td>Elevation certificates</td>
<td>YES</td>
<td>Building Commission/Floodplain Management (Joint City/County)</td>
</tr>
</tbody>
</table>

Other Mitigation Activities

The City’s Department of Sustainability, Energy, and Environmental Quality has a sustainable Evansville eNewsletter about local projects and goings-on pertaining to sustainability, energy, and the environment.
**Town of Darmstadt**

**Overview**

Darmstadt is located in the northern portion of the County and has a population of 1,471 in 2011-2015 American Community Survey 5 Year Estimates. In 2011-2015, for the employed population 16 years and older, the leading industries in Darmstadt town were educational services, and health care, and social assistance, 26.3 percent, and Manufacturing, 12.5 percent.

**Land Use and Development Trends**

The 2015-2035 Comprehensive Plan of Evansville and Vanderburgh County, details the goals, objectives, and policies for land use in the planning area. It also includes the Town of Darmstadt.

Development trends since the 2011 Multi-Hazard Mitigation Plan are presented in Section 2.2.1.

**Technical and Fiscal Resources**

The Town of Darmstadt is included with the Evansville-Vanderburgh County Area Plan Commission that is designated to carry out land use planning for all three jurisdictions. This board also makes decision on zonings and subdivisions within these jurisdictions, updates the City/County Comprehensive Plan, and enforcement of zoning and subdivision ordinances. Evansville-Vanderburgh County has a joint city-county office for emergency management services and a Joint Dispatch Center that handles all 911 calls. Table 2.12 outlines the Town’s personnel resources in 2011.

<table>
<thead>
<tr>
<th>Personnel Resources</th>
<th>Yes/No</th>
<th>Department/Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planner/Engineer with knowledge of land development/land</td>
<td>YES</td>
<td>Area Plan Commission</td>
</tr>
<tr>
<td>management practices</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Engineer/Professional trained in construction practices</td>
<td>YES</td>
<td>Area Plan Commission</td>
</tr>
<tr>
<td>buildings and/or infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Planner/Engineer/Scientist with an understanding of natural hazards</td>
<td>YES</td>
<td>Area Plan Commission</td>
</tr>
<tr>
<td>Personnel skilled in GIS</td>
<td>YES</td>
<td>County services</td>
</tr>
<tr>
<td>Full time building official</td>
<td>YES</td>
<td>County services</td>
</tr>
<tr>
<td>Floodplain Manager</td>
<td>YES</td>
<td>County services</td>
</tr>
<tr>
<td>Emergency Manager</td>
<td>YES</td>
<td>County/City EMA</td>
</tr>
</tbody>
</table>
Financial tools or resources that the city could potentially use to help fund mitigation activities include the following:

- Community Development Block Grants

**Existing Plans and Policies**

The City does not participate in the National Flood Insurance Program and were sanctioned in February 1981.
2.2.3 Evansville Vanderburgh School Corporation

The Evansville Vanderburgh School Corporation (EVSC) provides educational services to 23,000 students and employees 3,000+ personnel. The school corporation has the following building assets:

Table 2.13 Evansville Vanderburgh School Corporation Buildings

<table>
<thead>
<tr>
<th>Type of Building</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>High School</td>
<td>5</td>
</tr>
<tr>
<td>Middle School</td>
<td>7</td>
</tr>
<tr>
<td>Elementary Schools</td>
<td>17</td>
</tr>
<tr>
<td>K-8 Schools</td>
<td>4</td>
</tr>
<tr>
<td>Early Childhood Centers</td>
<td>2</td>
</tr>
<tr>
<td>Charter Schools</td>
<td>2</td>
</tr>
<tr>
<td>Alternative School</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: www.evscschools.com

Technical and Fiscal Resources

The school’s Principals serve as building officials for the school buildings. EVSC has access to the following identified financial resources for hazard mitigation efforts:

- Capital improvements project funding
- Local Funds
- General obligation bonds
- Special tax bonds
- Private activities/donations
- State and federal funds

Existing Plans and Policies

The EVSC has Bylaws and Policies in place to govern the Corporation. It also has a Strategic Building Plan that describes their plans for updating and remodeling the school buildings.

Other Mitigation Activities

The school district conducts fire evacuation and tornado sheltering exercises as required by the State and the school buildings are all equipped with NOAA weather radios and public-address notification systems.
2.3 Capabilities Summary

Table 2.14 summarizes the existing regulatory tools and planning mechanisms for Vanderburgh County and the participating jurisdictions. These plans, codes, and ordinances form a framework that supports this hazard mitigation plan. It is expected that future updates of these planning mechanisms will acknowledge, integrate, and implement this hazard mitigation plan, as necessary and appropriate.

Table 2.14  Vanderburgh County—Summary of Mitigation-Related Plans and Policies

<table>
<thead>
<tr>
<th>Capability</th>
<th>Vanderburgh County</th>
<th>Evansville</th>
<th>Darmstadt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive Plan</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Emergency Operations Plan</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Economic Development Plan</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Capital Improvements Plan</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Building Code</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stormwater Management Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Stream Management Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Zoning Management Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Subdivision Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Erosion Management Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Floodplain Management Ordinance</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Elevation Certificates Maintained</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>National Flood Insurance Program Community</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>National Flood Insurance Join Date</td>
<td>2/1/1980</td>
<td>10/15/1981</td>
<td>n/a</td>
</tr>
<tr>
<td>NFIP Community Number</td>
<td>180256</td>
<td>180257</td>
<td>n/a</td>
</tr>
<tr>
<td>NFIP Community Rating System Number</td>
<td>8</td>
<td>8</td>
<td>n/a</td>
</tr>
</tbody>
</table>
3 RISK ASSESSMENT

44 CFR Requirement §201.6(c)(2): [The plan shall include] A risk assessment that provides the factual basis for activities proposed in the strategy to reduce losses from identified hazards. Local risk assessments must provide sufficient information to enable the jurisdiction to identify and prioritize appropriate mitigation actions to reduce losses from identified hazards.

The risk assessment process identifies and profiles relevant hazards and assesses the exposure of lives, property, and infrastructure to these hazards. The goal of the risk assessment is to estimate the potential loss in Vanderburgh County, including loss of life, personal injury, property damage, and economic loss, from a hazard event. The risk assessment process allows communities in Vanderburgh County to better understand their potential risk to natural hazards and provides a framework for developing and prioritizing mitigation actions to reduce risk from future hazard events.

A Multi-Hazard Mitigation Plan was completed for Vanderburgh County in September 2004. Therefore, this risk assessment is an update to the risk assessment previously prepared. There are, however, several improvements:

1) Hazards to include were evaluated and refined;
2) HAZUS-MH MR5 and parcel data provided by the HMPC was utilized to determine assets at risk; and
3) HAZUS-MH MR5 results assessed vulnerability and loss estimates for earthquake, flooding, and levee failure.

The risk assessment for Vanderburgh County and its jurisdictions followed the methodology described in the FEMA publication 386-2, Understanding Your Risks: Identifying Hazards and Estimating Losses (2002), which includes a four-step process:

- Identify Hazards
- Profile Hazard Events
- Inventory Assets
- Estimate Losses

This chapter is divided into four parts: hazard identification, hazard profiles, vulnerability assessment, and Summary of Key Issues.

- **Section 3.1 Hazard Identification** identifies the hazards that threaten the planning area and describes why some hazards have been omitted from further consideration.
- **Section 3.2 Hazard Profiles** discusses the threat to the planning area and describes previous occurrences of hazard events and the probability of future occurrence.
• **Section 3.3 Vulnerability Assessment** assesses the County’s total exposure to natural hazards, considering critical facilities and other community assets at risk, and assessing growth and development trends. Hazards that vary geographically across the planning area are addressed in greater detail. This section includes steps 3 and 4 from above.

• **Section 3.4 Summary of Key Issues** provides a summary of the key issues or problems identified in the Risk Assessment.

### 3.1 Hazard Identification

**Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the type...of all natural hazards that can affect the jurisdiction.**

#### 3.1.1 Disaster Declaration History

One method used by the HMPC to identify hazards was to examine events that triggered federal and/or state disaster declarations. Federal and/or state declarations may be granted when the severity and magnitude of an event surpasses the ability of the local government to respond and recover. Disaster assistance is supplemental and sequential. When the local government’s capacity has been surpassed, a state disaster declaration may be issued, allowing for the provision of state assistance. Should the disaster be so severe that both the local and state governments’ capacities are exceeded; a federal emergency or disaster declaration may be issued allowing for the provision of federal assistance.

The federal government may issue a disaster declaration through FEMA, the U.S. Department of Agriculture (USDA), and/or the Small Business Administration. FEMA also issues emergency declarations, which are more limited in scope and do not include the long-term federal recovery programs of major disaster declarations. Determinations for declaration type are based on scale and type of damages and institutions or industrial sectors affected.

Table 3.1 lists federal disaster declarations through FEMA received by Vanderburgh County. Each of the disaster events affected multiple counties; estimated damages reflect total losses to all counties.
<table>
<thead>
<tr>
<th>DR #*</th>
<th>Declaration Date</th>
<th>Disaster Description</th>
<th>Counties Included for Public Assistance</th>
<th>Counties Included for Individual Assistance</th>
<th>Public Assistance ($)</th>
<th>Individual Assistance ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4173</td>
<td>4/22/2014 (1/5-9/2014)</td>
<td>Severe Winter Storm and Snowstorm</td>
<td>Allen, Benton, Blackford, Boone, Carroll, Cass, Clay, Clinton, DeKalb, Delaware Elkhart, Fountain, Fulton, Grant, Hamilton, Hancock, Hendricks, Henry, Howard, Huntington, Jasper, Jay, Johnson, Kosciusko, LaGrange, Lake, LaPorte, Madison, Marion, Miami, Montgomery, Morgan, Newton, Noble, Owen, Parke, Putnam, Rush, Shelby, Sullivan, Tipton, Vanderburgh, Vermillion, Vigo, Wabash, Warren, Wells, White, Whitley</td>
<td>None</td>
<td>80,504.30 (Vanderburgh County)</td>
<td>N/A</td>
</tr>
<tr>
<td>1828</td>
<td>3/5/2009 (1/26-28/2009)</td>
<td>Severe Winter Storm</td>
<td>Clark, Crawford, Dubois, Floyd, Gibson, Harrison, Jackson, Jefferson, Jennings, Lawrence, Ohio, Orange, Perry, Posey, Ripley, Scott, Spencer, Switzerland, Vanderburgh, Warrick, and Washington</td>
<td>None</td>
<td>$11,643,357</td>
<td>None</td>
</tr>
<tr>
<td>DR #</td>
<td>Declaration Date</td>
<td>Disaster Description</td>
<td>Counties Included for Public Assistance</td>
<td>Counties Included for Individual Assistance</td>
<td>Public Assistance ($)</td>
<td>Individual Assistance ($)</td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td>----------------------</td>
<td>----------------------------------------</td>
<td>------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>1795</td>
<td>9/23/2008 (9/12-10/6/2008)</td>
<td>Severe Storms and Flooding (primary impact to Vanderburgh County was severe storms)</td>
<td>Clark, Crawford, Daviess, Dearborn, Decatur, Dubois, Fayette, Floyd, Franklin, Gibson, Harrison, Jackson, Jefferson, Jennings, La Porte, Lake, Lawrence, Martin, Newton, Ohio, Orange, Perry, Pike, Porter, Ripley, Vanderburgh, Scott, Spencer, Switzerland, Union, Vanderburgh, Warrick, Washington, and Wayne.</td>
<td>Clark, Crawford, Dearborn, Floyd, Franklin, Gibson, Harrison, Jackson, Jasper, Jefferson, Jennings, Knox, La Porte, Lake, Lawrence, Martin, Ohio, Orange, Perry, Pike, Porter, Posey, Ripley, Saint Joseph, Scott, Spencer, Switzerland, Vanderburgh, Warrick, and Washington.</td>
<td>$24,555,126</td>
<td>$36,964,929</td>
</tr>
<tr>
<td>1662</td>
<td>10/6/2006 (9/12-9/14/2006)</td>
<td>Severe Storms and Flooding</td>
<td>None</td>
<td>Lake, Vanderburgh, and Warrick.</td>
<td>None</td>
<td>$12,105,107</td>
</tr>
<tr>
<td>DR #*</td>
<td>Declaration Date</td>
<td>Disaster Description</td>
<td>Counties Included for Public Assistance</td>
<td>Counties Included for Individual Assistance</td>
<td>Public Assistance ($)</td>
<td>Individual Assistance ($)</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>----------------------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------</td>
<td>-----------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>DR #*</td>
<td>Declaration Date</td>
<td>Disaster Description</td>
<td>Counties Included for Public Assistance</td>
<td>Counties Included for Individual Assistance</td>
<td>Public Assistance ($)</td>
<td>Individual Assistance ($)</td>
</tr>
<tr>
<td>-------</td>
<td>------------------</td>
<td>----------------------</td>
<td>------------------------------------------</td>
<td>-------------------------------------------</td>
<td>-----------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>DR #*</td>
<td>Declaration Date</td>
<td>Disaster Description</td>
<td>Counties Included for Public Assistance</td>
<td>Counties Included for Individual Assistance</td>
<td>Public Assistance ($)</td>
<td>Individual Assistance ($)</td>
</tr>
<tr>
<td>-------</td>
<td>-----------------</td>
<td>----------------------</td>
<td>------------------------------------------</td>
<td>---------------------------------------------</td>
<td>-----------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>EM-3197</td>
<td>1/11/2005</td>
<td>Snow</td>
<td>Bartholomew, Blackford, Brown, Clark, Crawford, Daviess, Dearborn, Decatur, Delaware, Dubois, Fayette, Floyd, Franklin, Gibson, Greene, Hamilton, Hancock, Harrison, Henry, Jackson, Jay, Jefferson, Jennings, Johnson, Knox, Lawrence, Madison, Marion, Martin, Monroe, Morgan, Ohio, Orange, Owen, Perry, Pike, Posey, Randolph, Ripley, Vanderburgh, Scott, Shelby, Spencer, Sullivan, Switzerland, Union, Vanderburgh, Warrick, Washington, and Wayne.</td>
<td>None</td>
<td>$5,819,086</td>
<td>None</td>
</tr>
</tbody>
</table>

Emergency Declarations

Source: Federal Emergency Management Agency, www.fema.gov; *DR # = Disaster Number; Note: Incident dates are in parentheses.
It is also important to note that the federal government may issue a disaster declaration through the U.S. Department of Agriculture and/or the Small Business Administration, as well as through FEMA. The quantity and types of damage are the factors that determine whether such declarations are issued.

The U.S. Department of Agriculture (USDA) provides assistance to farmers and other rural residents, as the result of natural disasters. Agricultural-related disasters are quite common. One-half to two-thirds of the counties in the United States have been designated as disaster areas in each of the past several years. Agricultural producers may apply for low-interest emergency loans in counties named as primary or contiguous in a disaster designation.

USDA Secretarial disaster designations must be requested of the Secretary of Agriculture by a governor or the governor’s authorized representative, or by an Indian Tribal Council leader. From 2005-2012, Vanderburgh County has had four primary and nine contiguous USDA Secretarial disaster designations as summarized in Table 3.2.

**Table 3.2 USDA Disaster Declarations in Vanderburgh County 2005-2012**

<table>
<thead>
<tr>
<th>Designation Number</th>
<th>Description</th>
<th>Primary or Contiguous Designation</th>
<th>Start Date</th>
<th>End Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>S3864</td>
<td>Excess Rain/Flood</td>
<td>Contiguous</td>
<td>5/1/2015</td>
<td>4/12/2016</td>
</tr>
<tr>
<td>S3277</td>
<td>Drought</td>
<td>Contiguous</td>
<td>6/19/2012</td>
<td>Continuing</td>
</tr>
<tr>
<td>S3275</td>
<td>Drought</td>
<td>Primary</td>
<td>6/19/2012</td>
<td>Continuing</td>
</tr>
<tr>
<td>S3380</td>
<td>Combined effects of Excessive Heat, Frost, freeze and Drought</td>
<td>Primary</td>
<td>2/1/2012</td>
<td>Continuing</td>
</tr>
<tr>
<td>S3229</td>
<td>Severe Storms, excessive rainfall, and severe flooding</td>
<td>Contiguous</td>
<td>4/17/2011</td>
<td>Continuing</td>
</tr>
<tr>
<td>S3087</td>
<td>Drought</td>
<td>Primary</td>
<td>08/01/2010</td>
<td>12/31/2010</td>
</tr>
<tr>
<td>S3045</td>
<td>Drought</td>
<td>Contiguous</td>
<td>08/01/2010</td>
<td>Continuing</td>
</tr>
<tr>
<td>S2657</td>
<td>Drought</td>
<td>Primary</td>
<td>06/05/2007</td>
<td>11/07/2007</td>
</tr>
<tr>
<td>S2594</td>
<td>Drought</td>
<td>Contiguous</td>
<td>02/01/2007</td>
<td>01/31/2008</td>
</tr>
<tr>
<td>S2522</td>
<td>Below Normal Temperature, Winter Storm</td>
<td>Contiguous</td>
<td>04/05/2007</td>
<td>04/10/2007</td>
</tr>
<tr>
<td>S2221</td>
<td>Drought</td>
<td>Contiguous</td>
<td>05/01/2005</td>
<td>08/31/2005</td>
</tr>
</tbody>
</table>

The Small Business Administration provides disaster assistance to families and businesses through their Disaster Assistance Program. The mission of this program is to offer financial assistance to those who are trying to rebuild their homes and businesses in the aftermath of a disaster. By offering low-interest loans, the SBA is committed to long-term recovery efforts. SBA is also committed to mitigation, and has additional loan programs to help reduce future losses.

An SBA declaration may be requested by State Governor. When the Governor’s request for assistance is received, a survey of the damaged area(s) is conducted with State and local officials, and the results are submitted to the Administrator for a decision. When the Administrator of SBA declares an area, both primary and adjacent counties are eligible for the same assistance.

SBA Declarations Including Vanderburgh County:

- May 1, 2015 and Continuing-Indiana Declaration 14426- Indiana counties were eligible for Economic Injury Disaster Loans from the Small Business Administration due to the loss in Excessive Rain and Flooding.
- July 31, 2012-Indiana Declaration 13217 and 13218- For Gibson County with the Contiguous counties that included Vanderburgh were eligible for Home Disaster, Business Physical Disaster, and Economic Injury Disaster loans from the Small Business Administration due to loss in Severe Storms, High Winds, and Large Hail.
- June 19, 2012-Continuing- Kentucky Declaration 13127(S3277) - Indiana Contiguous Counties were eligible for Economic Injury Disaster Loans from the Small Business Administration due to loss in Drought.
- June 19, 2012 and Continuing Indiana Declaration 13125 (S3275) - Indiana counties were eligible for Economic Injury Disaster loans from Small Business Administration due to Drought.
- February 29, 2012-March 3,2012- Indiana Declaration 13035 and 13036- Indiana Counties were eligible for Home Disaster, Business Physical Disaster and Economic Injury Disaster loans from Small Business Administration due to Severe Storms, Straight-Line Winds and Tornadoes.
- February 1, 2011-Continuing- Indiana Declaration 13280(S3380) - Indiana counties were available for Economic Injury Disaster Loans from the Small Business Administration due to the Combined effects of Excessive Heat, Frost, Freeze and Drought.
- July 1, 2011-October 18, 2011-Indiana Declaration 13009(S3230)-Indiana Counties were eligible for Small Business Administration for Economic Injury Disaster loans due to the loss in Drought and Excessive Heat.
- April 19,2011-June 6,2011-Indiana Declaration 12813 and 12814-Indiana counties were eligible for Small Business Administration Loans for loss due to Severe Storms, Hail, Tornadoes, and Flooding. Loans that were available were Home Disaster, Business Physical Disaster, and Economic Injury Disaster.
- April 12, 2011-May20, 2011-Kentucky Declaration 12599 and 12600- Indiana Contiguous counties included Vanderburgh was eligible for loans from Small Business Administration
due to loss in Severe Storms, Tornadoes, and Flooding. Loans that were available were Home Disaster, Business Physical Disaster, and Economic Injury Disaster.

- April 7, 2011- and continuing (The Commonwealth of Kentucky) Declaration 12623(S3119) - Indiana Contiguous Counties included Vanderburgh was eligible for loans from Small Business Administration due to the loss in Severe Storms, Excessive Rainfall and Severe Flooding. These loans are under the Economic Injury Disaster loans.
- August 1, 2010-December 31, 2010— Small businesses were eligible for federal disaster loans from the Small Business Administration for financial loss due to drought from August 1, 2010 through the end of the year. The declaration made small businesses, small agricultural cooperatives, and nurseries eligible for loans through the Economic Injury Disaster Loan program.
- June 1, 2008-January 8, 2009—Small businesses in Indiana are eligible for federal disaster loans from the Small Business Administration for financial loss due to drought and strong winds since June 1, 2008
- June 5, 2007-January 31, 2008—Small businesses in 84 Indiana counties are eligible for federal disaster loans from the Small Business Administration for losses in revenue due to drought from June 5, 2007 through November 7, 2007

3.1.2 Research Additional Sources

Additional data on the past impacts of hazards in the planning area was collected from the following sources:

- Indiana State Hazard Mitigation Plan (2014)
- Evansville-Vanderburgh County Community Comprehensive Hazard Analysis (2010)
- Evansville-Vanderburgh County Stormwater Master Plan
- National Weather Service Weather Forecast Office, Paducah, Kentucky
- Vanderburgh County Flood Insurance Study (March 17, 2011)
- Information on past hazard events from the Spatial Hazard Event and Loss Database (SHELDUS), a component of the University of South Carolina Hazards Research Lab that compiles county-level hazard data for 18 different natural hazard event types
- Information on past extreme weather and climate events from the National Oceanic and Atmospheric Administration’s (NOAA) National Climatic Data Center
- Disaster declaration history from the Federal Emergency Management Agency (FEMA), the Public Entity Risk Institute, and the USDA Farm Service Agency Disaster Declarations
- The National Drought Mitigation Center Drought Reporter
- Information provided by members of the Hazard Mitigation Planning Committee
- Various articles and publications available on the internet
  (sources are indicated where data is cited)
3.1.3 Review of Existing Mitigation Plans

The Hazard Mitigation Planning Committee (HMPC) reviewed data and discussed the impacts of each of the hazards included in the 2011 Vanderburgh County Hazard Mitigation Plan, as well as the State of Indiana Hazard Mitigation Plan. Table 3.3 below provides a comparison of the hazards included in these two plans:

<table>
<thead>
<tr>
<th>Vanderburgh County Hazard Mitigation Plan</th>
<th>2014 State of Indiana Hazard Mitigation Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought / Wildfires</td>
<td>Mutual</td>
</tr>
<tr>
<td>Earthquake / Liquefaction and Ground Motion Amplification</td>
<td>Mutual</td>
</tr>
<tr>
<td>Extreme Temperatures</td>
<td>Mutual</td>
</tr>
<tr>
<td>Flood / Dam and Levee Failure</td>
<td>Mutual</td>
</tr>
<tr>
<td>Infestations</td>
<td>Disease Outbreak</td>
</tr>
<tr>
<td>Mine Subsidence</td>
<td>Ground Failure</td>
</tr>
<tr>
<td>Severe Weather</td>
<td>Equal to or Exceeds the State</td>
</tr>
<tr>
<td>- Extreme Temperatures</td>
<td>Mutual</td>
</tr>
<tr>
<td>- Thunderstorms / High Winds</td>
<td>Mutual</td>
</tr>
<tr>
<td>- Tornadoes</td>
<td>Mutual</td>
</tr>
<tr>
<td>Winter Storms</td>
<td>Equal to or Exceeds the State</td>
</tr>
</tbody>
</table>

3.1.4 Hazards Identified

After a careful review of the previous disaster declarations, the State of Indiana Hazard Mitigation Plan, and additional sources, the HMPC determined that they would make the following modifications to the hazards included in the 2011 plan:

- Wildfires would be addressed separately from drought;
- Dam and Levee Failure will be analyzed separate from flood and separate from each other;
- Infestations will include the Emerald Ash Borer; and
- Manmade Hazards will continue to not be profiled in this plan as they are addressed in the Comprehensive Emergency Management Plan.

Therefore, the HMPC identified 13 natural hazards that significantly affect the planning area. These hazards are listed below with an “X” indicating the affected jurisdictions in Table 3.4. Each of these hazards is profiled in further detail in the next section.
### Table 3.4 Hazards Identified for Each Participating Jurisdiction

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Vanderburgh County</th>
<th>Darmstadt</th>
<th>Evansville</th>
<th>Evansville-Vanderburgh School Corporation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- Wildfires</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Earthquake</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Flood</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>- Dam Failure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>- Levee Failure</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Infestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- West Nile</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- Emerald Ash Borer</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Mine Subsidence</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Severe Weather</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Extreme Temperatures</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- Thunderstorms/High Winds</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- Tornadoes</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- Winter Storms</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

### Multi-Jurisdictional Risk Assessment

For this multi-jurisdictional plan, the risk assessment assesses each jurisdiction’s risks where they deviate from the risks facing the entire planning area. Vanderburgh County is 235.74 square miles and is fairly uniform in terms of climate and topography as well as construction characteristics and development trends. Accordingly, overall risk to hazards does not vary greatly across the planning area for hazards that do not have geographically-specific hazard boundaries. Weather-related hazards, such as drought, extreme temperature, thunderstorms/high winds, tornadoes, and winter storms, affect the entire planning area. In addition, Emerald Ash Borer has the potential to affect the entire planning area.

The hazards that do have specific geographic risk areas and the potential to vary across the planning area include: dam failure, earthquake, flood, levee failure, mine subsidence, and wildfires. In Section 3.2, Hazard Profiles, the Geographic Location section discusses how the hazard varies among jurisdictions across the planning area. The Previous Occurrences section lists the best available data on where past events have occurred and the associated losses to particular jurisdictions. Section 3.3.2, Community Asset Inventory, describes critical facilities and other community assets by jurisdiction. Section 3.3.3, Vulnerability by Hazard, identifies structures and estimates potential losses by jurisdiction where data is available and hazard areas are identified for hazards of moderate and high planning significance.
The previous chapter, Chapter 2 Planning Area Profile and Capabilities, discussed the existing mitigation capabilities of each jurisdiction, such as plans and policies, personnel, and financial resources, which are or could be used to implement measures to reduce hazard losses.

3.2 Hazard Profiles

Requirement §201.6(c)(2)(i): [The risk assessment shall include a] description of the...location and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Methodology

Each hazard identified in Section 3.1 Hazard Identification is profiled individually in this section. The level of information presented in the profiles varies by hazard based on the information available. With each update of this plan, new information will be incorporated to provide for better evaluation and prioritization of the hazards that affect Vanderburgh County.

The sources used to collect information for these profiles include those mentioned in Section 3.1.1 as well as those cited individually in each hazard section.

Detailed profiles for each of the identified hazards include information categorized as follows:

Hazard Description

This section consists of a general description of the hazard and the types of impacts it may have on a community.

Geographic Location

This section describes the geographic extent or location of the hazard in the planning area. Where available, maps are utilized to indicate the areas of the planning area that are vulnerable to the subject hazard. The geographic location was assigned a rank as defined in the following manner:

- **Extensive**—50-100 percent of planning area affected.
- **Significant**—10-50 percent of planning area affected.
- **Limited**—less than 10 percent of planning area affected.

Previous Occurrences

This section includes information on historic incidents and their impacts based upon the sources described in Section 3.1 Hazard Identification and the information provided by the Hazard Mitigation Planning Committee.
Probability of Future Occurrence

The frequency of past events is used to gauge the likelihood of future occurrences. Where possible, the probability or chance of occurrence was calculated based on historical data. Probability was determined by dividing the number of events observed by the number of years and multiplying by 100. This gives the percent chance of the event happening in any given year. An example would be three droughts occurring over a 30-year period, which suggests a 10 percent chance of a drought occurring in any given year. The probability was assigned a rank as defined in the following manner:

- **Highly Likely**—Near 100 percent chance of occurrence next year or happens every year.
- **Likely**—10-100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.
- **Occasional**—1-10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years.
- **Unlikely**—Less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

The magnitude of the impact of a hazard event (past and perceived) is related directly to the vulnerability of the people, property, and the environment it affects. This is a function of when the event occurs, the location affected the resilience of the community, and the effectiveness of the emergency response and disaster recovery efforts.

The magnitude of each profiled hazard is classified in the following manner:

- **Catastrophic**—Multiple deaths; property destroyed and severely damaged; and/or interruption of essential facilities and service for more than 72 hours.
- **Critical**—Isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours.
- **Limited**—Minor injuries and illnesses; minimal property damage that does not threaten structural stability; and/or interruption of essential facilities and services for less than 24 hours.
- **Negligible**—No or few injuries or illnesses; minor quality of life loss; little or no property damage; and/or brief interruption of essential facilities and services.
### 3.2.1 Drought

#### Description

A drought is a period of drier-than-normal conditions that result in water-related problems. Precipitation (rain or snow) falls in uneven patterns across the country. The amount of precipitation at a particular location varies from year to year but, over a period of years, the average amount is fairly constant. The average monthly precipitation for Evansville, Vanderburgh County, is presented in Tables 3.5a and 3.5b below.

<table>
<thead>
<tr>
<th>Station</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville Museum</td>
<td>3.14</td>
<td>3.27</td>
<td>4.50</td>
<td>4.54</td>
<td>4.78</td>
<td>4.21</td>
<td>4.11</td>
<td>3.10</td>
<td>3.17</td>
<td>2.96</td>
<td>4.30</td>
<td>3.68</td>
<td>45.76</td>
</tr>
<tr>
<td>Evansville Regional</td>
<td>2.91</td>
<td>3.10</td>
<td>4.29</td>
<td>4.48</td>
<td>5.01</td>
<td>4.10</td>
<td>3.75</td>
<td>3.14</td>
<td>2.99</td>
<td>2.78</td>
<td>4.18</td>
<td>3.54</td>
<td>44.27</td>
</tr>
</tbody>
</table>


The table below shows the average precipitation from 2011-2016.

<table>
<thead>
<tr>
<th>Station</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>EVV</td>
<td>4.93</td>
<td>3.21</td>
<td>4.71</td>
<td>4.94</td>
<td>5.02</td>
<td>3.87</td>
<td>4.83</td>
<td>3.08</td>
<td>3.55</td>
<td>3.7</td>
<td>4.19</td>
<td>4.29</td>
<td>50.32</td>
</tr>
</tbody>
</table>

Source: 2011-2016 Precipitation Summary; Information was gathered from gis.ncdc.noaa.gov/maps/ncei/summaries/monthly.

When no rain or only a very small amount of rain falls, soils can dry out and plants can die. When rainfall is less than normal for several weeks, months or years, the flow of streams and rivers declines and the water levels in lakes reservoirs and wells fall. If dry weather persists and water-supply problems develop, the dry period can become a drought. Lower river levels can also cause transportation interruptions on navigable streams.

The beginning of a drought is difficult to determine. Several weeks, months, or even years may pass before people recognize that a drought is occurring. The end of a drought can occur as gradually as it began. Dry periods can last for 10 years or more. The first evidence of drought usually is seen in records of rainfall. Within a short period of time, the amount of moisture in soils can begin to decrease. The effects of a drought on flow in streams and rivers or on water levels in lakes and reservoirs may not be noticed for several weeks or months. Water levels in wells may not reflect a shortage of rainfall for a year or more after a drought begins.

In 1994, the Indiana Department and Natural Resources prepared Indiana's Water Shortage Plan. In July 2009, this plan was revised incorporating input from a variety of stakeholders that comprise the Water Shortage Task Force. The plan includes triggers to identify the onset
of a water shortage and appropriate response actions, including water use priorities and conservation tools.

The Water Shortage Plan establishes nine “Water Shortage Identification Regions” that correspond to the nine climate divisions determined by the National Weather Service. As shown in Figure 3.1, Vanderburgh County is in Water Shortage Identification Region Seven.

Figure 3.1. Water Shortage Identification Regions

The Water Shortage Plan also establishes “Water Shortage Stages”: Normal, Watch, Warning and Emergency. These stages are based on 3 variables: (1) Standardized Precipitation Index (SPI), the U.S. Drought Monitor, and below normal percentiles of regionalized monthly average streamflow.
Standardized Precipitation Index (SPI): For the purposes of Indiana’s Water Shortage Plan, a monthly SPI value is computed for each of the State’s nine climatic regions. The Standardized Precipitation Index was developed in 1993 and is a simple index that is calculated for any location based on the long-term precipitation record (typically 30 years or greater). This long-term record is fitted to a probability distribution, which is then transformed into a normal distribution so that the mean SPI for the location and desired period is zero. Positive SPI values indicate greater than median precipitation (i.e. wet conditions), and negative values indicate less than median precipitation (i.e. dry conditions). Values of the SPI normally range from +2 to -2. An index of +2.0 or greater indicates extremely wet conditions; +1.99 to +1.50, very wet conditions; +1.49 to 1.00, moderately wet; +0.99 to -0.99, near normal to abnormally dry; -1.0 to -1.49, moderately dry; -1.50 to -1.99, severely dry; and -2 and less, extremely dry. Standardized Precipitation Index values for Indiana are prepared for each of the nine climatologic divisions on a monthly basis.

U.S. Drought Monitor: The U.S. Drought Monitor began in 1999 and is a synthesis of multiple climate monitoring tools as well as the informed judgments of its authors and federal, state, and academic reviewers across the country. The U.S. Drought Monitor Map is produced weekly and summarizes information onto a single, easy-to-read colored map. The Drought Monitor Map identifies general drought areas, labeling droughts by intensity, with D1 being the least intense and D4 being the most intense. The data cutoff for Drought Monitor maps is Tuesday at 7 a.m. Eastern Standard Time. The maps, which are based on analysis of the data, are released each Thursday at 8:30 a.m. Eastern Time. The map released the first Thursday of the month will be used as a drought indicator for the previous month’s water shortage stages.

Streamflow: The U.S. Geological Survey, in cooperation with the Department of Natural Resources and a number of other Federal, State and Local agencies, maintains a network of approximately 190 gaging stations in Indiana. Twenty-eight of these stations are used to monitor drought conditions. There are four stations in climate division 7 that includes Vanderburgh County. They are: Wabash River at Riverton, East Fork White River at Shoals, White River at Petersburg, and Wabash River at Mt. Carmel. Streamflow at the 25th percentile means that streamflow is only 25% of the historical average streamflow for that particular month. Lower percentiles correspond to increasingly lower streamflow and drought conditions.

The stage is defined as Normal if no more than one indicator is outside the normal range. The stages and associated criteria are provided in Table 3.6.

<table>
<thead>
<tr>
<th>Water Shortage Stages</th>
<th>1-Month Standardized Precipitation Index</th>
<th>U.S. Drought Monitor (Conditions)</th>
<th>Streamflow As Percentile of Normal (Average Streamflow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>+0.99 to -0.99</td>
<td>None to D0</td>
<td>Greater than or equal to 25</td>
</tr>
<tr>
<td>Watch</td>
<td>-1.00 to -1.49</td>
<td>D1</td>
<td>10 to 24</td>
</tr>
<tr>
<td>Warning</td>
<td>-1.50 to -1.99</td>
<td>D2</td>
<td>6 to 9</td>
</tr>
<tr>
<td>Emergency</td>
<td>-2.00 or less</td>
<td>D3 to D4</td>
<td>5 or less</td>
</tr>
</tbody>
</table>

Another common indicator of drought is the Palmer Drought Severity Index (PDSI). The PDSI is a soil moisture algorithm calibrated for relatively homogeneous regions. It is used by many U.S. government agencies and states to trigger drought relief programs. It was also the first comprehensive drought index developed in the United States. The classifications of the PDSI are presented in Table 3.7 below.

<table>
<thead>
<tr>
<th>Palmer Classifications</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>4.0 or more</td>
<td>extremely wet</td>
</tr>
<tr>
<td>3.0 to 3.99</td>
<td>very wet</td>
</tr>
<tr>
<td>2.0 to 2.99</td>
<td>moderately wet</td>
</tr>
<tr>
<td>1.0 to 1.99</td>
<td>slightly wet</td>
</tr>
<tr>
<td>0.5 to 0.99</td>
<td>incipient wet spell</td>
</tr>
<tr>
<td>0.49 to -0.49</td>
<td>near normal</td>
</tr>
<tr>
<td>-0.5 to -0.99</td>
<td>incipient dry spell</td>
</tr>
<tr>
<td>-1.0 to -1.99</td>
<td>mild drought</td>
</tr>
<tr>
<td>-2.0 to -2.99</td>
<td>moderate drought</td>
</tr>
<tr>
<td>-3.0 to -3.99</td>
<td>severe drought</td>
</tr>
<tr>
<td>-4.0 or less</td>
<td>extreme drought</td>
</tr>
</tbody>
</table>

The PDSI indicates that for the period of 1895 through 1995 the southwestern portion of Indiana was in a severe to extreme drought 10 to 15 percent of the time (Figure 3.2). During periods of drought, the Governor has called for a ban of open burning in an effort to reduce the risk of wildfire (see Wildfire). Also presented in Figure 3.2 is the current PDSI for September 2017 showing Vanderburgh County as a mid-range Palmer Classification -1.99 to 1.99.
Figure 3.2. Palmer Drought Severity Index, 1895-1995 and current October 2017

SOURCE: McKee et al. (1993); NOAA (1990); High Plains Regional Climate Center (1996)
Albers Equal Area Projection; Map prepared at the National Drought Mitigation Center
Geographic Location

Drought tends to affect broad regions and the entire planning area is subject to drought occurrence at roughly equal probability. The impacts of prolonged drought are most significant in agricultural areas of the County. According to the 2012 Census of Agriculture, 76,554 acres in Vanderburgh County are used for agricultural purpose. This translates to nearly 54% percent of all land in the county.

Additionally, drought can severely limit public water supplies due to depletion of natural water sources and greatly increased demand. Problems due to limited treatment capacity or limited distribution system capacity are an additional concern.

Therefore, the geographic location of this hazard is extensive, 50-100 percent of planning area is affected.

Previous Occurrences

Historical information on previous periods of drought and drought impacts was obtained from three primary sources, the USDA Secretarial disaster designations for drought, University of Nebraska’s National Drought Mitigation Centers Drought Impact Reporter and the National Oceanic Atmospheric Administration’s (NOAA) National Climatic Data Center (NCDC).

From January 2011 to December 2016 there were 7 events of drought in Vanderburgh County. Below was the most significant incident, in this incident the State of Indiana issued a Water Shortage Warning.

Previous drought impacts in Vanderburgh County, Indiana are summarized below:

- **June 1, 2012**—The spring drought worsened considerably across southwest Indiana as summer arrived. By the end of June, all of southwest Indiana was upgraded to extreme drought. At Evansville, only 0.15 inch of rainfall was measured in June, making it the driest June in 115 years of record-keeping. Soil moisture deficits continued to increase. By the end of June, 80 to 100 percent of the region's topsoil moisture was reported as short or very short, and 70 to 95 percent of the subsoil moisture was reported as short or very short. Many crops were showing stress. A majority of the corn and soybeans were listed in fair to poor condition. Increasing amounts of livestock and pasture were showing stress. The percentage of pastures rated as poor or very poor was growing. Ponds across the region were drying quickly. Fire danger increased to the point where bans on outdoor burning were implemented in all counties in southwest Indiana. The mayor of Evansville declared a local emergency and banned all personal fireworks in the city through the Fourth of July. Streamflows were running below normal. The State of Indiana issued a Water Shortage Warning for all of southwest Indiana. The goal of water conservation efforts during a Water Shortage Warning is a voluntary reduction in current water use of 10 to 15 percent. Public water supply systems are advised to develop and update water shortage contingency plans. The drought began in May and continued into July.

- **August 1-December 31, 2010**—The U.S. Department of Agriculture designated 52 counties in Indiana as natural disaster areas because of losses caused by drought. Vanderburgh County was included in this declaration as a primary county (S3087).
• **October 2010**—Drought conditions triggered the state's Water Shortage Plan into effect. Twenty-six counties were under a water shortage warning and Twenty-two counties, including Vanderburgh County were in a water shortage watch. In addition, 72 counties, including Vanderburgh County, were placed under outdoor burning restrictions (Drought Impact Reporter).

• **June 5, 2007- November 7, 2007**—The U.S. Department of Agriculture designated 84 counties in Indiana as natural disaster areas because of losses caused by drought. Vanderburgh County was included in this declaration as a primary county (S2675).

• **May 5, 2005-August 31, 2005**—The U.S. Department of Agriculture designated portions of the State a natural disaster area due to losses caused by drought. Vanderburgh County was included in this declaration as a contiguous county (S2221).

• **September 22, 2004**—This was the driest September on record for southwest Indiana. At Evansville, the monthly rainfall was only 0.09 inch, which broke the old September record of 0.25 inch set in 1928. This was the third driest month on record at Evansville, where records extend back to 1897. The dry weather turned lawns and fields brown. The dry weather set in too late to harm crops. In fact, the timing of the dry weather helped farmers harvest a bountiful crop (NCDC).

• **September 1, 2002**—A prolonged summer drought gradually worsened, becoming severe by early September. Many parts of southwest Indiana received little or no measurable rainfall during August. At Boonville, only 0.08 inch was measured in August. Evansville reported an August total of 0.63 inch. Rainfall was highly variable during the summer, and Evansville reported more rain than many other sites. The main effect of the drought was on agriculture. Crop loss estimates totaled around 70 million dollars. The corn crop, which was especially susceptible to the combined effects of heat and drought, took the biggest hit. About 50 million dollars in corn was lost in southwest Indiana. Another 20 million dollars was lost in soybean production. Some trees and shrubs died in the drought, especially newly planted ones with shallow root systems. However, the effect of this drought on trees, shrubs, and wildfire danger was considerably less than the drought of 1999. The remnants of Tropical Storm Isidore provided very heavy rainfall late in September. One to three inches of rain fell over most of southwest Indiana, which greatly eased the drought.

• **August 1, 2002**—Moderate drought conditions developed over southwest Indiana during August as a result of persistent dryness that began in June. At Boonville, which is about 15 miles east of Evansville, total rainfall during the month of August was 0.08 inches. Evansville reported 0.63 inches during the month, compared to a normal of 3.14 inches. This dry period came on the heels of a very wet first half of the year, when 24.90 inches fell from January through May. The main effect of the drought was on agriculture. Farmers anticipated substantial crop losses at harvest time. Heavy spring rains delayed planting of many crops until late May, which made them especially susceptible to the summer drought.

• **December 1, 1999**—Moderate drought conditions continued to plague southwest Indiana into early winter. Heavy rainfall during mid month, up to 4 inches in some places, brought significant relief. Until then, wildfire danger was especially high. The Christmas tree crop...
was damaged by the long-term drought. Most tree seedlings died, but the larger trees fared remarkably well.

- **November 1, 1999**—The unseasonably warm and dry fall allowed drought conditions to worsen. The Palmer Drought Index fell deeper into the moderate drought category during the month. Total rainfall for the month of November at Evansville was 0.51 inches, which is 3.22 inches below normal. Since the official growing season was over, crop damage was no longer a major concern. As a result of temperatures in the 70s, gusty winds, and low humidity, wildfire activity was well above normal. Upon receiving a recommendation from the governor of Indiana, most counties in Southwest Indiana banned outdoor burning. Two of the largest fires occurred in rural Warrick and Spencer Counties, east of Evansville. These fires were near Elberfeld in Warrick County and near Gentryville in Spencer County. The fire near Gentryville consumed about 100 acres and required assistance from Warrick County firefighters.

- **October 1, 1999**—The moderate to severe summer-long drought was greatly alleviated by heavy rain on October 8th and 9th, when 2 to 4 inches of rain fell during a 24-hour period. Unfortunately, no more rain occurred during the rest of October, which rekindled drought concerns. Before the heavy rain, a couple of wildland fires occurred in Spencer County during the first week of October. They were both field fires and were under control within several hours. The governor of Indiana lifted the burning ban once rainy conditions began.

- **September 1, 1999**—The moderate summer drought took a considerable toll on crops across Southwest Indiana. Rainfall at Evansville for the three-month period from July through September was about 3 inches. This compares to a 3-month average of around 10 inches. Evansville received 0.39 inches in September, which was 3 inches below normal. The soybean crop suffered the greatest effects from the drought, with average yields estimated only about 20 percent of normal. Corn yields were much closer to normal, mainly due to heavy rains in June and early July, when the corn crop matures. The fire danger reached extreme levels at times. The governor of Indiana declared a total burning ban across all of Southwest Indiana. A wildland fire in mid-September scorched several hundred acres near Chandler, which is in Warrick County. A field fire early in the month occurred near Evansville at the junction of Interstate 164 and U.S. Highway 41. Although no evacuations were required, the westbound lanes of Interstate 164 were closed briefly due to smoke. A wildfire on September 27 burned about 150 acres just west of Owensville in Gibson County. Fire departments from throughout Gibson County and parts of Posey County worked to extinguish this fire.

- **August 1, 1999**—After one of the wettest Junes on record, the rest of the summer was very dry. By the end of August, Southwest Indiana was in a moderate drought, according to the Palmer Drought Index. Total rainfall at Evansville from July 1 through the end of August was around 2.5 inches, which is less than one third of the normal rainfall. Effects on crop yields were mild. The greatest effect was on soybeans, which mature relatively late. The corn crop fared relatively well, mainly due to heavy spring rains, which allowed it to mature before the drought set in. In those areas where drinking water supplies were taken from the Ohio River, a degradation in water quality occurred. This degradation was due to nearly stagnant river flows, which contributed to algae buildups that gave the water a poor taste and appearance. The dry weather raised fire danger into the high category at
times. A number of brush and field fires occurred, including one near the junction of Interstate 64 and U.S. 41. A couple of bean and corn field fires scorched 5 to 10 acres each.

- **1999**—Palmer Index within report places Vanderburgh County in the worst drought since 1952 to 1957 episode. Bans on burning were issued in both 2002 and 1999.

- **1988**—Most of the State of Indiana was under extreme temperatures and prolonged periods of little or no rain. Several hundreds of thousands of dollars in crops and agricultural losses.

- **1986-1988**—Nationwide attention. Affecting agriculture, water supply, and electric-power generation

- **April 1962-November 1966**—Streamflow less than 7-day, 10-year value. Floods occurred in 1963 and 1964 in central and southern Indiana.

- **April 1952-March 1957**—Streamflow less than 7-day, 10-year value. Broken in northern Indiana in Oct. 1954 by floods.

- **May 1939-January 1942**—Central Indiana severely affected. Most streams had less flow than 7-day, 10-year value

- **June 1933-September 1936**—Streamflow less than 7-day, 10-year value in central and northern Indiana

- **March 1930-August 1931**—Began decade of low-flow conditions. Streamflow generally greater than 7-day, 10-year value in central and northern Indiana.

According to the USDA’s Risk Management Agency, insured crop losses in Vanderburgh County as a result of drought conditions from 2007-2016 totaled $11,957,586. As of 2016, 79 percent of insurable crop acreage was insured. Crop insurance claims as a result of drought are detailed in Table 3.8 below.

### Table 3.8 Claims Paid in Vanderburgh County for Crop Loss as a Result of Drought (2007-2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Acres</th>
<th>Claims Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>CORN</td>
<td>1,238</td>
<td>$110,511</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>5,698</td>
<td>$354,833</td>
</tr>
<tr>
<td>2008</td>
<td>CORN</td>
<td>372</td>
<td>$94,181</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>375</td>
<td>$34,672</td>
</tr>
<tr>
<td>2010</td>
<td>CORN</td>
<td>2,301</td>
<td>$259,592</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>1,584</td>
<td>$84,020</td>
</tr>
<tr>
<td>2011</td>
<td>CORN</td>
<td>1,151</td>
<td>$175,986</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>1,923</td>
<td>$247,660</td>
</tr>
<tr>
<td></td>
<td>WHEAT</td>
<td>371</td>
<td>$111,295</td>
</tr>
<tr>
<td>2012</td>
<td>CORN</td>
<td>19,537</td>
<td>$9,359,179</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>7,357</td>
<td>$1,090,510</td>
</tr>
<tr>
<td></td>
<td>WHEAT</td>
<td>14</td>
<td>$2,403</td>
</tr>
<tr>
<td>2013</td>
<td>CORN</td>
<td>74</td>
<td>$20,296</td>
</tr>
<tr>
<td></td>
<td>SOYBEANS</td>
<td>21</td>
<td>$3,776</td>
</tr>
</tbody>
</table>
Probability of Future Occurrences

Lack of precipitation for a given area is the primary contributor to drought conditions. Since precipitation levels cannot be predicted in the long term, it is difficult to determine the probability of future occurrences of drought. Figure 3.2 shows the Palmer Drought Severity Index for the U.S. in 2015, in the map following is the 1895-1995. Vanderburgh County is in a region of central Indiana that experienced severe and extreme drought 10-15 percent of the time during that 100-year period. Considering this historical data as well as more recent periods of drought, the HMPC determined the probability of future occurrence of drought to be likely, 10-100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.

Magnitude/Severity

Drought impacts are wide-reaching and may be economic, environmental, and/or societal. The most significant impacts associated with drought in Indiana are those related to agriculture. A prolonged drought could have severe economic impacts.

Drought conditions can also cause soil to compact and not absorb water well, potentially making an area more susceptible to flooding. An ongoing drought may also leave an area more prone to wildfires.

The magnitude/severity for this hazard is negligible, no or few injuries or illnesses; minor quality of life loss; little or no property damage; and/or brief interruption of essential facilities and services.

Drought Hazard Summary by Jurisdiction

As discussed in the previous occurrences and vulnerability sub-sections, the majority of the damages seen historically as a result of drought are to crops and other agriculture-related activities. Therefore, the magnitude of the impacts is greater in the unincorporated areas. In the cities, the frequency of drought conditions would be the same, but the magnitude would be less with lawns and local gardens affected, and leading to expansive soil problems around foundations. If drought conditions are severe and prolonged, water supplies could also be affected.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Corporation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.2.2 Wildfire

Description

Heavily wooded or forested areas cover approximately 9.7 percent of Vanderburgh County’s total land area. However, when the conditions are right, these areas become vulnerable to devastating wildfires. Also, in the last few decades, the risks associated with Vanderburgh County’s wildfire hazard have increased dramatically due to the increase in wildland-urban interface (areas where development occurs within or immediately adjacent to wildlands, near fire-prone trees, brush, and/or other vegetation), more and more structures and people are at risk. On occasion, ranchers and farmers intentionally ignite vegetation to restore soil nutrients or alter the existing vegetation growth. These fires have the potential to erupt into wildfires. But the main culprit of wildfires in the County is caused by careless or unintentional activities of people. These fires start in or near where people live or where people choose to do recreational activities.

Generally, there are three major factors that sustain wildfires and allow for predictions of a given area’s potential to burn. These factors include:

- Fuel;
- Topography; and
- Weather.

Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuels sources are diverse and include everything from dead tree needles, twigs, and branches to dead standing trees, live trees, brush, and cured grasses. Man-made structures and other associated combustibles are also to be considered as a fuel source. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for spreading wildfires.

An area’s topography (terrain and land slopes) affect its susceptibility to wildfire spread. Fire intensities and rates of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The natural arrangement of vegetation throughout a hillside can also contribute to increased fire activity on slopes.

Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfire. High temperatures and low relative humidity dry out the fuels that feed the wildfire creating a situation where fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The issue of drought conditions contributes to concerns about wildfire vulnerability.
Geographic Location

In general, Indiana has two fire seasons a year: in the spring when the leaf litter on the ground dries out and before young herbaceous plants start to grow and cover the ground (green up); and in the fall after the leaves come down and before they are wetted down by the first heavy snow.

With 9.7-percent of the total land area heavily wood, the geographic location was assigned a rank of significant, 10-50 percent of planning area affected.

Previous Occurrences

According to the data supplied to the Indiana Department of Natural Resources, Division of Forestry, Fire Control Headquarters, Vanderburgh County had 91 rural fires that burned 141.7 acres. The rural and volunteer fire districts that submitted data were the: Scott Township Fire Department, Scott Township Volunteer Fire Department, Perry Township Volunteer Fire Department, German Township Volunteer Fire Department, and Knight Township Volunteer Fire Department. The main cause of the wildfires were from debris burning, followed by smoking, sparks by the railroad line, equipment, and three from lightning strikes.

Table 3.9 below details wildfire occurrences in Vanderburgh County from 1994-2016.

<table>
<thead>
<tr>
<th>Year</th>
<th># Fires</th>
<th>Acres Burned</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>1995</td>
<td>8</td>
<td>4.75</td>
</tr>
<tr>
<td>1996</td>
<td>6</td>
<td>29</td>
</tr>
<tr>
<td>1997</td>
<td>12</td>
<td>3.5</td>
</tr>
<tr>
<td>1998</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>1999</td>
<td>3</td>
<td>18.35</td>
</tr>
<tr>
<td>2000</td>
<td>15</td>
<td>5.2</td>
</tr>
<tr>
<td>2001</td>
<td>5</td>
<td>1.7</td>
</tr>
<tr>
<td>2002</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2003</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2004</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2005</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2006</td>
<td>11</td>
<td>2.5</td>
</tr>
<tr>
<td>2007</td>
<td>10</td>
<td>2.5</td>
</tr>
<tr>
<td>2008</td>
<td>19</td>
<td>64.2</td>
</tr>
<tr>
<td>2009</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2010</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2011</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2012</td>
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<td>2013</td>
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<td>*</td>
</tr>
<tr>
<td>2014</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2015</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td>2016</td>
<td>*</td>
<td>*</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>91</strong></td>
<td><strong>141.7</strong></td>
</tr>
</tbody>
</table>

Source: Indiana Department of Natural Resources, Division of Forestry, Fire Control Headquarters

* No wildfires reported
Also the City of Evansville Environmental Protection Agency has the authority to issue bans on open burning in the area of its jurisdiction (City of Evansville and six miles out in the County) when conditions warrant the ban. Then the County Commissioners will order a ban on open burning for the remainder of the County at the same time.

**Probability of Future Occurrences**

Wildfires occur in Vanderburgh County on an annual basis. The average number of wildfires per year for the 15-year period from 1994-2009 was 6. The planning committee anticipates that this rate of occurrence is likely to continue. Future occurrences of this hazard are likely to increase if development in wildland-urban interface areas increases. The probability was assigned a rank of **occasional**, 1-10 percent chance of occurrence in the next year or has a recurrence interval of 11 to 100 years. The years of 2009-2016, there were no wildfires reported to the Department of Natural resources or to the Hoosier National Forest.

**Magnitude/Severity**

Wildfires occur on an annual basis and are mainly caused by humans from debris burning, followed by smoking, sparks by the railroad line, equipment, and only three from a natural occurrence such as lightning strikes. Historically, the magnitude has been minimal with the largest wildfire being 25 acres. The magnitude was classified as **limited**, minor injuries and illnesses; minimal property damage that does not threaten structural stability; and/or interruption of essential facilities and services for less than 24 hours.

**Wildfire Hazard Summary by Jurisdiction**

Wildfires occur more frequently in the unincorporated portions of Vanderburgh County and these areas are more vulnerable to wildfires due to more homes built in rural areas in closer proximity to land/trash/debris that is burned. Also, homes in these more rural areas do not have hydrants in most cases and are farther from firehouses. Wildfires can occur in city limits. However, the magnitude is generally lower due to proximity to firefighting services. There is less potential for wildfires impacting schools due to general locations away from heavily wooded areas. As with the cities, if a wildfire were to occur near school buildings, the magnitude would be lower due to close proximity to firefighting services.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Significant</td>
<td>Occasional</td>
<td>Limited</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Significant</td>
<td>Occasional</td>
<td>Negligible</td>
<td>Low</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Significant</td>
<td>Occasional</td>
<td>Negligible</td>
<td>Low</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Significant</td>
<td>Occasional</td>
<td>Negligible</td>
<td>Low</td>
</tr>
</tbody>
</table>
3.2.3 Earthquake

Description

An earthquake is a shaking or trembling of the earth’s surface caused by the lifting, shifting, breaking, or slipping of a fault line. Stresses in the earth’s outer layer push the sides of the fault together. Stress builds up and the rocks slip suddenly, releasing energy in waves that travel through the earth’s crust and cause the shaking that is felt during an earthquake. Evansville and Vanderburgh County are subject to earthquakes because of the close proximity of two seismic zones: the New Madrid and the Lower Wabash Valley.

Geographic Location

The New Madrid Seismic Zone (NMSZ) extends from west-central Mississippi northward past Cape Girardeau, Missouri. The center of this seismic zone is in New Madrid, Missouri, which is approximately 160 miles southwest of Evansville. It is the major source of seismic activity east of the Rocky Mountains. Although activity in the New Madrid Seismic Zone is less frequent than that along the West Coast, when tremors do occur, the destruction covers over more than 20 times the area of an equivalent West Coast earthquake because of the underlying geology. The largest earthquake in continental United States, according to the U.S. Geological Survey (USGS), occurred on the New Madrid fault in 1811.

The Lower Wabash Valley Seismic Zone generally follows the Wabash River from the Ohio River north to Terre Haute, Indiana. It extends to southeastern Illinois, southwestern Indiana and parts of western Kentucky. The Wabash Valley Fault System is probably the best-documented fault system in the eastern United States due to past petroleum exploration in the area. However, seismologically it is poorly understood. This zone is considered a source of strong earthquakes with geological evidence of prehistoric earthquakes of up to magnitude 7.5. One of the largest seismic events instrumentally recorded for the Wabash Valley Seismic Zone occurred in April 2008 of at a magnitude of 5.4.

Figure 3.3 indicates the locations of the New Madrid and Lower Wabash Seismic Zones. This U.S. Geological Survey map shows earthquakes as circles. Red circles indicate earthquakes that occurred from 1974 to 2002 with magnitudes larger than 2.5. Green circles denote earthquakes that occurred prior to 1974. Larger earthquakes are represented by larger circles.

All these central United States earthquakes are being monitored and researched by multiple sources such as the U.S. Geological Survey, Center for Earthquake Research and Information at the University of Memphis, Central United Stated Earthquake Consortium, Indiana Geological Survey, Indiana University, St. Louis University, and the University of Kentucky.

University of Southern Indiana, University of Evansville and Career and Technical Center has seismic monitors. Oak hill Middle School and Scott Elementary Schools has seismic monitors but no information on Indiana Geological site was available. New Harmony and Harrison schools no longer have the seismic monitors. This seismic information is then transmitted on the Princeton Earth Physics project (PEPP) network to Indiana University for research.
Information on location of seismic monitors can be found at igs.indiana.edu/IGSMap/?map=CUSEC.

**Figure 3.3.** New Madrid and Lower Wabash Valley Seismic Zones Earthquakes 1974-2002.

Several methods have been developed to quantify the strength of an earthquake. The most recognized methods for measuring earthquake strength are:

**Richter Magnitude** is a measure of earthquake strength or the amount of energy released. This scale was originally developed by Charles Richter in 1935. Magnitude is expressed in whole numbers and decimals, with each succeeding whole number representing a tenfold increase in the energy released. There is only one Richter value calculated for the epicenter of a specific earthquake. (The epicenter is the location on the surface of the earth directly above where an earthquake originates. It is determined by measuring the amplitudes of ground motion on seismograms.)

**Modified Mercalli Intensity Scale** is an evaluation of the severity of ground motion at a given location measured relative to the effects of the earthquake on people and property. This scale was developed by Wood and Nueman in 1931, based on Mercalli’s 1902 original version. Intensity is expressed in Roman numerals I – XII. The Mercalli scale is the most effective means
of determining the approximate magnitude of a quake that occurred in historic time prior to the advent of uniform seismic detection devices and the Richter Scale. Table 3.10 provides a comparison of the Richter Magnitude and Modified Mercalli Intensity Scales.

<table>
<thead>
<tr>
<th>Richter Magnitude</th>
<th>Modified Mercalli Scale</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>I – II</td>
<td>Usually detected only by instruments</td>
</tr>
<tr>
<td>3</td>
<td>III</td>
<td>Felt Indoors</td>
</tr>
<tr>
<td>4</td>
<td>IV – V</td>
<td>Felt by most people; slight damage</td>
</tr>
<tr>
<td>5</td>
<td>VI – VII</td>
<td>Felt by all; damage moderate</td>
</tr>
<tr>
<td>6</td>
<td>VII – VIII</td>
<td>Damage moderate to major</td>
</tr>
<tr>
<td>7</td>
<td>IX – X</td>
<td>Major damage</td>
</tr>
<tr>
<td>8+</td>
<td>X - XII</td>
<td>Total and major damage</td>
</tr>
</tbody>
</table>

**Liquefaction**

When strong earthquakes release energy, the resultant violent shaking motions may cause underground layers of saturated sandy soil to behave like a fluid under pressure. This process is called liquefaction. When the pressure forces liquefied sand to move up through cracks in the overlying soil and flow out over the surface a feature called sandblow is created. Liquefaction may cause landslides, the collapse of earthen dams, and the shifting and settling of buildings and other structures.

A diagram of a sandblow is presented in the Figure 3.4 (A). The photo in Figure 3.4 (B) shows a cross-sectional view of an ancient sandblow exposed in the bank of the Wabash River near Vincennes. After the sandblow formed, it was covered by layers of silt deposited during floods.

**Figure 3.4. A. and B. Example of Liquefaction Feature of Sandblow**

Source: Central U.S. Earthquake Consortium
This major liquefaction feature, along the east bank of the Wabash River, was discovered in the mid 1980s. At the time of the earthquake that formed this feature, sand and gravel from a buried terrace of the Wabash River was ejected onto the surface and simultaneously captured part of a tree that had been growing along the river bank at the time. Using radio carbon dating methods, the tree was discovered to be 6,100 years old, thus the liquefaction feature is also approximately 6,100 years old. It is estimated that it would have taken at least a magnitude 7 earthquake to produce the Vincennes liquefaction feature. From field evidence at this and other sites in southwestern Indiana, it is concluded that the Lower Wabash Valley is capable of producing large and potentially damaging earthquakes. Loose soils susceptible to liquefaction are found throughout Vanderburgh County.

**Ground Motion Amplification**

Ground motion is the movement of the earth’s surface due to earthquakes or explosions. It is produced by waves generated by a sudden slip on a fault or sudden pressure at the explosive source and travels through the earth and along its surface. Ground motion is amplified when surface waves of unconsolidated materials bounce off of or are refracted by adjacent solid bedrock. The New Madrid Seismic Zone hazard area is shown in Figure 3.5 which uses contour values to indicate the earthquake ground motions that have a common probability of being exceeded in 50 years.

In developing Figure 3.6, the ground motions being considered at a given location are those from all future possible earthquake magnitudes at all possible distances from that location. The ground motion coming from a particular magnitude and distance is assigned an annual probability equal to the annual probability of occurrence of the causative magnitude and distance.

The method assumes a reasonable future catalog of earthquakes, based upon historical earthquake locations and geological information on the recurrence rate of fault ruptures.

When all the possible earthquakes and magnitudes have been considered, a ground motion value is determined such that the annual rate of its being exceeded has a certain value. Therefore, as presented on Figure 3.6, for the given probability of exceedance, two percent, the locations shaken more frequently will have larger ground motions.
Figure 3.5. New Madrid Seismic Zone Map—2 Percent Probability of Exceedance in 50 Years

NMSZ and Vicinity, 1-hz SA 2%/50yr PE 2008

Note: Red square shows the approximate location of Vanderburgh County.
The geographic location was assigned a rank of **extensive**, 50-100 percent of planning area affected.

**Previous Occurrences**

There have been 52 recorded earthquakes within a 50-mile radius of Evansville since 1827. Identified fault lines and earthquake epicenters are presented in the following figure. The following list shows the major events sited from the Evansville-Vanderburgh County Community Comprehensive Hazard Analysis 2010, U.S. Geological Survey’s Earthquake Hazards Program, and the Evansville Courier. As of 2008, there have been 2 earthquakes that have occurred within a 50 mile radius of Evansville/Vanderburgh County.

- **November 20, 2012 Richter Magnitude 3.6 Wabash Valley Seismic Zone**-The earthquake struck near Mt. Carmel Illinois, 40.8 miles from Evansville, Indiana. There were 162 reports, and was felt in Vincennes In, Jasper In, Evansville In, Owensboro Kentucky, Bloomington In, and Mt. Vernon Illinois.
• April 18, 2012 Richter Magnitude 2.5- The earthquake happened in Owensboro Kentucky, 40.6 miles from Evansville In. There were 35 responses were reported and was felt in the following places, Owensboro Kentucky, Henderson Kentucky, Lewisport Kentucky, Hawesville Kentucky, Evansville In, and New Harmony In.

• April 18, 2008. Richter Magnitude 5.4. Wabash Valley Seismic Zone. The earthquake struck near Mt. Carmel, Illinois and was felt in at least 16 states, by more than 40,000 people. Fortunately, there were no serious injuries or fatalities, only non-structural damage reported.


• September 12, 2004. Richter Magnitude 3.6. It was centered near Shelbyville in Shelby County that sent tremors through the earth. No injuries were reported by the quake did cause minor damage to some structures.


• January 3, 2003. Richter Magnitude 2.9. The epicenter was in Gallatin County, Illinois, less than one-half mile west of the Indiana state line. It was the third earthquake to be felt in southwestern Indiana in the last two years.

• June 18, 2002. Richter Magnitude 5. Wabash Valley Seismic Zone. Five miles northwest of Evansville "Initial confusion was a common theme around Evansville and surrounding towns after the magnitude 5.0 earthquake. The temblor struck at 12:37 p.m., was felt for a few seconds and left behind very little damage. The quake's epicenter was eventually established nine miles northwest of Evansville and six miles west-southwest of Darmstadt, Ind." Broken glass, fallen chimneys. "It was the largest quake to rumble through the Tri-State since 1987, when a magnitude 5.0 temblor struck near Lawrenceville, Illinois. The strongest earthquake to occur in the last 100 years in the Wabash Valley region happened on Nov. 9, 1968, in south-central Illinois. It had a magnitude of 5.4 and was felt in 23 states."


• November 9, 1968. Richter Magnitude 5.5. Wabash Valley Seismic Zone. Occurred south of McLeansboro, in Hamilton County, Illinois. Evansville probably experienced a VI-VII on the Mercalli scale. This was the strongest felt earthquake in southern Illinois since the 1895 Missouri event. Property damage in the area consisted mainly of fallen bricks from chimneys, broken windows, toppled television aerials, and cracked or fallen plaster. In the epicentral area, near Dale, Hamilton County, Illinois intensity VII was characterized by downed chimneys, cracked foundations, overturned tombstones, and scattered instances of collapsed parapets. Most buildings that sustained damage to chimneys were 30 to 50 years old. A large two-story brick house near Dale, Illinois, sustained several thousand dollars damage. About 10 kilometers west of Dale, near
Tuckers Corners, a concrete and brick cistern collapsed. A large amount of masonry damage occurred at the City Building at Henderson, Kentucky, 80 kilometers east-southeast of the epicenter. Moderate damage to chimneys and walls occurred in several towns in south-central Illinois, southwest Indiana, and northwest Kentucky. Felt over all or parts of 23 States: from southeast Minnesota to central Alabama and Georgia and from western North Carolina to central Kansas.

- **November 9, 1968. Richter Magnitude 5.4. New Madrid Seismic Zone.** Property damage in the area consisted mainly of fallen bricks from chimneys, broken windows, toppled television aerials, and cracked or fallen plaster.

- **April 27, 1925. Richter Magnitude 4.8. Wabash Valley Seismic Zone.** Wabash River Valley, near Princeton, Indiana (38.2N 87.8W) Chimneys were downed at Princeton and at Carmi, Illinois, 100 km southwest; chimneys were broken at Louisville, Kentucky. Crowds fled from the theaters at Evansville. The felt area includes parts of Indiana, Illinois, Kentucky, Missouri, and Ohio.

- **September 27, 1909. Richter Magnitude 5.1. Wabash Valley Seismic Zone.** Occurred near Terra Haute, Indiana. Estimated magnitude of 5.1 and Evansville likely experienced a V on the Mercalli scale. The NEIC lists this as the strongest earthquake with an epicenter in Indiana. At Terre Haute (Vigo County), two chimneys were thrown down, plaster was cracked, and pictures were shaken from walls. At Covington, north of Terre Haute in Fountain County, a few chimneys were downed and windows were broken. Chimneys were "jarred loose" south of Vincennes at Princeton, Indiana, one chimney was shaken to pieces at Olivette, Missouri (a suburb of St. Louis), and a brick wall was shaken down at St. Louis, Missouri. Also reported felt in Arkansas, Illinois, Iowa, Kentucky, Ohio, and Tennessee.

- **April 29, 1899. New Madrid Seismic Zone.** Rated intensity VI to VII on the Modified Mercalli Scale. It was strongest at Jeffersonville and Shelbyville; at Vincennes, chimneys were thrown down and walls cracked. It was felt over an area of 40,000 square miles.

- **July 27, 1891. Richter Magnitude 4.1. New Madrid Seismic Zone.** A strong local earthquake damaged a wall on a hotel, broke dishes, and overturned furniture at Evansville. The shock also was strong near Evansville at Mount Vernon and Newburgh, Indiana, and at Hawesville, Henderson, and Owensboro, Kentucky.

- **February 6, 1887. Richter Magnitude 4.6. New Madrid Seismic Zone.** This centered near Vincennes and was felt over 75,000 square miles. This shock was strongest in southwest Indiana and southeast Illinois. Plaster was shaken from walls at Vincennes, Ind., and west of Terre Haute, at Martinsville, Illinois; a cornice reportedly fell from a building at Huntington, Indiana. It was felt distinctly at Evansville, Indiana, but only slightly in the outskirts of St. Louis, Missouri. Also reported felt at Louisville, Kentucky.

- **1895. Richter Magnitude 6.7. New Madrid Seismic Zone.** Occurred at Charleston, Missouri. This damaged buildings in Evansville and other parts of southwestern Indiana.


- **July 5, 1827. Richter Magnitude 4.8. New Madrid Seismic Zone.** Epicenter near New Harmony, Indiana. The earthquake cracked a brick store at New Harmony, Indiana, and
greatly alarmed some people. It was described as violent in New Madrid, Missouri, and severe in St. Louis. It also alarmed many in Cincinnati, Ohio, and Frankfort, Kentucky.

- **December 16, 1811 two occurred. January 23, 1812, and February 7, 1812. Richter Magnitude 8. New Madrid Seismic Zone.** A series of four earthquakes centered on New Madrid, Missouri. They were estimated magnitudes of 8 plus. These shock waves rippled through the earth with such force that buildings collapsed, trees topples, and the Mississippi River changed course. The explosive force that shattered the stillness of that serene setting was one of the most powerful earthquakes ever recorded in North America. During the next two months, the area was rocked by three more quakes as powerful as the first (one just six hours after the first) and hundreds of smaller ones. Evansville probably experienced a VII to VIII on the Mercalli scale (equal to a six on the Richter).

---

**Figure 3.7. Earthquake Epicenters in Indiana and surrounding states from 1800 to 1995.**


Note: Red square shows the approximate location of Vanderburgh County
Probability of Future Occurrences

The New Madrid Fault is an active fault, averaging more than 180 events per year measuring 1.0 or more on the Richter scale. This is equivalent to 15 events per month. Events measuring 2.5-3.0 on the Richter scale include tremors large enough to be felt and are noted annually. Every 18 months the New Madrid Fault releases a shock of 4.0 or more, capable of local minor damage. Magnitudes of 5.0 or greater occur approximately once per decade, can cause significant damage and can be felt in several states. A damaging earthquake in the New Madrid area (6.0 or greater) occurs about every 80 years (the last one in 1895).

A major earthquake in the New Madrid area (7.5 or greater) happens every 200-300 years (the last one in 1812). It is predicted that there is a 25 percent chance of disaster by 2040. A New Madrid Fault rupture this size would be felt throughout half the United States and damage is expected in 20 states or more. Events measuring 6.0-7.6 have more significant probabilities in the near future. Recent field work has shown that a major earthquake has already happened in the Wabash Valley fault zone in the past several thousand years. According to the U.S. Geological Survey and Figure 3.5 there is a 25 percent chance that a 4.75 or greater earthquake will occur in the next 100 years. Approximately 30 counties in Missouri, Illinois, Indiana and Kentucky could be affected with potential for serious damage to unreinforced buildings.

The Lower Wabash Valley Fault System is also an active fault with recent events on April 18, 2008 near Mt. Carmel, Illinois, and on January 2, 2006, 45 miles west of Evansville. These events measured 5.4 and 3.6 on the Richter scale, respectively. These recent events along with the identified large liquefaction features suggest the possibility that the region is capable of producing very large earthquakes.
Figure 3.5 indicates that there is a 20 percent probability of an earthquake exceeding a peak acceleration of four percent gravity in the next 50 years in the Vanderburgh County planning area. The probability was assigned a rank of **likely**, 10-100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.

**Magnitude**

The City of Evansville and Vanderburgh County have been preparing for an epic earthquake. This includes constructing critical facilities such as schools, hospitals, dams, and bridges to survive the maximum level of shaking likely to occur at the site. Evansville is currently requiring structure designs that will withstand a magnitude 7 earthquake. They are also developing a plan for coordinating activities among emergency response agencies, developing plans of action for schools, businesses, and homes; and educating everyone about earthquakes and what can be done to lessen their potential effects.

The Indiana Geological Survey has worked with the City of Evansville to estimate the shaking potential in sections of the City and therefore where best to locate critical facilities.

The magnitude was classified as **critical**, isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours.

**Earthquake Hazard Summary by Jurisdiction**

The following hazard summary table shows that this hazard does not significantly vary by jurisdiction. Although damage amounts would be higher in the more urban areas, damage ratios would be relatively the same.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corp.</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
</tbody>
</table>
3.2.4 Flood

Description

Floods are among the most frequent and costly natural disaster in terms of human hardship and economic loss. There are several different types of likely flood events in Indiana including flash, riverine, and urban storm water. Regardless of the type of flood, the cause can almost always be attributed to excessive rainfall, either in the flood area or upstream reach.

The term "flash flood" describes localized floods of great volume and short duration. In contrast to riverine flooding, flash flooding usually results from a heavy rainfall on a relatively small drainage area. Precipitation of this sort usually occurs in the spring and summer.

Riverine flooding is defined as an event when a watercourse exceeds its “bank-full” capacity and is the most common type of flood event. Riverine floods result from precipitation over large areas. This type of flood occurs in river systems whose tributaries may drain large geographic areas and include many independent river basins. Riverine flooding generally occurs as a result of prolonged rainfall, or rainfall that is combined with soils already saturated from previous rain events. The duration of riverine floods may vary from a few hours to many days. Factors that directly affect the amount of flood runoff include precipitation, intensity and distribution, the amount of soil moisture, seasonal variation in vegetation, snow depth, and water-resistance of the surface areas due to urbanization. The area adjacent to a river channel is its floodplain. In its common usage, “floodplain” most often refers to that area that is inundated by the 100-year flood, the flood that has a 1 percent chance in any given year of being equaled or exceeded. The 1 percent annual flood is the national standard to which communities regulate their floodplains through the National Flood Insurance Program.

Urban flood events result as land loses its ability to absorb rainfall as it is converted from fields or woodlands to roads, buildings, and parking lots. Urbanization increases runoff two to six times over what would occur on undeveloped terrain. During periods of urban flooding, streets can become swift moving rivers.

All flood events may result in upstream flooding due to downstream conditions such as channel restriction and/or high flow in a downstream confluence stream. This type of flooding is known as backwater flooding.

Geographic Location

The major sources of flooding in the Evansville and Vanderburgh County are the Ohio River and Pigeon Creek. The Ohio River forms 28 miles of the City and County southern border. Pigeon Creek, originating in neighboring Warrick County, flows in a southwesterly direction through the southeastern corner of Vanderburgh County and Evansville to discharge into the Ohio River, near downtown Evansville. Damage from flooding along Pigeon Creek in the planning area occurs when the Ohio River reaches a stage great enough to back water up Pigeon Creek, or when Pigeon Creek headwater becomes sufficiently high enough to
overflow the channel. Because of continued development in the unprotected areas, flood problems are not considered greater than at the time of the 1937 flood. The flooding problem now consists principally of overflow from Pigeon Creek onto the agricultural lands in the eastern part of Vanderburgh County and residential sections northeast of Evansville.

Suffering the greatest damage in more recent headwater floods on Pigeon Creek were the homes and farm buildings in the North Green River Road area. In addition to flooding on Pigeon Creek, floods on the Ohio River cause extensive overflow in the southeastern corner of the county. Because of the meandering nature of the river, this portion of the county lies almost entirely in the floodplain of the river. Backwater flooding from Pigeon Creek aggravates the flood problems on Mill Road Tributary. While there is also potential backwater flooding on both Schlensker Ditch and Greenbriar Hills Tributary, it is not as significant as that on Mill Road Tributary.

Following the major flood event of 1937 on the Ohio River, the City of Evansville, in conjunction with the Louisville District of the U.S. Army Corps of Engineers, initiated flood protection projects. Portions of the riverfront area are now protected from severe flooding by levees, floodwalls, and large pumps. There is also a levee system to help control flooding on Pigeon Creek. These provide protection to the City of Evansville and portions of the unincorporated areas east of the City from a repetition of the 1937 flood, which had a recurrence interval greater than 500 years. Although related to flood hazard, levee failure is discussed separately in Section 3.2.7.

As a part of the National Flood Insurance Program (NFIP), floodplains and floodways on the Ohio River, Pigeon Creek, and many local streams have been established and are regulated by the local floodplain management ordinance. The most recent Flood Insurance Study (FIS) for Vanderburgh County unincorporated and incorporated areas has an effective date of March 17, 2011. The FIS and associated Digital Flood Insurance Rate Maps (DFIRMs) present the adopted floodplains, floodways, and flood profiles for streams in the planning area. Table 3.11 presents the Vanderburgh County Flooding Sources that were studied by Detailed Methods in the FIS. As of 2016, this table is accurate with the information of flooding sources.
Table 3.11  Flooding Sources Studied by Detailed Methods

<table>
<thead>
<tr>
<th>Source: Vanderburgh County Flood Insurance Study, March 17, 2011</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bluegrass Creek</td>
<td>Nurenbern Ditch</td>
</tr>
<tr>
<td>Boesche Ditch</td>
<td>Ohio River</td>
</tr>
<tr>
<td>Crawford-Brandeis Ditch</td>
<td>Pigeon Creek</td>
</tr>
<tr>
<td>Dry Run Lower</td>
<td>Pond Flat Ditch</td>
</tr>
<tr>
<td>Dry Run Upper</td>
<td>Pond Flat Ditch Lateral “A”</td>
</tr>
<tr>
<td>Greenbriar Hills Tributary</td>
<td>Pond Flat Ditch Lateral “B”</td>
</tr>
<tr>
<td>Harper Ditch</td>
<td>Pond Flat Ditch Lateral “C”</td>
</tr>
<tr>
<td>Harper Ditch Overflow</td>
<td>Rusher Creek</td>
</tr>
<tr>
<td>Hirsch Ditch</td>
<td>Pond Flat Ditch Lateral “D”</td>
</tr>
<tr>
<td>Little Pigeon Creek</td>
<td>Pond Flat Ditch Lateral “E”</td>
</tr>
<tr>
<td>Locust Creek</td>
<td>Schlensker Ditch</td>
</tr>
<tr>
<td>Lockwood Ditch</td>
<td>Schlensker Ditch Tributary</td>
</tr>
<tr>
<td>Mill Road Tributary</td>
<td>Stockfleith Ditch</td>
</tr>
</tbody>
</table>

Figure 3.9 provides an example of the geographic location of the known flood hazard areas as identified by FEMA digital flood insurance rate maps (DFIRM) for Vanderburgh County. The geographic location was assigned a rank of **significant**, 10-50 percent of planning area affected.
Figure 3.9. Excerpt of Floodplain on Carpenter Creek from DFIRM 18163C0157D
National Flood Insurance Program (NFIP) Participation

Vanderburgh County and the City of Evansville are currently participating in the National Flood Insurance Program (NFIP). Both Vanderburgh County and Evansville are a rated Class 8 in the Community Rating System. This class rating results in a 10% reduction in flood insurance premiums for NFIP policy holders. Darmstadt does not participate in the NFIP and was sanctioned on February 1, 1981. Table 3.12 provides additional details on NFIP participation as well as flood insurance policies and claims.

Table 3.12  Community Participation in the National Flood Insurance Program in Vanderburgh County

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Status/Date</th>
<th>Effective FIRM Date</th>
<th>Policies in Force</th>
<th>Insurance in Force (Millions)</th>
<th>Number of Paid Losses</th>
<th>Total Losses Paid(Millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Darmstadt</td>
<td>Was Sanctioned 3/17/2012</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Source: http://www.fema.gov/policy-claim-statistics-flood-insurance

All streams within Evansville and Vanderburgh County, as previously identified, are subject to flooding and backwater flooding. Backwater flooding is defined as upstream flooding caused by downstream conditions such as channel restriction and/ or high flow in a downstream confluence stream. The primary effect of flooding on these streams appears to be inundation, although velocities will become significant to persons and structures under more extreme flooding situations. Calculated floodplain velocities range from 0.2 to 6.5 feet per second (fps). Velocities greater than 5.0 fps which is considered to be of dangerous magnitude. Table 3.13 outlines the critical depths and velocities that will harm residents and structures during a flood event.
### Table 3.13  Critical Flood Depths and Velocities

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Depth (threat to life)</strong></td>
<td>In stagnant backwater areas (zero velocity), depths in excess of about 1m (3.3ft) are sufficient to float young children, and depths above 1.4m (4.6ft) are sufficient to float teenage children and many adults.</td>
</tr>
<tr>
<td><strong>Velocity (threat to life)</strong></td>
<td>In shallow areas, velocities in excess of 1.8m/s (5.9 ft/s) pose a threat to the stability of many individuals.</td>
</tr>
<tr>
<td><strong>Depth and Velocity (threat to life)</strong></td>
<td>The hazards of depth and velocity are closely linked as they combine to effect instability through an upward buoyant force and a lateral force. A product of less than or equal to 0.4m2/s (43 ft2/s) defines a low hazard provided the depth does not exceed 0.8m (2.6ft) and the velocity does not exceed 1.7m/s (5.6 ft/s).</td>
</tr>
<tr>
<td><strong>Vehicular access (emergency access)</strong></td>
<td>Most automobiles will be halted by flood depths above 0.3-0.5m (1.0-1.7ft). A maximum flood velocity of 3m/s (9.8 ft/s) would be permissible, providing that flood depths are less than 0.3m (1.0ft). A depth of 0.9-1.2m (2.9-3.9 ft) is the maximum depth for rapid access of large emergency vehicles.</td>
</tr>
<tr>
<td><strong>Structural Integrity (structures above ground)</strong></td>
<td>A depth of 0.8m (2.6ft) is the safe upper limit for the above ground/super structure of conventional brick veneer, and certain types of concrete block buildings. The structural integrity of elevated structures is more a function of flood velocities (e.g. Erosion of foundations, footings or fill) than depth. The maximum velocity to maintain structural stability depends on soil type, vegetation cover, and slope but ranges between 0.8-1.5m/s (2.6-4.9 ft/s).</td>
</tr>
<tr>
<td><strong>Fill (stability)</strong></td>
<td>In general, fill may become susceptible to erosion/instability at depths of 1.8-2.4m (5.9-7.9ft).</td>
</tr>
</tbody>
</table>


### Identified Problem Areas

Approximately 30 chronic flooding areas within Evansville have been identified in the 2007 Stormwater Master Plan Update for the City of Evansville (Appendix C). The problem areas are categorized as follows:

- Neighborhood flooding;
- Combined sewer related flooding; and
- Channel cleanout/stream system flooding.

Neighborhood flooding problems refer primarily to street flooding (primarily in residential areas) caused by undersized storm sewers and roadside ditches. Combined sewer related flooding includes street and property flooding caused by back up of the combined sewer system. Channel cleanout and stream system flooding refers to areas where natural streams exceed their channel banks or back up at bridges or culverts and flood adjacent property. Because of the extensive levee system in Evansville, stream system flooding is not a major problem. The channel cleanout problems also refer to stream systems which have major debris blockages or are heavily overgrown, causing capacity and back up problems.
A total of 15 neighborhood, 10 combined sewer, and 2 channel cleanout/stream system project areas were identified to alleviate flooding. A name was assigned to each problem area. The names were based on nearby major streets and are meant to represent the general vicinity of flooding problems, not the location of a specific problem. Table 3.14 identifies the flooding problem areas.

<table>
<thead>
<tr>
<th>Flooding Problem Classification</th>
<th>Inventory of Flooding Project Areas Identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighborhood</td>
<td>Eastview Terrace</td>
</tr>
<tr>
<td></td>
<td>Lauderdale Subdivision</td>
</tr>
<tr>
<td></td>
<td>Blueridge Drive Addition</td>
</tr>
<tr>
<td></td>
<td>Greencove Avenue</td>
</tr>
<tr>
<td></td>
<td>Stockwell Road Ditch</td>
</tr>
<tr>
<td></td>
<td>Red Bank Road and Nolan Avenue</td>
</tr>
<tr>
<td></td>
<td>Fulton Avenue and Columbia: South</td>
</tr>
<tr>
<td></td>
<td>Old Booneville Highway and Crawford Brandeis Ditch</td>
</tr>
<tr>
<td></td>
<td>Lincoln and Kirkwood</td>
</tr>
<tr>
<td></td>
<td>Ray Becker and Bristol Myers</td>
</tr>
<tr>
<td></td>
<td>Kratzville Road and Allens Lane</td>
</tr>
<tr>
<td></td>
<td>Bonnie View Ditch</td>
</tr>
<tr>
<td></td>
<td>Fulton Avenue and Columbia: North</td>
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<tr>
<td></td>
<td>Hesmer Road Ditch</td>
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<tr>
<td></td>
<td>Sixth Avenue and Nester Street</td>
</tr>
<tr>
<td>Combined Sewer</td>
<td>Diamond Avenue Phases I-IV (already designed)</td>
</tr>
<tr>
<td></td>
<td>Southeast Boulevard, Brookside Drive and Covert Outfall</td>
</tr>
<tr>
<td></td>
<td>Cass Avenue</td>
</tr>
<tr>
<td></td>
<td>St. Joseph Laterals</td>
</tr>
<tr>
<td></td>
<td>Akin Park</td>
</tr>
<tr>
<td></td>
<td>State Hospital Grounds</td>
</tr>
<tr>
<td></td>
<td>Boeke Road Outfall</td>
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<tr>
<td></td>
<td>Jeanette and Cass Addition</td>
</tr>
<tr>
<td></td>
<td>Weinback &amp; Boeke Lateral (already designed)</td>
</tr>
<tr>
<td></td>
<td>Weinback &amp; Keck Lateral (already designed)</td>
</tr>
<tr>
<td>Channel Cleanout/Stream System Flooding</td>
<td>Rollett Lane and Red’s Creek</td>
</tr>
<tr>
<td></td>
<td>Carpentier Creek Cleanout</td>
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</table>
Repetitive Loss Structures

A Repetitive Loss (RL) property is any insurable building for which two or more claims of more than $1000 were paid by the National Flood Insurance Program (NFIP) within any rolling 10-year period since 1978. The Federal Emergency Management Agency (FEMA) has repetitive loss properties within Vanderburgh County and the City of Evansville as follows:

- City of Evansville:
  - 15 - Non-Mitigated Properties
    - 9 - Single Family
    - 2 - Multi-Family
    - 4 - Other Non-Residential
  - 21 Mitigated Properties
    - 15 - Single Family
    - 2 - Multi-Family
    - 4 - Other Non-Residential

- Vanderburgh County:
  - 37 - Non-Mitigated Properties
    - 35 - Single Family
    - 2 - Multi-Family
  - 1 - Mitigated Properties
    - 1 - Single Family

Flood claims are primarily due to the disaster declaration events DR 1662 (10/6/2006) and DR 1795 (9/23/2008). These repetitive loss properties do not reflect the total number of homes that have flooded in Evansville and Vanderburgh County, but rather the number of insured properties that have filed for an insurance claim repeatedly.

There are at least two common sources of repetitive flooding to these structures which are: Riverine—the Ohio River and the associated tributaries including Pigeon Creek; and Urban Neighborhood which can occur in one of two ways: When low lying areas cannot drain following a storm event. Several of these were identified in the Stormwater Master Plan as areas below the Ohio River stage elevation. The other is combined sewer related flooding. This happens when the combined sewer system cannot accommodate additional Stormwater, the area is then flooded. In the lost below causes will be listed as Ohio River, Pigeon Creek, or Urban Neighborhood Flooding.

The Repetitive Loss (RL) structures that were not mapped was based upon site inspection where these appeared to be isolated locations due to individual site or structure characteristics for example; doorways below the surrounding grades and being in the X Protected by Levee Zone. Repetitive Loss (RL) areas, which encompass a repetitive loss structure along with other adjacent properties, identified as being subject to a similar flood risk, have been further identified in 20 locations. Below is a brief description of these location sources of flooding and where they are on the Flood Map. Location of maps of the repetitive loss areas are presented in Appendix C.
Repetitive Loss Areas

City of Evansville

- Rheinhard Avenue - Urban Neighborhood Flooding, located within Zone X protected by levee

- East Columbia Street - Urban Neighborhood Flooding, located within 0.2 percent or old 500-year floodplain.

- Johnson Lane - Bayou Creek an Ohio River Tributary, Bayou Creek, located within the 100-year floodplain.

- North Grand Avenue and North Kentucky Avenue - Urban Neighborhood Flooding, located in an isolated 100-year flood zone.

- Peacock Lane - Crawford Brandies Ditch, a Legal Drain, which drains into Pigeon Creek, located in both a floodway and the 100-year floodplain.

- Bossee Avenue - Possible combination of both Carpentier Creek tributary and Urban Neighborhood Flooding, located within the 100-year floodplain.

- Colonial Garden Road - Crawford Brandies Ditch, a Legal Drain, which drains into Pigeon Creek, located in both a floodway and the 100-year floodplain.

- North First Avenue - Pigeon Creek, located within the 0.2 percent or old 500-year floodplain.

Vanderburgh County

- Union Township - Ohio River, located in both the floodway and the 100-year floodplain.

- Knight Unincorporated on Ohio River - Ohio River, located in both the floodway and the 100-year floodplain.

- Broadway Avenue - Combination of terrain and un-named tributary of Bayou Creek, an Ohio River tributary, located within the 100-year floodplain.

- North St. Joseph Avenue - Locust Creek, an Ohio River tributary, located within the 100-year floodplain.
• **Old Boonville Highway**-1-Pigeon Creek. Located within the 100-year floodplain; 2-Boesche Ditch, a Legal Drain, which drains into Pigeon creek, located in both a floodway and the 100-year floodplain.

• **Green River Road**- Pigeon Creek, located within the 100-year floodplain.

• **Six School Road**- Un-named tributary of Little Creek, located at the upstream limits of the 100-year floodplain.

• **Heckel Road**-Pigeon Creek, located in the 100-year floodplain.

• **Bergdolt Road**-Pigeon Creek, located in the 100-year floodplain.

• **Elmridge Drive**-Pigeon Creek, located in the 100-year floodplain.

• **Voight Road**-Firlick Creek, a Pigeon Creek tributary, located in the 100-year floodplain.

• **Warrick County Line Road**-Blue Grass Creek, a Pigeon Creek tributary, located in the 100-year floodplain.

**Previous Occurrences**

There are 86 flood events listed in the NCDC database for Vanderburgh County between 1993 and 2016. This database provides information on flooding events back to 1993. In addition, Vanderburgh County received six Presidential disaster declarations for flooding between 1965 and February 2011. (Note: DRs 17945 and 1520 included flooding in the description. However the Vanderburgh County damages were not the result of flooding. The September/October 2008 declaration (DR-1795) was for flooding in northern Indiana. Southern Indiana, including Vanderburgh County had damages primarily from severe storms. Therefore, this declaration is included in the Severe Storms Previous Occurrences Section. The May/June 2004 declaration (DR-1520) impacts in Vanderburgh County were primarily as a result of the tornado that occurred in Darmstadt. Therefore, this declaration is included in the Tornado Previous Occurrences Section.) Historical accounts of flooding events are recorded below. Sources are the NCDC database, FEMA, the National Weather Service Weather Forecast Office in Paducah, Kentucky, and the Evansville–Vanderburgh county Community Comprehensive Hazard Analysis. The following is the most recent descriptions of the significant events of flooding and flash flooding in Vanderburgh County.

• **December 22, 2013**-A slow-moving cold front passed across the region between the 20th and 22nd. Several upper level disturbances moved north-northeast along the front, touching off numerous showers and thunderstorms. The ground was already moist from snowmelt in the wake of the early December winter storm. On the 21st, a strong negatively tilted shortwave at 500 mb ejected northeast from the southern Plains, providing strong forcing for ascent. Widespread heavy rain and thunderstorms surged northeast in association with the
strengthening surface low that tracked across the Lower Ohio Valley. Storm total rainfall amounts ranged mainly from 4 to 7 inches, with the highest amounts north and west of Evansville. Ditches and creeks quickly spilled out onto roadways and into nearby fields. There were numerous road closures and water rescues as waters continued to rise.

- **May 5, 2011, Flood**—Heavy rainfall in March set the stage for major flooding when near-record rains fell in April and May. At Evansville, April was the second wettest April on record with 11.77 inches. For the season, Evansville had the second wettest meteorological spring (March through May) with 25.01 inches. The result of all this rain was rapid and dramatic rises on rivers. Record flood crests occurred on some rivers, inundating numerous homes and businesses. There were numerous closed roads across the region, leading to often lengthy detours. Because of the high water, there were numerous day and nighttime restrictions to barge traffic. Hundreds of thousands of acres of farmland were flooded. Crops were late getting planted.

- **November 25, 2010, Flash Flood**—Water was over roads in numerous places in Evansville. The intersection of Indiana 66 and First Avenue was closed due to flooding. On the southeast side of Evansville, a spotter reported 4.6 inches of rain in 36 hours.

- **September 5, 2009, Flash Flood**—1.67 inches of rain fell in less than an hour on the southeast side of Evansville. Widespread street flooding caused numerous vehicles to stall out. Police and fire crews were kept busy with vehicle rescues. Water was up to waist-deep on one side street south of downtown. The most affected areas of Evansville were from the downtown area to the southeast side. Garages and basements were flooded in the southeast section of the city. Flooding occurred on the Lloyd Expressway, causing westbound traffic to narrow to one lane that was under water but passable.

- **March 18, 2008, Flood**—Major flooding of Pigeon Creek occurred. Sandbag walls and pumps were placed around a number of residences near the creek, which flows into the Ohio River near Evansville. National Guard troops and firefighters were among those helping with sandbagging. About 100,000 sandbags were filled in this massive flood-fighting effort. Voluntary evacuations were in effect for residents of 194 mobile homes at a mobile home park which was threatened by a weakening levee. Water was about one foot from the top of the levee, and sinkholes formed in the levee. Floodwaters seeping through the levee flooded parts of the mobile home park, but water was not believed to have entered any homes. At least a dozen other homes were threatened by the creek. The Red Cross opened a shelter for evacuees. Access to one home was by boat only. Four teenagers were rescued from an SUV that stalled in floodwaters. In the city of Evansville, the manager of the water and sewer department received 29 reports of storm water in homes. Thirty homes were affected by floodwaters, and a few were heavily damaged. Motorists were stuck in high water on roads near the Evansville Regional Airport. Schools were closed across the county, and a State of Emergency was declared.

- **March 7, 2008, Flood**—Minor flooding of the Ohio River occurred. At the Evansville gage, the river crested at 43.65 feet on March 23. Flood stage there is 42 feet. Basements along the riverfront were flooded. At the Angel Mounds boat ramp, a man in a pickup truck was swept into the Ohio River and then rescued by fire crews 100 yards down the river. Backwater aggravated flooding along Pigeon Creek, a tributary that flows through Vanderburgh County. The river was 3300 feet wide.
• **September 12-14, 2006, Flash Flood (FEMA-1662-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. Major flash flooding inundated sections of Evansville. Based on radar estimates, about one inch of rain fell within 20 minutes of the onset of heavy rain. Flooding occurred within 30 minutes of the onset of heavy rain. The extreme rainfall was very localized. A total rainfall measurement of 4.87 inches was received from the Community Collaborative Rain, Hail, and Snow (CoCoRaHS) Network just east-southeast of Evansville. A total of 248 occupied structures were affected. Of those 248, fifteen were single family homes that sustained major damage, 141 were structures that received minor damage, and 92 others were affected in some way. The totals include three businesses and 40 to 50 apartments. A school cafeteria was flooded with an inch or two of water. The basement wall of a residence collapsed. Thirteen families were displaced, and at least four of those families were placed in hotels by the Red Cross. Over 30 water rescues were conducted from cars stalled in flooded streets. Six persons were rescued from a stranded school bus. The occupants of four flooded residences were rescued by firefighters. Long-time residents reported this was the worst flood in memory. Many roads were barricaded and closed. Persistent and repeated drainage problems occurred on the southeast side of Evansville.

• **March 12, 2006, Flash Flooding**—Many city streets in Evansville were closed due to high water, with water rescues conducted. The county highway department ordered 16 road closures as a result of high water, including heavily-travelled Green River Road. The basement of a vacant house collapsed. Emergency managers provided sandbags to a handful of property owners who requested them. The rainfall total of 2.61 inches at Evansville broke the daily rainfall record for March 12. The total rainfall for the three rounds of thunderstorms from March 9 to March 12 was 7.90 inches.

• **August 26, 2005, Flash Flood**—Rainfall amounts reported by emergency management officials ranged from 2.2 inches in downtown Evansville to 5 inches on the east side. Numerous city roads and one county road were closed by high water. Residential areas that were affected were mostly limited to three neighborhoods on Evansville's southeast side. Approximately 50 homes and 3 apartment buildings were affected by high water, many with water in the basements. Numerous vehicles were flooded, including those parked on the street, in garages, and driven into high water. At least 17 cars were reportedly flooded in the Dexter neighborhood.

• **January/February 2005, Flooding (FEMA-1573-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. Flooding throughout the region was due to a prolonged period of wet weather following the rapid snowmelt from a record late December snowstorm. Rainfall at the Evansville airport for the January 5-6 event was nearly 1.5 inches. On January 5, Pigeon Creek was out of its banks. In northern Vanderburgh County, a vehicle stalled in several feet of water, requiring the assistance of the fire department. Minor to moderate flooding of the Ohio River occurred. A state of emergency was declared in Vanderburgh and Posey Counties. Isolated evacuations of homes in low-lying areas were conducted in both counties. Many roadways in the vicinity of the river were closed. In Vanderburgh County, a total of 20 roads were closed. They were mostly farm roads flooded near the river, outside the Evansville city limits. Most of the flooded roads were south of Interstate 164 in the southeast part of the county and in lowland areas in the...
southwest part of the county. At Evansville, the Ohio River crest was 44.14 feet; about two feet above flood stage, but lower than the crest of 47.52 in 1997. The Army Corps of Engineers closed the locks on the Ohio River at Newburgh Lock and Dam.

- **July 16, 2004, Flash Flood**—Significant flash flooding occurred over the Evansville area and parts of Wabash County Illinois. Widespread street flooding occurred in Vanderburgh County after 5 to 10 inches of rain fell in a couple of hours. The rain began at Evansville about 10:30 P.M., and by midnight measured 1.47 inches at the Evansville airport. Radar indicated considerably heavier rainfall rates over downtown Evansville and western Vanderburgh County. The Vanderburgh county Emergency Management Agency reported 175 to 200 residential structures were affected by the flooding. In one trailer park alone, 150 homes were evacuated with the water 6 feet deep in places. In the downtown area, 35 homes were affected by the flooding. No dollar damage estimates were available. Figure 3.10 provides a radar image of the "storm-total" rainfall estimate. The shades of red indicate 5-plus inches. Yellow and gold colors indicate 2.5 to 5 inches. Green shades indicate 1 to 2.5 inches. The yellow oval provides the location of Vanderburgh County.

![Figure 3.10. July 16, 2004 Flash Flood Storm Total Radar Image](image)


- **May 1, 2004, Flash Flood**—Major flooding occurred in a band extending eastward across the Wabash River into northern Posey, southern Gibson, and northern Vanderburgh Counties. In northern Vanderburgh County, Interstate 64 was flooded west of U.S. Highway 41 (exit
25); with water up to 2 feet deep in spots. At least one vehicle was stranded in deep water near the Gibson/Vanderburgh County line.

- **January 5, 2004, Flood**—The Ohio River rose above flood stage in response to heavy rains from Illinois to Ohio at the end of December and into the first days of January. The river flooding was moderate, consisting of extensive bottomland flooding of fields and woodlands. A number of lesser travelled county roads were closed. Some families in flood-prone areas had to find alternate routes to and from their homes. One man was swept into the floodwaters in southern Vanderburgh County as he tried to walk to dry land. Two men were driving through the flooded area when their pickup truck stalled in waist-deep water. They spent the night in a river camp that they broke into, and then decided to try crossing the floodwaters to dry land. Although one of the men turned back, the second continued into the cold water and was swept away by the current. He was able to grab onto a tree, and he spent three hours wedged between its limbs before he was found. The man was airlifted to a local hospital where he was treated for hypothermia with a body temperature of 90 degrees. The river first rose above flood stage at Newburgh on the 5th and last fell below flood stage at Mount Vernon on the 17th. At Newburgh, where flood stage is 38 feet, the river crested at 45.0 feet on the 10th. Evansville crested just inches above its 42-foot flood stage. Mount Vernon crested at 42.8 feet on the 12th, nearly 8 feet over flood stage. The river was 3300 feet wide at Evansville. Basements along the riverfront began to fill, and Pigeon Creek was flooded by backwater. Near Evansville, several gravel secondary roads were closed, mostly across from Henderson, KY where there is a bend in the river.

- **November 25, 2003**—Minor flooding of the Ohio River occurred in southwest Indiana. About 30 school children living in the river bottoms of Union Township were picked up at alternate locations on higher ground. No evacuations of residents were required. Among the roads closed included Weinbach Avenue, Happe Road, and Seminary Road.

- **July/August 2003, Flash Flooding (FEMA-1476-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. On July 9, A severe thunderstorm developed over Evansville, producing torrential rain, wind gusts around 60 MPH, and hail up to the size of dimes. Flash flooding of streets occurred in the City of Evansville. Water was reportedly over the tops of cars at the intersection of St. Joseph Road and Franklin Road. Other sections of St. Joseph Road were impassable. Division Street was another problem area, where at least one vehicle stalled out in floodwaters. On July 30, during the incident period for this declaration, an unofficial measurement of 3.0 inches of rain was recorded in downtown Evansville resulting in extensive street flooding. A railroad underpass was closed on Diamond Avenue, and Old U.S. Highway 41 was under water for about a three-quarter mile stretch. An intersection on Becker Parkway was under two feet of water.

- **November 8, 1998, Urban Flooding**—A band of slow-moving thunderstorms produced heavy rain as it sagged south across southwest Indiana. A particularly strong thunderstorm intensified to severe levels as it passed right over Evansville. Dime size hail and copious rainfall amounts between 2 and 4 inches per hour occurred downtown. Serious street flooding took place, with numerous stranded vehicles. Emergency services personnel performed many water rescues due to submerged vehicles. A restaurant was surrounded by water, trapping about 25 people inside the building until the water receded. A school on the north side of
Evansville was closed after water came pouring into the building through doors and drains. The 265 students in the school were moved to a church on higher ground.

- **August 1997, Flash Flooding**—Thunderstorms dumped heavy rain estimated between 2 and 3 inches over Evansville within 3 hours. Less than an inch of rain was measured at the Evansville airport. The flooding stranded many motorists in floodwaters around 3 feet deep. Several streets were closed. Firefighters were busy rescuing people stranded in the flooding, including a group of elderly people at Division and Main Streets. The group of six elderly people were stranded in a van, and had to be taken out of the area by a fire truck. Two other people were rescued at the same intersection. The Water Rescue Team was called to a viaduct to rescue two people stranded in a car. No injuries were reported. An official with the city Division of Transportation estimated about 200 cars were stranded by flooding in the city. The Lloyd Expressway was closed for about two hours near the Vann Avenue exit when a Greyhound bus became stranded. The only homes threatened by flooding were on two city streets that routinely experience flood problems. City pump trucks were sent to that area to help remove the water.

- **March 1997, Flood (FEMA-1165-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. Widespread rainfall amounts around 10 inches in the middle Ohio Valley, from around Louisville to Cincinnati, occurred over a one to three day period. This resulted in a massive flood crest that took a few weeks to travel down the Ohio River. The resultant flood was the worst in about 30 years, and one of the five worst on record. Water from the Ohio River backed up into the Pigeon Creek, which flows through Evansville. About 60 homes were evacuated along Pigeon Creek, and two bridges over the creek were closed. In Warrick County, just a few families were forced from their homes. Numerous roads were closed for days at a time. All barge traffic was halted on the Ohio River upstream from Newburgh. Near Evansville, a few families were evacuated by boat.

- **April/May 1996, Flood (FEMA-1125-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. Over seven inches of rain fell at Evansville in 24 hours. School openings were delayed for two hours because of floodwaters. Damage to county roads and bridges was estimated to be around 150,000 dollars. So much water overloaded the sewer system that officials released raw sewage into the Ohio River.

- **November 14, 1993, Flash Flood**—This flash flood event developed into a widespread major flood event over central and southern Indiana. The heavy rain on November 14 was followed by an additional 1.50 to 2.50 inches of rain from November 16 to November 17. Flooding in much of central and southern Indiana was reminiscent of the late December 1990 and early January 1991 flood. Flood levels in portions of the state exceeded the late December 1990 and early January 1991 flood, and were the highest experienced in 50 or more years. Over 1,000 people were forced to flee their homes, and the Indiana Department of Natural Resources made numerous rescues of hunters and stranded residents.

- **December 1990/January 1991, Flood (FEMA-891-DR)**—This event resulted in a Presidential Disaster Declaration that included Vanderburgh County. River and small stream flooding occurred in the County.
• **January 29, 1937, Flood**—The precursors to this historic flood event began January 5th with heavy rain, snow, and sleet falling almost continually over the Ohio Valley. The rainfall from Wheeling, West Virginia, to Cairo, Illinois was an average of sixteen to twenty-one inches in eighteen days. The watershed was unable to carry the tremendous volume of water. Rising temperatures in the north began melting snow and it too drained into the raging Ohio. The flooding of low lands along the Ohio River was nothing out of the ordinary, but the rampage of the Ohio River in 1937 was something that no one expected. The flood stage of 35 ft. was reached at Evansville on January 11th. The river continued to rise steadily and more residents were forced out of their homes. The water rose higher and higher, forcing people to flee for their lives. This record flood reached its' crest January 29, 1937, when the Ohio at Evansville reached 53.7 feet. (January 31st in FIS Report) Approximately 7,500 of the 22,000 homes in Evansville were damaged to some extent, and 500 city blocks were inundated. In the Pigeon Creek basin, approximately 10,000 acres were flooded. The City of Henderson KY had remained relatively dry. Henderson was one of the few towns along the Ohio to remain dry. Evansville, however, had over 300 square blocks under water. The depth of the floodwater at the corner of Washington and Kentucky Avenues on January 31, 1937, was seven feet.

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**Figure 3.11  1937 Flood in Vanderburgh County**

![Image of 1937 flood in Vanderburgh County](image-url)
According to the USDA’s Risk Management Agency, insured crop losses in Vanderburgh County as a result of flood conditions and excessive moisture from 2007 to 2016 totaled $5,675,717. As of 2016, 79 percent of insurable crop acreage was insured. Crop insurance claims as a result of flooding are detailed in Table 3.15 on the following page.

### Table 3.15 Claims Paid in Vanderburgh County for Crop Loss as a Result of Flood and Excessive Moisture (2007-2016)

<table>
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<tr>
<th>Year</th>
<th>Crop</th>
<th>Excessive Moisture</th>
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<td>Acres</td>
<td>Claims Paid</td>
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<td>CORN</td>
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Source: USDA Risk Management Agency
Probability of Future Occurrences

The terms "10 year", "50 year", "100 year" and "500 year" floods are used to describe the estimated probability of a flood event happening in any given year. A 10 year flood has a 10 percent probability of occurring in any given year, a 50 year event a 2% probability, a 100 year event a 1% probability, and a 500 year event a 0.2% probability. While unlikely, it is possible to have two 100 or even 500 year floods within years or months of each other.

The potential for flooding can change and increase through various land use changes and changes to land surface. A change in environment can create localized flooding problems inside and outside of natural floodplains through the alteration or confinement of natural drainage channels. These changes can be created by human activities or by other events, such as wildfires, earthquakes, or landslides.

Based on data from NCDC, from 1993 to 2016, there were 86 records of flood or flash flood events over a 23 year period. The average number of flood and flash flood events calculates to 3.7 per year. The probability was assigned a rank of likely, 10-100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.

Magnitude/Severity

The magnitude was classified as catastrophic, multiple deaths; property destroyed and severely damaged; and/or interruption of essential facilities and service for more than 72 hours.

Flooding Hazard Summary by Jurisdiction

To demonstrate how flooding varies by jurisdiction, the geographic location of the known flood hazard areas was identified using flood insurance rate maps (FIRM) for Vanderburgh County. For those jurisdictions with no Special Flood Hazard Areas, the geographic location was noted as limited. To determine the rankings for the school districts, the critical facility layer of school buildings was compared against the Flood Insurance Rate Map.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Significant</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>High</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Significant</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>High</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Limited</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Limited</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
3.2.5 Dam Failure

Description

A dam is defined as a barrier constructed across a watercourse for the purpose of storage, control, or diversion of water. Dams are typically constructed of earth, rock, concrete, or mine tailings. A dam failure is the collapse, breach, or other failure resulting in downstream flooding.

A dam impounds water in the upstream area, referred to as the reservoir. The amount of water impounded is measured in acre-feet. An acre-foot is the volume of water that covers an acre of land to a depth of one foot. As a function of upstream topography, even a very small dam may impound or detain many acre-feet of water. Two factors influence the potential severity of a full or partial dam failure: the amount of water impounded, and the density, type, and value of development and infrastructure located downstream.

The failure of dams could result in injuries, loss of life, or damage to property, the environment, and the economy. Dams often serve multiple purposes, one of which may be flood control. Severe flooding and other storms can increase the potential that dams will be damaged and fail as a result of the physical force of the flood waters or overtopping.

Dams are usually engineered to withstand a flood with a computed risk of occurrence. If a larger flood occurs, then that structure will likely be overtopped. If during the overtopping, the dam fails or is washed out, the water behind is released as a flash flood. Failed dams can create floods that are catastrophic to life and property, in part because of the tremendous energy of the released water.

The hazard potential for dam failure is classified according to the following definitions accepted by the Interagency Committee on Dam Safety:

- **High Hazard Dam**—A dam located in an area where failure could result in any of the following: extensive loss of life, damage to more than one home, damage to industrial or commercial facilities, interruption of a public utility serving a large number of customers, damage to traffic on high-volume roads that meet the requirements for hazard class C dams or a high-volume railroad line, inundation of a frequently used recreation facility serving a relatively large number of persons, or two or more individual hazards described for significant hazard dams

- **Significant Hazard Dam**—A dam located in an area where failure could endanger a few lives, damage an isolated home, damage traffic on moderate volume roads that meet certain requirements, damage low-volume railroad tracks, interrupt the use or service of a utility serving a small number of customers, or inundate recreation facilities, including campground areas intermittently used for sleeping and serving a relatively small number of persons

- **Low Hazard Dam**—A dam located in an area where failure could damage only farm or other uninhabited buildings, agricultural or undeveloped land including hiking trails, or traffic on low-volume roads that meet the requirements for low hazard dams
Dam failures can result from any one or a combination of the following causes:

- Prolonged periods of rainfall and flooding, which causes most failures;
- Inadequate spillway capacity, resulting in excess overtopping flows;
- Internal erosion caused by embankment or foundation leakage or piping;
- Improper maintenance, including failure to remove trees, repair internal seepage problems, replace lost material from the cross section of the dam and abutments;
- Improper design, including the use of improper construction materials and construction practices;
- Negligent operation, including failure to remove or open gates or valves during high flow periods;
- Failure of upstream dams on the same waterway;
- Landslides into reservoirs, which cause surges that result in overtopping;
- High winds, which can cause significant wave action and result in substantial erosion; and
- Earthquakes, which typically cause longitudinal cracks at the tops of embankments and weaken entire structures.

**Geographic Location**

According to data from the Indiana Department of Natural Resources, Division of Water, Water Structures Program, Vanderburgh County has 22 total state-regulated dams. Of those, eight are high hazard dams and eight are significant hazard dams. The remaining six are low hazard dams.

Table 3.16 below summarizes low, high and significant hazard dams in Vanderburgh County. All high and significant hazard dams in Vanderburgh County are privately owned and are for recreational purposes as reported by the National Inventory of Dams.

<table>
<thead>
<tr>
<th>Dam Name</th>
<th>Hazard Class</th>
<th>Last Inspection</th>
<th>Height (Ft.)</th>
<th>Storage (Acre Feet)</th>
<th>River</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lake Shawnee Dam No.2</td>
<td>Low</td>
<td>2/10/2014</td>
<td>29</td>
<td>33</td>
<td>Unnamed Tributary Bluegrass Creek</td>
</tr>
<tr>
<td>Bell Conservation Lake</td>
<td>Low</td>
<td>2/26/2014</td>
<td>27</td>
<td>101</td>
<td>Unnamed Tributary Bluegrass Creek</td>
</tr>
<tr>
<td>Morgan Lake Dam</td>
<td>Low</td>
<td>1/15/1999</td>
<td>18</td>
<td>63</td>
<td>Unnamed Tributary Schlensker Ditch</td>
</tr>
<tr>
<td>Pavlick Lake Dam No.6</td>
<td>Low</td>
<td>3/24/2016</td>
<td>29</td>
<td>177</td>
<td>Unnamed Tributary Neu Creek</td>
</tr>
<tr>
<td>Servel Lake Dam</td>
<td>Low</td>
<td>1/1/1985</td>
<td>19</td>
<td>76</td>
<td>Unnamed Tributary Ohio River</td>
</tr>
<tr>
<td>Woodland Lake Dam</td>
<td>Low</td>
<td>2/21/2014</td>
<td>34</td>
<td>401</td>
<td>Unnamed Tributary Bayou Creek</td>
</tr>
<tr>
<td>Dam Name</td>
<td>Hazard Class</td>
<td>Last Inspection</td>
<td>Height (Ft.)</td>
<td>Storage (Acre Feet)</td>
<td>River</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------</td>
<td>-----------------</td>
<td>--------------</td>
<td>---------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Bittner Lake Dam</td>
<td>High</td>
<td>1/10/2002</td>
<td>24</td>
<td>76</td>
<td>Unnamed Tributary Maidlow Ditch</td>
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<tr>
<td>Kahre Lake Dam</td>
<td>High</td>
<td>11/16/2016</td>
<td>31</td>
<td>288</td>
<td>Locust Creek</td>
</tr>
<tr>
<td>Schnacke Lake No.1 Dam</td>
<td>High</td>
<td>7/2/2016</td>
<td>41</td>
<td>230</td>
<td>Unnamed Tributary Locust Creek</td>
</tr>
<tr>
<td>North Lake Estates West Lake Dam</td>
<td>High</td>
<td>5/28/2015</td>
<td>22</td>
<td>152</td>
<td>Unnamed Tributary Little Creek</td>
</tr>
<tr>
<td>Mater Dei Provincialate Dam</td>
<td>High</td>
<td>4/26/2016</td>
<td>33</td>
<td>223</td>
<td>Unnamed Tributary Little Creek</td>
</tr>
<tr>
<td>USI Student Residence Complex Lake Dam</td>
<td>High</td>
<td>6/25/2015</td>
<td>28</td>
<td>98</td>
<td>Unnamed Tributary Bayou Creek</td>
</tr>
<tr>
<td>USI Reflection Lake Dam</td>
<td>High</td>
<td>6/25/2015</td>
<td>35</td>
<td>135</td>
<td>Unnamed Tributary Bayou Creek</td>
</tr>
<tr>
<td>Lloyd Hahn Lake Dam</td>
<td>High</td>
<td>1/18/2017</td>
<td>30.7</td>
<td>220</td>
<td>Unnamed Tributary Bayou Creek</td>
</tr>
<tr>
<td>Lake Shawnee Dam No.2</td>
<td>Significant</td>
<td>3/13/2015</td>
<td>26</td>
<td>289</td>
<td>Unnamed Tributary Bluegrass Creek</td>
</tr>
<tr>
<td>Ray Nell Lake Dam</td>
<td>Significant</td>
<td>3/27/2015</td>
<td>21</td>
<td>63</td>
<td>Unnamed Tributary Sclensker Ditch</td>
</tr>
<tr>
<td>Lake Talahi Lake Dam</td>
<td>Significant</td>
<td>3/15/2015</td>
<td>36.6</td>
<td>259</td>
<td>Unnamed Tributary Pigeon Creek</td>
</tr>
<tr>
<td>Edgewater Lake Dam</td>
<td>Significant</td>
<td>4/1/2015</td>
<td>29</td>
<td>172</td>
<td>Unnamed Tributary Barr Creek</td>
</tr>
<tr>
<td>Dr. Mok Lake Dam</td>
<td>Significant</td>
<td>5/11/1982</td>
<td>18</td>
<td>*</td>
<td>Unnamed Tributary Carpenter Creek</td>
</tr>
<tr>
<td>Schnacke Lake No.3 Dam</td>
<td>Significant</td>
<td>4/15/2015</td>
<td>40</td>
<td>*</td>
<td>Unnamed Tributary Locust Creek</td>
</tr>
<tr>
<td>Schnacke Lake No.4 Dam</td>
<td>Significant</td>
<td>4/15/2015</td>
<td>40</td>
<td>*</td>
<td>Unnamed Tributary Locust Creek</td>
</tr>
<tr>
<td>Schnacke Lake No.2 Dam</td>
<td>Significant</td>
<td>4/15/2015</td>
<td>40</td>
<td>*</td>
<td>Unnamed Tributary Locust Creek</td>
</tr>
</tbody>
</table>

Source: National Inventory of Dams and Indiana Department of Natural Resources

*- No records of Storage Volume per Indiana Department of Natural Resources

**Previous Occurrences**

There have been no reported previous occurrences of dam failure in Vanderburgh County.

**Probability of Future Occurrences**

Because dam failure is generally a secondary effect of other causes and hazards, calculating probability is difficult. Based on the past performance of these structures during flooding...
conditions, the HMPC determined that the probability of this hazard is **unlikely**, less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. Additionally, as reflected in Table 3.16, all but two of the high and significant state-regulated dams have been inspected within the last three years. Frequent inspections can identify needed repairs or improvements that may be necessary to prevent failure.

**Magnitude/Severity**

Although there have been no documented failures of state-regulated dams in Vanderburgh County and the probability of failure is low, if failure were to occur, it could be **catastrophic** for people and structures in the inundation path. According to the Indiana Department of Natural Resources, Emergency Action Plans and Inundation Maps are not required for privately-owned dams. As a result, data is not available to specifically address potential magnitude of failure in quantitative terms. Additionally, if additional development occurs in downstream areas where inundation would occur, the severity of failure would also increase.

**Dam Failure Hazard Summary by Jurisdiction**

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
3.2.6 Levee Failure

Description

Levees are earth embankments constructed along rivers and coastlines to protect adjacent lands from flooding. Floodwalls are concrete structures, often components of levee systems, designed for urban areas where there is insufficient room for earthen levees. When levees and floodwalls and their appurtenant structures are stressed beyond their capabilities to withstand floods, levee failure can result in loss of life and injuries as well as damages to property, the environment, and the economy.

Levees range from small agricultural levees that protect farmland from high-frequency flooding to large urban areas that protect people and property from larger-less frequent flooding events such as the 100-year and 500-year flood levels. For purposes of this discussion, levee failure will refer to both overtopping and breach of a levee as defined in FEMA’s Publication “So You Live Behind a Levee” (http://content.asce.org/ASCELeveeGuide.html).

Overtopping: When a Flood Is Too Big

Overtopping occurs when floodwaters exceed the height of a levee and flow over its crown. As the water passes over the top, it may erode the levee, worsening the flooding and potentially causing an opening, or breach, in the levee.

Breaching: When a Levee Gives Way

A levee breach occurs when part of a levee gives way, creating an opening through which floodwaters may pass. A breach may occur gradually or suddenly. The most dangerous breaches happen quickly during periods of high water. The resulting torrent can quickly swamp a large area behind the failed levee with little or no warning.

Earthen levees can be damaged in several ways. For instance, strong river currents and waves can erode the surface. Debris and ice carried by floodwaters—and even large objects such as boats or barges—can collide with and gouge the levee. Trees growing on a levee can blow over, leaving a hole where the root wad and soil used to be. Burrowing animals can create holes that enable water to pass through a levee. If severe enough, any of these situations can lead to a zone of weakness that could cause a levee breach. In seismically active areas, earthquakes and ground shaking can cause a loss of soil strength, weakening a levee and possibly resulting in failure. Seismic activity can also cause levees to slide or slump, both of which can lead to failure.
In 2004, as it initiated work under the Flood Map Modernization Initiative (Map Mod), FEMA determined that analysis of the role of levees in flood risk reduction would be an important part of the mapping efforts. A report issued in 2005 noted that the status of the Nation’s levees was not well understood and the condition of many levees and floodwalls had not been assessed since their original inclusion in the NFIP. As a result, FEMA established policies to address existing levees. As DFIRMs are developed, levees fall under one of the three following categories:

1) Accredited Levee – With the except of areas of residual flooding (interior drainage), if the data and documentation specified in 44 CFR 65.10 is readily available and provided to FEMA, the area behind the levee will be mapped as a moderate-risk area. There is no mandatory flood insurance purchase requirement in a moderate-risk area, but flood insurance is strongly recommended.

2) Provisionally Accredited Levee (PAL) – If data and documentation is not readily available, and no known deficiency precludes meeting requirements of 44 CFR 65.10, FEMA can allow the party seeking recognition up to two years to compile and submit full documentation to show compliance with 44 CFR 65.10. During this two-year period of provisional accreditation, the area behind the levee will be mapped as moderate-risk with no mandatory flood insurance purchase requirement.

3) De-Accredited Levees – If the information established under the 44 CFR 65.10 is not readily available and provided to FEMA, and the levee is not eligible for the PAL designation, the levee will be de-accredited by FEMA. The area behind the levee will be mapped as a high-risk area subject to mandatory flood insurance purchase requirement.

**Geographic Location**

In Vanderburgh County, there is one Accredited Levee System that provides flood protection for the City of Evansville and portions of unincorporated Vanderburgh County. This levee system is depicted on the Digital Flood Insurance Rate Map (DFIRM) dated March 17, 2011. The area behind the levee is mapped as moderate-risk with no mandatory flood insurance purchase requirement.

There are also several agricultural levees in the county that provide low-level protection to agricultural land during high-frequency flood events. The agricultural levees are not intended to provide protection for development or individuals.

The geographic location was assigned a rank of **significant**, 10-50 percent of planning area affected.

**Evansville-Vanderburgh County Levee (PAL Levee)**

The city of Evansville, Vanderburgh County, Indiana, is situated in the southwestern part of the state on the right bank of the Ohio River 792 miles below Pittsburgh, Pennsylvania. Following the major flood event of 1937 on the Ohio River, under the general authorization for the Ohio River Basin contained in the Flood Control Act approved August 28, 1937, the City of Evansville, in conjunction with the Louisville District of the U.S. Army Corps of Engineers, initiated the flood protection project. The resulting levee system provides protection to the City
of Evansville and portions of the unincorporated areas east of the City from a repetition of the 1937 flood, which had a recurrence interval greater than 500 years. The flood protection system is designed to pump rainwater from the city/county back into the river during high river conditions as well as prevent the river from backing into the sewer system.

The levee system project consists of 79,183 feet of earth levee, 8,175 feet of concrete wall, 1,761 feet of combined wall and highway, 3,160 feet of roadway levee, 20 pumping stations, 24 movable closures, and 15 sandbag closures. The protective works is made up of seven sections along both the Ohio River and Pigeon Creek as follows:

1) A Knight and Howell section began in June 1939 and was completed in 1948.
2) Gatewell construction began in 1976 and was completed in 1979.
4) Pigeon Creek, Unit 2, Part 1 began in 1974 and completed in 1985.

**Figure 3.12 Evansville-Vanderburgh County Levee**

The Evansville-Vanderburgh Levee Authority District (EVLAD) is responsible for operation and maintenance of the levee system. EVLAD is a separate body of the City of Evansville and Vanderburgh County governments and is governed by a three-member board. Funding to maintain this project is provided by local funds per an agreement between federal and local funds.
government entities. The EVLAD is partnered with the U. S. Army Corps of Engineers (Louisville District) who inspects the system annually. Any changes or modifications to the system must have approval by both the local levee district and the Corps of Engineers.

Flood stage at Evansville is 42 feet; zero elevation corresponds to 329.18 feet above sea level at the Court Street Gauge located at Dress Plaza. According to EVLAD, with all road closures in place, and pumps operational, the levee would overtop if the river stage reached 56.7 feet. At a river stage of 26 ft., EVLAD starts working 24 hours day, seven days a week, pumping rain/storm water into the river. After the river rises past 32 ft., a computerized remote control system is activated necessitating three employees per shift trouble-shooting and monitoring the remote control system.

**Agricultural Levees**

In addition to the Evansville-Vanderburgh County Levee that is provisionally accredited as providing flood protection, there are several agricultural levees in the County that provide minimal protection to agricultural land during high-frequency, low level flooding.

**Union Township Levee**

The Union Township Levee is located within the southwestern boundaries of Evansville, Indiana and is located approximately 9.25 miles southwest of downtown Evansville. The levee starts at the intersection of Hendricks Lane and Seminary Road in Evansville, Indiana and extends south-southwest for approximately 1.60 miles to the intersection of Old Henderson Road and Golden Rule Road. At the intersection of Old Henderson Road and Golden Rule Road, the levee parallels Old Henderson Road south-southwest for approximately 0.95 miles, terminating at an elevated farmhouse. Total project length is approximately 2.55 miles (all levee embankments).

According to the Louisville District U.S. Army Corps of Engineers, the maximum level of protection of the levee with its current design crest elevation, while maintaining no freeboard, is less than a 98% exceedance frequency (1-year event). The overtopping elevation is 365.5 Feet NGVD, or to stage 36.7 as measured by the Evansville River Gage.

**Other Agricultural Levees**

There are numerous other agricultural levees in Vanderburgh County that provide low-level protection to agricultural land. These levees are routinely overtopped and are not intended to protect structures or people.

**Previous Occurrences**

**Evansville-Vanderburgh County Levee**

Since its construction, the Evansville-Vanderburgh County Levee has not failed or been overtopped. Flood stage at Evansville is 42 ft; zero elevation corresponds to 329.18 feet above sea level at the Court Street gauge located at Dress Plaza. However, as indicated above, according to EVLAD, with all road closures in place, and pumps operational, the levee would
overtop if the river stage reached 56.7 feet. In recorded history, the river has never reached this level. The highest the river stage reached in recorded history is 53.7 feet, which was the river stage of the 1937 flood. This flood exceeded the 500-year recurrence interval.

Some high river stages of record at Evansville:

- January 29, 1937 53.7 ft.
- February 19, 1884 48.8 ft.
- February 18, 1883 48.6 ft.
- April 5, 1913 48.4 ft.
- March 11, 1945 48.2 ft.
- March 16, 1964 47.7 ft.
- March 10, 1997 47.5 ft.
- May 6, 2001 46.8 ft.

Since 1940 the Ohio River at Evansville has been above flood stage (42 ft.) 41 times. From 1950, it has been above 30 ft. 138 times.

**Agricultural Levees**

The Union Township Levee and Drainage Association indicated that the Union Township Levee is overtopped approximately every year, and that adding material to the crown after overtopping is a regular occurrence.

**Probability of Future Occurrences**

According to events and river stages in recorded history, it is unlikely that the Evansville-Vanderburgh County Levee would be overtopped. The EVLAD has the responsibility to ensure the levee is inspected and maintained to ensure that levee failure does not occur. Although overtopping or failure of this levee is unlikely, it remains a risk that could occur due to unprecedented river stages or inspection oversight or lack of maintenance.

It is likely that agricultural levees will continue to be overtopped during low-level high-frequency flood events. In land use and development planning, these levees should not be considered as providing protection for populations or development.

**Magnitude/Severity**

Although unlikely, the magnitude of an overtopping or failure of the Evansville-Vanderburgh County levee would be catastrophic as this levee protects developed, populated areas.

As for agricultural levees, overtopping occurs regularly. The magnitude is negligible and impacts are limited to agricultural losses.
## Levee Failure Hazard Summary by Jurisdiction

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
3.2.7 Infestations - Emerald Ash Borer

Description

The HMPC determined that potential infestation of the Emerald Ash Borer (EAB) is of particular concern in the planning area. This pest is a slender, emerald green beetle that is ½ inch long, and responsible for the destruction of approximately 20 million ash trees in Ohio, Michigan, Indiana, Illinois, and Maryland. This exotic beetle feeding on ash trees was discovered in southeastern Michigan in July 2002. On April 21, 2004, Emerald Ash Borer was confirmed in Indiana. Figure 3.13 is a photo of an Emerald Ash Borer.

Figure 3.13  Emerald Ash Borer

![Emerald Ash Borer](http://www.in.gov/dnr/entomolo/3443.htm)

Although ash trees are not necessarily important economically, they are important aesthetically. In addition, the need to remove numerous dead trees throughout the planning area could create problems for residents and local governments.

The Emerald Ash Borer (EAB), *Agrilus planipennis* (Fairmaire) (Coleoptera: Buprestidae), is a pest of ash trees native to Asia and first discovered in North America in 2002 in the Detroit, Michigan area. It has killed millions of ash trees and thousands of ash trees have been removed. Since this initial discovery, the core area affected by EAB has expanded. It has been detected in Windsor, Ontario (2003), Ohio (2003), Indiana (2004), Illinois (2006), Maryland (2006), Pennsylvania (2007), West Virginia (2007), Toronto, Canada (2007), Virginia (2008), Wisconsin (2008) and Missouri (2008).

The United States Department of Agriculture restricted the importation and movement of ash nursery stock from Canada into the United States in August 2007 to prevent the spread of Emerald Ash Borer. Illinois, Indiana and Ohio and some counties in Maryland, Missouri, Pennsylvania, West Virginia and Wisconsin are quarantined areas also.

All ash trees native to Indiana are susceptible to infestation by EAB. Trees become infested when adult beetles lay eggs on the bark, which hatch into larvae that bore into the tree. The larvae tunnel in the phloem layer (between bark and wood) and disrupt the movement of water and nutrients, eventually killing the tree. EAB appears to prefer trees under stress, but is capable of killing perfectly healthy trees.
Geographic Location

Figure 3.14 provides the currently identified areas of the Indiana and the surrounding states where EAB has been confirmed. In May 2010, the Department of Natural Resources has placed purple traps in trees in Vanderburgh County. To date, EAB has been detected in Vanderburgh County.

A recent audit revealed that of the 10,000 trees in public areas around Evansville, which includes approximately 700 ash trees. The geographic location was assigned a rank of extensive, 50-100 percent of planning area affected.

Figure 3.14 Emerald Ash Borer Locations in Indiana and Federal Quarantine

Source: United States Department of Agriculture
Figure 3.15 provides the known locations of EAB in the surrounding states.

**Figure 3.15  Locations of Emerald Ash Borer in Surrounding State**

![Map of Emerald Ash Borer locations](http://www.in.gov/dnr/entomolo/files/epMultiState_EABpos.pdf)


**Previous Occurrences**

There has been a documented occurrence of Emerald Ash Borer in Vanderburgh County.

**Probability of Future Occurrences**

Arborists and other local officials agree that the chances of sparing local trees from the Emerald Ash Borer’s destructive effects are slim to nonexistent. The insect population can travel naturally up to two miles per year. With several major transportation routes going through Vanderburgh County, the natural mobility is increased when, despite prohibitions, individuals transport lumber and firewood. The Emerald Ash Borer was found in Vanderburgh County in 2016. The probability of future occurrences was assigned a rank of **highly likely**, 100 percent chance of occurrence in the next year or happens every year.

To avoid the large cost associated with cleaning up a large number of trees at once, Evansville officials have chosen to cut them down on their own, starting with the weakest ones first. The tree-removal plan was adopted in early 2009. A few ashes in public cemeteries will be saved, as well as a "state champion" tree — the largest of its species in Indiana — in Wesselman Woods Nature Preserve. Ash trees can be protected by injecting them with chemicals, a procedure that must be done as often as every 2-3 years to be effective.
Magnitude/Severity

It is estimated that Ash trees make up 7 percent of all trees on public ground in Vanderburgh County. If all of them were to die after an infestation by the emerald ash borer, the city would not have the manpower to cut them down. Faced with such a prospect, officials would have to hire the help of tree services, placing a heavy burden on local budgets.

Infestation – Emerald Ash Borer Hazard Summary by Jurisdiction

The emerald ash borer is a regional hazard and impacts all jurisdictions in the planning area.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corp.</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
3.2.8 Infestations – West Nile Virus

Description

West Nile Virus (WNV) is one of several mosquito-borne viruses in the United States that can infect people. The virus exists in nature primarily through a transmission cycle involving certain species of mosquitoes and birds. Mosquitoes become infected with WNV when they feed on infected birds.

The West Nile Virus usually causes West Nile fever, a milder form of the illness, which can include fever, headache, body aches, swollen lymph glands, or a rash. A small number of individuals can develop a more severe form of the disease with encephalitis or meningitis and other neurological syndromes, including flaccid muscle paralysis. Health officials report individuals age 50 and over are at greatest risk for serious illness and even death from West Nile virus. However, people of all ages can be and have been infected with the virus.

WNV first struck the northern hemisphere in Queens, N.Y., in 1999 and killed four people. The disease spread from New York to the West Coast in three years. By 2003, all 50 states were warning of an outbreak.

A positive case of West Nile Virus in Vanderburgh County in a bird was first reported in 2001. Since that time, positive cases in humans, horses, and birds have been reported each year. The figure below presents human case data from 2002-2016.

The tenth annual West Nile Virus conference was held in Savannah, Georgia, in February 2009. Conclusions of the conference include:

- WNV has become the most common cause of arboviral neuro invasive disease in the U.S.
- WNV activity has also been detected at a lower level in Tropical Americas
- ArboNET, a cooperative surveillance system, was developed in response to WNV introduction
- Non-human activity has helped define the geographic location and spread of WNV
- WNND affects all age groups; causing more deaths and encephalitis in individuals > 50 years
- WNV human disease may have reached endemic level in the U.S.

Geographic Location

The entire planning area is subject to mosquito habitat. The geographic location was assigned a rank of extensive, 50-100 percent of planning area affected.

Previous Occurrences

The summer of 2010 was extremely hot and dry in Vanderburgh County. These conditions are of extreme concern due to the biology of the primary West Nile Vector, Culex pipiens. This mosquito breeds in stagnant ditches and catch basins in water with very high organic content.
With the drought conditions, the potential for significant numbers of this species and a WNV outbreak was high. The Vanderburgh County Vector Control program focused its efforts on controlling these habitats by treating the catch basins and ditches regularly. Despite the ideal conditions for an outbreak, the Indiana State Health Department conducted periodic adult mosquito surveillance, but numbers of mosquitoes caught were lower than previous years and none tested positive for WNV.

The table below presents the annual number of human disease cases in Vanderburgh County since 2003. Positive human cases of West Nile Virus in Indiana for 2010 are also presented in Figure 3.16. In 2015 there were three cases that were reported, 1 case was fatal and the other case remained in the hospital. In 2016, there were only two cases reported. The total of human cases between 2011-2016 is 13.

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>WNV Human Disease Cases</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>

Source: USGS West Nile Virus Historical Maps
http://diseasemaps.usgs.gov/wnv_historical.html

Figure 3.16  Human Disease Cases, 2016

Source: Indiana State Department of Health Arboviral Disease Mapping; http://isdhmaps.isdh.in.gov/apps/pubstat/WNVStat.htm
Probability of Future Occurrences

From 2003 to 2016 there have been 18 Cases in Vanderburgh County. The probability of a future occurrence is unlikely, less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years. The figure below presents the West Nile activity in the US as of January 2015.

Figure 3.17 West Nile Activities within the United States January 2015

Source: Center for Disease Control;
http://www.cdc.gov/ncidod/dvbid/westnile/Mapsactivity/surv&control11MapsAnybyState.htm

Magnitude/Severity

The magnitude/severity for this hazard is negligible, no or few injuries or illnesses; minor quality of life loss; little or no property damage; and/or brief interruption of essential facilities and services.

Infestation – West Nile Virus Hazard Summary by Jurisdiction

West Nile Virus is a regional hazard and impacts all jurisdictions in the planning area.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corp.</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
3.2.9 Mine Subsidence

Description

Mine subsidence is movement of the ground surfaces as a result of the collapse or failure of underground mine workings. In active underground mining operations using longwall mining or high extraction pillar recovery methods, subsidence can occur concurrently with the mining operation in a predictable manner. In abandoned mines where rooms and unmined coal pillars are often left in various sizes and patterns, it may be impossible to predict if and when subsidence will occur. Mine subsidence resulting from abandoned room and pillar mines can generally be classified as either sinkhole subsidence or trough subsidence.

Mine subsidence can occur as a result of mining at any depth. As a general rule, the total surface area affected by subsidence increases as the depth of mining increases. This means a structure can be damaged by subsidence even if it is located directly above a pillar or solid block of coal.

Geographic Location

All of Indiana's coal is located in the west-central and southwestern portion of the State in a large geologic structure known as the Illinois Basin. Illinois Basin coal originated from plant material that accumulated in tropical wetlands during the Pennsylvanian Period of geologic time (approximately 300 million years ago).

For more than 150 years, the coal region of west-central and southwestern Indiana has undergone widespread mining and that continues in the present (see 0 3.18). But there are no surface or underground coal mines active in Vanderburgh County now. The now inactive mines are presented in Figure 3.19. Underground (deep) mining was the dominant mining technique until the 1950s when the development of large-scale excavation and transportation equipment made surface (strip) mining more efficient. Most of Indiana's underground mines used a method called room-and-pillar mining, whereby 20 to 50 percent of the coal is left in the mine to support the overlying rock. In instances where the remaining coal pillars are insufficient to bear the weight of the overlying rock, subsidence of the mine roof will occur. Subsidence may occur decades or centuries after an underground mine is abandoned. All undermined areas are at risk of subsidence, but it is not possible to predict when, if ever, subsidence will occur at a given locality.

Common factors causing or affecting mine subsidence include:

- Time elapsed since mining;
- Depth of the mine;
- Water conditions of the mine;
- Type and thickness of rock and sediment overlying the mine; and
- Method of mining and plan shape of the mine.
There are also special factors of importance for transportation agencies. Due to the driving force for subsidence being gravity:

- Added weight of fill, especially at bridge approaches, could accelerate subsidence; and
- Acceleration and amplification of gravity forces from earthquakes could accelerate the subsidence.

About 100,000 acres of southwestern Indiana are undermined, but there are no estimates of the total acreage of subsidence damage. Subsidence is indicated by the formation of sinkholes, ponds, and troughs, alteration of the flow of ground water, and damage to manmade structures. The effects of subsidence, which are long lasting in many places and may not be eliminated by natural processes for decades or centuries, may be difficult to recognize and must be studied in the field and on aerial photographs. The character and areal extent of subsidence, as well as the time elapsed before its formation; depend on the layout of a mine, the methods used in mining, the depth of a mine, the character of the rocks and sediments overlying a mine, the flow of groundwater through the workings, and later human activity, such as surface mining.

Within Vanderburgh County, the area of parcels which overlay with the area of the identified mines is approximately 3-percent of the total planning area. Thus, the geographic location was assigned a rank of limited, less than 10 percent of planning area affected.
Figure 3.18  Map of Coal Mines in Indiana, 2008

2007 COAL STATISTICS

In 2007, 70 companies operated 169 surface mines and 6 underground mines in Indiana. The surface mines produced 33.1 million short tons, while underground operations produced 0.3 million short tons. (Indiana Department of Natural Resources, Division of Reclamation, 2007). Total coal production in excess of 35 million short tons in Indiana ranked eighth out of all coal-producing states in 2007. (U.S. Department of Energy, 2007).

Source: Directory of Coal Mines and Producers in Indiana, 2008
Figure 3.19  Vanderburgh County Coal Mines

DATA AVAILABILITY

The Indiana Geological Survey has additional information for many of the mines shown on this map. Additional information may include detailed maps showing underground mine workings, mine history information, and coal production data. Requests for specific mine information should be directed to the Energy Resources Section:

Indiana Geological Survey
611 N. Walnut Grove
Bloomington, IN 47405
Phone: 812-855-7636
FAX: 812-855-2862
Email: IGSINFO@indiana.edu
URL: http://www.indiana.edu/~igs

Some mine and entry locations are approximate and incomplete. Please provide additions or corrections to Head, Energy Resources Section, Indiana Geological Survey.

DISCLAIMER

This map was compiled by the Indiana Geological Survey, using data believed to be accurate; however, a margin of error is inherent in all maps. This product is distributed “AS-IS” without warranties of any kind, either expressed or implied, including but not limited to warranties of suitability of particular purpose or use. There is no attempt in either the design or production of this map to define the limits or jurisdiction of any federal, state or local government. This map is intended for use only at the scale of 1:24,000 or smaller. A detailed on-the-ground survey and historical analysis of a single site may differ from this map.

Indiana Coal Mine
Information System
Indiana Geological Survey
Indiana University
### Table 3.18  Coal Mines in Vanderburgh County

<table>
<thead>
<tr>
<th>Mine Number</th>
<th>Mine Name</th>
<th>Start Year</th>
<th>End Year</th>
<th>Area (sq. meter(s))</th>
<th>Perimeter (meters)</th>
<th>Mine Type</th>
<th>Source Confidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>810002</td>
<td>Kohler Farm Drift</td>
<td>1858</td>
<td>1898</td>
<td>870</td>
<td>135</td>
<td>A</td>
<td>Secondary</td>
</tr>
<tr>
<td>810003</td>
<td>Stevens Farm Drift</td>
<td>1898</td>
<td>1898</td>
<td>882</td>
<td>136</td>
<td>A</td>
<td>Secondary</td>
</tr>
<tr>
<td>800117</td>
<td>Unity Mine</td>
<td>1885</td>
<td>1891</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sunnyside #2 Mine</td>
<td>1892</td>
<td>1895</td>
<td>4,587,574</td>
<td>14,510</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>Unity Mine</td>
<td>1900</td>
<td>1913</td>
<td></td>
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<tr>
<td></td>
<td>Crescent #1 Mine</td>
<td>1914</td>
<td>1933</td>
<td>392,382</td>
<td>5,709</td>
<td>U</td>
<td>Secondary</td>
</tr>
<tr>
<td>800118</td>
<td>Diamond Mine</td>
<td>1883</td>
<td>1929</td>
<td>1,257,539</td>
<td>10,486</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td>800119</td>
<td>Crescent #2 Mine</td>
<td>1937</td>
<td>1946</td>
<td>854,011</td>
<td>11,955</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td>800120</td>
<td>Ingleside Mine</td>
<td>1883</td>
<td>1917</td>
<td>727,152</td>
<td>6,339</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>Bodium Mine</td>
<td>1858</td>
<td>1882</td>
<td>1,940,885</td>
<td>6,664</td>
<td>U</td>
<td>Secondary</td>
</tr>
<tr>
<td>800121</td>
<td>First Avenue Mine</td>
<td>1883</td>
<td>1913</td>
<td>537,170</td>
<td>3,748</td>
<td>U</td>
<td>Secondary</td>
</tr>
<tr>
<td>800122</td>
<td>Sunnyside Mine</td>
<td>1883</td>
<td>1936</td>
<td>2,815,621</td>
<td>16,012</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1883</td>
<td>1936</td>
<td>691,801</td>
<td>6,076</td>
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<td>Secondary</td>
</tr>
<tr>
<td>800751</td>
<td>Black Crow Mine</td>
<td>1934</td>
<td>1939</td>
<td>46,532</td>
<td>2,138</td>
<td>U</td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td>Banner Mine</td>
<td>1939</td>
<td>1939</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>802382</td>
<td>Echo Mine</td>
<td>1883</td>
<td>1888</td>
<td></td>
<td></td>
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</tr>
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<td></td>
<td>Cooperative Mine</td>
<td>1891</td>
<td>1895</td>
<td>123,410</td>
<td>1,294</td>
<td>U</td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td>Union Mine</td>
<td>1895</td>
<td>1898</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Mine Number:  Indiana Geological Survey Mine ID Number  
Year Start:  Approximate date that mine opened  
Year End:  Approximate date that mine closed  
Mine Type:  A – adit mine, small underground mine; U – underground mine  
Primary:  Mapped from company mine map  
Secondary:  Mapped from source other than a company mine map, including IGS publications, field notes and maps of IGS geologists, and Reports of the State Inspector of Mines
Previous Occurrences

There have not been any recorded events of mine subsidence within Evansville and Vanderburgh County. Therefore, it is not a high priority hazard facing Evansville and Vanderburgh County.

Probability of Future Occurrences

Because the initial stages of subsidence are hidden and because so many factors are involved, predicting subsidence above abandoned room-and-pillar mines for a particular locality is impossible. But as more information is gathered, determining probabilities of subsidence for selected sites may be possible. Because there have not been any recorded events within the planning area, the probability of future occurrence is assigned a rank of unlikely, less than 1 percent chance of occurrence in next 100 years or has a recurrence interval of greater than every 100 years.

Magnitude/Severity

Due to the parcels and structures located above the noted mines, this hazard is classified as critical, isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours.

Mine Subsidence Hazard Summary by Jurisdiction

To demonstrate how mine subsidence varies by jurisdiction, the geographic location of the known hazard areas were identified using underground mine mapping for Vanderburgh County. There are no mines located within the Town of Darmstadt.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Limited</td>
<td>Unlikely</td>
<td>Critical</td>
<td>Low</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Limited</td>
<td>Unlikely</td>
<td>Critical</td>
<td>Low</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School</td>
<td>Limited</td>
<td>Unlikely</td>
<td>Critical</td>
<td>Low</td>
</tr>
</tbody>
</table>
3.2.10 Severe Weather – Extreme Temperatures

Description

Extreme temperature events, both hot and cold, can have severe impacts on natural ecosystems, agriculture and other economic sectors, human health and mortality. All areas of Evansville and Vanderburgh County have an equal chance of experiencing extreme temperatures in the summer or winter months. The normal monthly temperatures for Evansville are presented Table 3.19a and 3.19b below.

<table>
<thead>
<tr>
<th>Table 3.19a</th>
<th>1971-2000 National Climatic Data Center Normals, Temperature Summary (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station</td>
<td>Jan</td>
</tr>
<tr>
<td>Evansville Museum</td>
<td>33.2</td>
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<tr>
<td>Evansville Regional Airport</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 3.19b</th>
<th>2006-2010 National Climatic Data Center Normals, Temperature Summary (°F)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Station</td>
<td>Jan</td>
</tr>
<tr>
<td>Evansville Museum</td>
<td>44.9</td>
</tr>
<tr>
<td>Evansville Regional Airport</td>
<td>42.6</td>
</tr>
</tbody>
</table>

Source: 2006-2010 Normal Temperatures Natural Centers for Environmental Information ncdc.noaa.gov/normalsPDFaccess
**Extreme Heat**

Temperatures that remain 10 degrees or more above the average high temperature for the region and last for several weeks are defined as extreme heat by FEMA. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when high atmospheric pressure traps damp air near the ground.

In an effort to alert the public to the hazards of prolonged heat and humidity episodes, the National Weather Service devised the “heat index”. The heat index is an accurate measure of how hot it feels to an individual when the affects of humidity are added to high temperature. Figure 3.21 provides the heat index chart demonstrating how the heat index value is determined based on relative humidity. Table 3.20 that follows presents heat index values and their potential physical effects.
Figure 3.21  Heat Index (HI) Chart

<table>
<thead>
<tr>
<th>Temperature (°F)</th>
<th>80</th>
<th>82</th>
<th>84</th>
<th>86</th>
<th>88</th>
<th>90</th>
<th>92</th>
<th>94</th>
<th>96</th>
<th>98</th>
<th>100</th>
<th>102</th>
<th>104</th>
<th>106</th>
<th>108</th>
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</thead>
<tbody>
<tr>
<td>40</td>
<td>80</td>
<td>81</td>
<td>83</td>
<td>85</td>
<td>88</td>
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<td>124</td>
<td>130</td>
<td>137</td>
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<tr>
<td>45</td>
<td>80</td>
<td>82</td>
<td>84</td>
<td>87</td>
<td>89</td>
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<td>100</td>
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<td>109</td>
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<td>91</td>
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<td>104</td>
<td>109</td>
<td>114</td>
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<td>124</td>
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<td>137</td>
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<td>160</td>
</tr>
</tbody>
</table>

*Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity*

Source: National Weather Service (NWS)

Note: Exposure to direct sun can increase Heat Index values by as much as 15°F. The shaded zone above 105°F corresponds to an HI that may cause increasingly severe heat disorders with continued exposure and/or physical activity.

Table 3.20  Heat Index Values and Effects

<table>
<thead>
<tr>
<th>Heat Index Values</th>
<th>Heat Index Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combination of Heat and Humidity</td>
<td>Fatigue possible with prolonged exposure and/or physical activity.</td>
</tr>
<tr>
<td>80 to 90 degrees F</td>
<td>Sunstroke, heat cramps, and heat exhaustion possible with prolonged exposure and/or physical activity.</td>
</tr>
<tr>
<td>90 to 105 degrees F</td>
<td>Sunstroke, heat cramps or heat exhaustion likely, and heatstroke possible with prolonged exposure and/or physical activity.</td>
</tr>
<tr>
<td>105 to 130 degrees F</td>
<td>Heatstroke/sunstroke highly likely with continued exposure.</td>
</tr>
</tbody>
</table>

The National Weather Service will issue a *Heat Advisory* for Evansville-Vanderburgh County when daytime heat indices are at or above 105°F and nighttime heat indices are at or above 80°F. An *Excessive Heat Warning* is issued when the heat index equals or exceeds 115°F for three hours or longer with a minimum heat index of at least 80°F during a 24-hour period. An excessive heat advisory is also issued when heat advisory conditions persist for at least 3 days. In either of these scenarios, the heat becomes dangerous for a large portion of the population. Those at greatest risk for heat-related illness include infants and children up to four years of age, people 65 years of age and older, people who are overweight, and people who are ill or on...
certain medications. However, even young and healthy individuals are susceptible if they participate in strenuous physical activities during hot weather.

**Extreme Cold**

Extreme cold can cause hypothermia (an extreme lowering of the body’s temperature), frostbite and death. Infants and the elderly are particularly at risk, but anyone can be affected. While there are no firm data on hypothermia (cold) death rates, it is estimated that 25,000 older adults die from hypothermia each year. The National Institute on Aging estimates that more than 2.5 million Americans are especially vulnerable to hypothermia, with the isolated elderly being most at risk. About 10 percent of people over the age of 65 have some kind of temperature-regulating defect, and 3-4 percent of all hospital patients over 65 are hypothermic. Also at risk are those without shelter or who are stranded, or who live in a home that is poorly insulated or without heat. Other impacts of extreme cold include asphyxiation (unconsciousness or death from a lack of oxygen) from toxic fumes from emergency heaters, household fires, and frozen/burst pipes.

In 2001, NWS implemented an updated Wind Chill Temperature (WCT) index. This index was developed by the National Weather Service to describe the relative discomfort/danger resulting from the combination of wind and temperature. Wind chill is based on the rate of heat loss from exposed skin caused by wind and cold. As the wind increases, it draws heat from the body, driving down skin temperature and eventually the internal body temperature.

Specifically, the new WCT index:

- Calculates wind speed at an average height of five feet (typical height of an adult human face) based on readings from the national standard height of 33 feet (typical height of an anemometer);
- Is based on a human face model;
- Incorporates modern heat transfer theory (heat loss from the body to its surroundings, during cold and breezy/windy days);
- Lowers the calm wind threshold to 3 mph;
- Uses a consistent standard for skin tissue resistance; and
- Assumes no impact from the sun (i.e., clear night sky).

Figure 3.22 shows the relationship of wind speed to apparent temperature and typical time periods for the onset of frostbite.
The National Weather Service will issue a Wind Chill Advisory for Evansville and Vanderburgh County when wind-chill temperatures are expected to reach –4 °F to –20 °F.

**Geographic Location**

The geographic location was assigned a rank of extensive, the entire planning area is subject to extreme temperatures and all participating jurisdictions are affected.

**Previous Occurrences**

Analysis of daily maximum temperatures recorded at the Evansville Airport Cooperative Weather Station revealed that during the 8-year period from 2000-2007; 279 days had a high temperature exceeding 90 degrees Fahrenheit. This translates to nearly 10 percent of the days during that time period. Six days in this time period, all in August 2007 had a high temperature that exceeded 100 degrees Fahrenheit. The record high temperature at this station occurred on July 28, 1930 with a temperature of 111 degrees Fahrenheit.

Analysis of daily minimum temperatures recorded at the Evansville Airport Cooperative Weather Station revealed that during the 8-year period from 2000-2007; 48 days had a low temperature of ten degrees Fahrenheit or less. Twenty-one days in this time period had a low temperature of zero or below. The record low temperature at this station occurred on February 2, 1951 with a temperature of minus 23 degrees Fahrenheit.
The following section summarizes 25 previous extreme temperature events in Vanderburgh County in the 42-year period from 1974 to 2016. Information on these events came from the National Climatic Data Center and the Evansville - Vanderburgh County Community Comprehensive Hazard Analysis. Of the historical events summarized, 16 were extreme heat events and 9 were extreme cold events.

- **Summer July, 28, 2015 Extreme Heat**—Heat indices peaked around 110 degrees on two consecutive afternoons. The maximum observed heat index at the Evansville airport was 110 degrees on the 29th. Emergency room doctors at a local hospital reported a sharp increase in heat-related illnesses, such as heat cramps and heat strokes. However, no exact numbers were available. The heat caused some interruptions of outdoor projects. Roofing repairs at the Warrick County courthouse were delayed. A 500 mb high over the southern Plains built slowly east and northeast into the Mid-Mississippi Valley. At the surface, weak high pressure over the Tennessee Valley produced a persistent southwest wind flow.

- **Summer July 1, 2012 Extreme Heat**—The historic heat wave that began in late June continued into July. This heat was comparable to the intense heat experienced in the 1930's. The high temperature exceeded 100 degrees on 10 out of 11 days going back to June 28 and ending on July 8. At Evansville, the high of 107 degrees on the 5th was one degree shy of the all-time highest temperature in 115 years of records at Evansville. The all-time record of 108 degrees was set on July 13, 1936. Daily high temperature records were broken on five of the first six days of the month. New daily records were 105 degrees on the 1st, 103 on the 2nd, 103 on the 4th, 107 on the 5th, and 104 on the 6th. From the 1st to the 6th, humidity levels were not especially high due to the ongoing drought, so heat index values were close to the actual temperature. Higher humidity on the 7th and 8th raised peak heat index values to between 109 and 115 degrees. There were three fatalities due to the heat. An elderly couple died of heat exhaustion inside their mobile home in Evansville. The air conditioner outside the home was not working. The temperature was measured at 108 degrees inside the home when they were found. A pet bird also died. The third fatality occurred outdoors. A 51-year-old man was found dead along railroad tracks. Strong high pressure aloft remained anchored over the middle part of the country through the first week of July.

- **Summer 1974, Extreme Summer Heat**—Summer temperatures reached all time highs in much of the Central and South United States resulting in numerous deaths.

- **January, 1978, Extreme Winter Cold**—The Winter of 1978 was the year that the State of Indiana experienced the worst blizzard on record. It hit the region on the 25th through the 27th of January and dumped up to 20 inches of snow onto the central and southern portions of the State. An amazing 40 inches was recorded in the extreme northern portions of Indiana. Even worse were the powerful wind gusts that reached up to 55 mph which caused snow drifting that reached in excess of 10 to 20 feet and deadly wind chills as low as -50. A Federal State of Emergency was declared for this event.

- **January 1979, Extreme Winter Cold**—In January of 1979, significant snows fell again, but ice storms came with it, making the state virtually stand still for two weeks. There were significant power outages, collapsed trees, and commercial and residential property damages
Damages were estimated at just over 1.5 million dollars. A federal disaster declaration was given to this event to assist in cleaning up.

- **Summer, 1988, Extreme Summer Heat**—In 1988, much of the country was experiencing drought conditions with extremely high temperatures.

- **January 14, 1994, Extreme Cold**—Bitter cold weather settled over Indiana during the third week of January. Many locations recorded daily minimum temperatures below zero each day from January 14 to January 21. The coldest temperatures were recorded on the morning of January 19, when a new record minimum for the state of Indiana was established with a reading of -36 at the National Weather Service cooperative weather station at New Whiteland in Johnson County. Other record low temperatures recorded on the 19th included an all time record low of -27 at Indianapolis, and **record lows for the day of -17 at Evansville, -18 at Fort Wayne, and -21 at South Bend.** Some locations with official temperatures of -30 or colder on the 19th included Cambridge City with -35, Martinsville with -35, Spencer with -33, the Bloomington Airport with -33, Salem with -32, Rushville with -31, and Brookville with -31. **Three people in Vanderburgh County died** as a result of the extreme cold. A 79 year woman died from hypothermia in her home, a 77 year old man died from exposure while working on his farm, and a 46 year old man froze to death after he passed out in his car.

- **July 13, 1995, Heat Wave**—Heat wave conditions developed across all of Indiana. High temperatures reached between 95 and 105 degrees with heat indices between 100 and 120 degrees. The Evansville area temperatures reached or exceeded 95 degrees from July 11-17. Nearly all heat related deaths occurred in the sick or elderly populations and most occurred in northwest Indiana. Also, nearly 800,000 baby chickens died at the Rose Acre Farms in Seymour resulting in losses totaling near one million dollars.

- **February 2, 1996, Extreme Cold**—The most severe cold snap of the 1995-96 winter season caused **water pipes to burst and heating systems to malfunction.** The high temperature at Evansville only reached 6 degrees on the 3rd, followed by a low of minus 7 on the 4th.

- **January 10, 1997, Extreme Wind Chill**—Arctic air blew into the region in the wake of a departing snowstorm. A wind chill advisory was issued for wind chills as low as minus 30.

- **July 25, 1997, Excessive Heat**—High temperatures rose into the mid to upper 90s for three consecutive days. High humidity raised the heat index to between 105 and 115 degrees. The potentially hazardous conditions prompted the **issuance of a heat advisory.**

- **February 1, 1998, Abnormal Warmth**—The month of February averaged well above normal. At Evansville, this was the sixth warmest February on record. The mild temperatures provided area residents with unusual opportunities for outdoor recreation. Many trees and plants, such as forsythia and daffodils, blossomed early. Unfortunately, the premature blossoms were vulnerable to late season cold snaps.

- **July 18, 1999, Excessive Heat**—Prolonged heat and humidity set in around mid month and continued through the latter half of July. High temperatures were in the 90s for the last 14 days of the month, including a 98-degree reading on the 30th. High humidity sent afternoon heat indices to between 105 and 115 degrees. **A Heat Advisory was in effect for over a week.** Power usage approached or exceeded record levels. There was a slight increase in emergency room visits for heat exhaustion.
• **December 12, 2000, Extreme Cold**—An invasion of arctic air occurred on December 12. The arctic air became permanently entrenched over the region for the remainder of the month, resulting in the second coldest December on record at Evansville. The average monthly temperature of 23.6 degrees was 11.6 below normal. On the coldest day of the month, the 22nd, the high was 15 and the low was 2. **Unusually high energy prices**, combined with the record cold, caused homeless shelters to fill to capacity. The usual problems associated with frigid temperatures, such as frozen pipes and water main breaks, were common during the latter half of the month.

• **January 1, 2001, Extreme Cold**—The prolonged arctic freeze that began during the second week of December finally ended by January 4. During the first few days of the new year, temperatures averaged 15 to 25 degrees below normal. Overnight lows were around zero.

• **January 23, 2003, Extreme Cold/Wind Chill**—Wind chills fell to 12 below zero across southwest Indiana during the morning hours. The extremely cold weather was a factor in the closing of schools in the Evansville area, and homeless shelters were filled beyond capacity. A southwest Indiana power company set a record for winter peak electric demand. This cold snap was just one of many cases of harsh winter weather during January. After the relatively mild winters of the past several years, the bitter mid-winter cold came as a shock to many. Temperatures fell below zero at some locations for the first time in several years. The low temperature at Evansville was zero, but some outlying areas were colder.

• **December 23, 2004, Extreme Cold/Wind Chill**—Bitterly cold temperatures arrived in the wake of a paralyzing snowstorm. The low temperature on Christmas morning was 11 degrees below zero at Evansville, which set a record for the date. This was the coldest temperature since January of 1994. It was four degrees shy of the coldest December temperature on record at Evansville, where records date back to 1897.

• **July 21, 2005, Excessive Heat**—Several days of excessive heat and humidity caused a significant increase in heat-related illnesses. A local hospital in Gibson County reported treating four people, all of whom were involved in outdoor activities. Statistics from Evansville hospitals were unavailable. The heat index peaked from 100 to 110 degrees each afternoon. True air temperatures reached the lower to mid 90's, with overnight lows in the lower to mid 70's. At Evansville, the heat index topped out at 109 degrees on the 21st, 105 on the 22nd, 98 on the 23rd, 109 on the 24th, 106 on the 25th, and 104 on the 26th. These heat indices were representative of the rest of southwest Indiana. The heat wave was the result of an expansive surface high pressure system extending from the Gulf of Mexico to the Great Lakes. A light southerly wind flow, combined with moist ground from the remnants of Hurricane Dennis earlier in the month, allowed dew points to hover just below 80 degrees at times.

• **August 19, 2005, Excessive Heat**—The heat index topped 105 degrees across most of southwest Indiana on two consecutive afternoons. At Evansville, the official peak heat indices were 106 degrees on the 19th and 107 on the 20th.

• **July 31, 2006, Heat**—Heat indices rose to around 105 degrees during the afternoon hours. At the Evansville airport, the highest observed hourly heat index was 105 degrees.

• **August 1, 2006, Heat**—Heat indices across southwest Indiana rose to 105 degrees or more on the afternoons of August 1st and 2nd. At Evansville, the heat index peaked at 107 degrees.
on August 1st and 105 degrees on August 2nd. A utility company based out of Evansville set an electricity demand record on August 1st.

- **August 7, 2007, Heat**—Surface high pressure located over the Deep South remained nearly stationary. A persistent hot and humid southwest wind flow around this high brought an extended period of dangerously high heat indices, ranging from 105 to 110 degrees on several afternoons. Four cooling centers were opened in Evansville/Vanderburgh County. 46 people attended the shelters. A count of heat-related illnesses was unavailable from local hospitals.

- **July 21, 2008, Heat** —Hot and humid conditions prevailed as a large upper-level ridge of high pressure covered the south central United States. The heat index peaked around 105 degrees for a few hours at Evansville.

- **August 5, 2008, Heat**—A large and strong high in the upper levels of the atmosphere stretched from the Tennessee Valley to the Plains. This feature contributed to hot and humid weather. Afternoon heat indices peaked near 105 degrees over parts of southwest Indiana, mainly south of Interstate 64.

- **June 20, 2010, Heat**—High temperatures reached the mid to upper 90's during this four-day streak of high heat indices. High humidity produced heat indices locally around 105 degrees on some afternoons. Most counties reached the 105-degree threshold for a Heat Advisory only once or twice. One county never quite reached it. A strong upper-level ridge remained quasi-stationary from the Tennessee Valley to the southern Plains through the period of heat.

According to the USDA’s Risk Management Agency, insured crop losses in Vanderburgh County as a result of heat and hot wind from 2007-2016 totaled $1,064,320. As of 2016, 79 percent of insurable crop acreage was insured. Crop insurance claims as a result of drought are detailed in Table 3.21 below.

**Table 3.21 Claims Paid in Vanderburgh County for Crop Loss as a Result of Heat and Hot Wind (2007-2016)**

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Heat Acres</th>
<th>Heat Claims Paid</th>
<th>Hot Wind Acres</th>
<th>Hot Wind Claims Paid</th>
<th>Total Claims Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>CORN</td>
<td>161</td>
<td>$8,042</td>
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<td>$8,042</td>
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<tr>
<td>2011</td>
<td>SOYBEANS</td>
<td>248</td>
<td>$15,481</td>
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<td>$15,481</td>
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<tr>
<td>2012</td>
<td>CORN</td>
<td>2,586</td>
<td>$874,272</td>
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<td>$874,272</td>
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<tr>
<td></td>
<td>SOYBEANS</td>
<td>1,304</td>
<td>$157,485</td>
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<td>$157,485</td>
</tr>
<tr>
<td>2013</td>
<td>CORN</td>
<td>40</td>
<td>$6,544</td>
<td>13</td>
<td>$2,181</td>
<td>$8,725</td>
</tr>
<tr>
<td>2016</td>
<td>CORN</td>
<td>6</td>
<td>$315</td>
<td></td>
<td></td>
<td>$315</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td>4,345</td>
<td>$1,062,139</td>
<td>13</td>
<td>2181</td>
<td>$1,064,320</td>
</tr>
</tbody>
</table>
Probability of Future Occurrences

On average, these events have a recurrence interval of 60 percent in any given year. The probability was assigned a rank of highly likely.

Magnitude/Severity

Due to the potential for fatalities and the possibility for the loss of electric power due to increased strain on power generation and distribution for air conditioning, periods of extreme heat can severely affect the planning area. In addition, accompanying drought may compound the problem exacerbating agricultural and economic losses. The impacts of extreme cold in the planning area have been primarily associated with agricultural losses. However, extreme cold can also cause injury such as frostbite or in extreme situations, death.

Although the most common impact of extreme temperatures is losses to crops, the primary concerns expressed by the planning committee for this hazard are the human health and safety issues. The magnitude is classified as limited, minor injuries and illnesses; minimal property damage that does not threaten structural stability; and/or interruption of essential facilities and services for less than 24 hours.

Extreme Temperatures Hazard Summary by Jurisdiction

Extreme temperature is a regional hazard and impacts all jurisdictions in the planning area.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corp</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
</tr>
</tbody>
</table>
3.2.11 Severe Weather - Thunderstorms / High Winds

Description

Thunderstorms are defined as localized storms, always accompanied by hail, lightning, damaging winds, heavy rain causing flash flooding (discussed separately in Section 3.2.x) and sometimes tornadoes (discussed separately in Section 3.2.x). Thunderstorms can produce a strong out-rush of wind known as a down-burst, or straight-line winds which may exceed 120 mph. These storms can overturn mobile homes, tear roofs off of houses and topple trees.

According to the National Oceanic and Atmospheric Administration, approximately 10 percent of the thunderstorms that occur each year in the United States are classified as severe. The typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes. A thunderstorm is classified as severe when it contains one or more of the following phenomena:

- Hail measuring three quarters of an inch or larger in diameter; and/or
- Winds equal or exceed 58 mph.

A severe thunderstorm watch is issued by the National Weather Service when the weather conditions are such that a severe thunderstorm is likely to develop. They are normally issued well in advance of the actual occurrence of severe weather. During the watch, people should review severe thunderstorm safety rules and be prepared to move to a place of safety if threatening weather approaches.

A severe thunderstorm warning is issued when a severe thunderstorm has been sighted or indicated by weather radar. At this point, the danger is very serious and it is time to go to a safe place, turn on a battery-operated radio or television, and wait for the "all clear" from authorities.

High Winds

A severe thunderstorm can produce winds that can cause as much damage as a weak tornado and these winds can be life threatening. The damaging winds of thunderstorms include downbursts, microbursts, and straight-line winds. Downbursts are localized currents of air blasting down from a thunderstorm, which induce an outward burst of damaging wind on or near the ground. Microbursts are minimized downbursts covering an area of less than 2.5 miles across. They include a strong wind shear (a rapid change in the direction of wind over a short distance) near the surface. Microbursts may or may not include precipitation and can produce winds at speeds of more than 150 miles per hour. Damaging straight-line winds are high winds across a wide area that can reach speeds of 140 miles per hour.

Figure 3.25 shows the wind zones of the United States based on maximum wind speeds; Indiana is located within wind zone IV, the highest inland categories. All of Vanderburgh County is in zone IV. High winds, often accompanying severe thunderstorms, can cause significant property
and crop damage, threaten public safety, and have adverse economic impacts from business closures and power loss.

**Hail**

Hail can occur when strong rising currents of air within a storm, called updrafts, carry water droplets to a height where freezing occurs. Then the grown ice particles fall to the ground. Severe thunderstorms can produce hail that can be three quarters of an inch or more in diameter and fall at speeds more than 100 mph. Hailstones of this size cause more than $1 billion in damages to properties and crops nationwide annually. Large hail can reach the size of grapefruit.

Based on information provided by the Tornado and Storm Research Organization, Table 3.22 describes typical damage impacts of the various sizes of hail.

### Table 3.22 TORRO Hailstorm Intensity Scale

<table>
<thead>
<tr>
<th>Intensity Category</th>
<th>Diameter (mm)</th>
<th>Size Description</th>
<th>Typical Damage Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hard Hail</td>
<td>5</td>
<td>Pea</td>
<td>No damage</td>
</tr>
<tr>
<td>Potentially</td>
<td>5-15</td>
<td>Mothball</td>
<td>Slight general damage to plants, crops</td>
</tr>
<tr>
<td>Damaging</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significant</td>
<td>10-20</td>
<td>Marble, grape</td>
<td>Significant damage to fruit, crops, vegetation</td>
</tr>
<tr>
<td>Severe</td>
<td>20-30</td>
<td>Walnut</td>
<td>Severe damage to fruit and crops, damage to glass and plastic structures, paint and wood scored</td>
</tr>
<tr>
<td>Severe</td>
<td>25-40</td>
<td>Pigeon's egg &gt; Squash ball</td>
<td>Widespread glass damage, vehicle bodywork damage</td>
</tr>
<tr>
<td>Destructive</td>
<td>30-50</td>
<td>Golf ball &gt; Pullet's egg</td>
<td>Wholesale destruction of glass, damage to tiled roofs, significant risk of injuries</td>
</tr>
<tr>
<td>Destructive</td>
<td>40-60</td>
<td>Hen's egg</td>
<td>Bodywork of grounded aircraft dented, brick walls pitted</td>
</tr>
<tr>
<td>Destructive</td>
<td>50-75</td>
<td>Tennis ball &gt; cricket ball</td>
<td>Severe roof damage, risk of serious injuries</td>
</tr>
<tr>
<td>Destructive</td>
<td>60-90</td>
<td>Large orange &gt; Soft ball</td>
<td>Severe damage to aircraft bodywork</td>
</tr>
<tr>
<td>Super Hailstorms</td>
<td>75-100</td>
<td>Grapefruit</td>
<td>Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open</td>
</tr>
<tr>
<td>Super Hailstorms</td>
<td>&gt;100</td>
<td>Melon</td>
<td>Extensive structural damage. Risk of severe or even fatal injuries to persons caught in the open</td>
</tr>
</tbody>
</table>

Source: Tornado and Storm Research Organization (TORRO)

Notes: In addition to hail diameter, factors including number and density of hailstones, hail fall speed and surface wind speeds affect severity.
Lightning

Lightning is defined as any and all of the various forms of visible electrical discharge caused by thunderstorms. Lightning can occur from cloud-to-cloud, within a cloud, cloud-to-ground, or cloud-to-air. It causes an average of about 60 fatalities and 300 injuries each year when people are caught outdoors in the summer months during the afternoon and evening.

Figures 3.23 and 3.24 show Vanderburgh County located in an area with four to eight lightning strikes per square kilometer per year and with an average of 30-50 days with thunderstorms per year per 10,000 square miles.

**Figure 3.23  Annual Frequency of Lightning in Indiana, 1996-2000**

![Flash Density Chart](https://www.lightningsafety.noaa.gov/lightning_map.htm)

Source: National Weather Service, [www.lightningsafety.noaa.gov/lightning_map.htm](https://www.lightningsafety.noaa.gov/lightning_map.htm)

Note: Green square indicates approximate location of Vanderburgh County

**Figure 3.24  Average Number of Thunderstorm Days per Year**

![Map of Thunderstorm Days](https://www.lightningsafety.noaa.gov/lightning_map.htm)

Source: Oklahoma Climatological Survey

Note: Blue square indicates approximate location of Vanderburgh County
Geographic Location

Thunderstorms and the associated high wind, hail, and lightning impact the entire Vanderburgh County planning area. Thunderstorms over Indiana typically occur between late April and early September, but, given the right conditions, they can develop as early as March. They are usually produced by supercell thunderstorms or a line of thunderstorms that typically develop on hot and humid days.

All of Vanderburgh County is susceptible to high wind events, and all of the participating jurisdictions are vulnerable to this hazard. Figure 3.25 below shows Vanderburgh County (blue square approximates location on map) is in Wind Zone IV. This zone of the United States can experience winds 200 to 250 mph.

The geographic location was assigned a rank of extensive, the entire planning area is subject to extreme temperatures and all participating jurisdictions are affected.

Figure 3.25  Wind Zones in the United States

Source: FEMA; [http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm](http://www.fema.gov/plan/prevent/saferoom/tsfs02_wind_zones.shtm)
Note: Blue square indicates approximate location of Vanderburgh County
Previous Occurrences

Vanderburgh County has not been included in any presidential disaster declaration that specifically included high winds. However, generally, the events that included severe storms likely included high winds as well. For reference, the eight declarations that Vanderburgh County received including severe storms are summarized below in Figure 3.23. These events are also discussed separately in the flood and tornado profiles.

Table 3.23 Thunder Storm Disaster Declaration History in Vanderburgh County, 1965-Present

<table>
<thead>
<tr>
<th>Declaration Number</th>
<th>Declaration Date (incident period)</th>
<th>Disaster Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1795</td>
<td>9/23/2008 (9/12-9/10/2008)</td>
<td>Severe Storms and Flooding</td>
</tr>
<tr>
<td>1662</td>
<td>10/6/2006 (9/12-9/12/2006)</td>
<td>Severe Storms and Flooding</td>
</tr>
</tbody>
</table>

Source: FEMA

High Winds

According to the NCDC database, the planning area experienced 146 severe thunderstorms with high winds in excess of 58 miles per hour (50 knots) from 1950 to 2016. Descriptions of the events are only provided from 1993 to 2016 and during this 23 year period there were 72 events causing nearly $39 Million in property damages and three injuries reported.

Summaries of some of the more damaging events are provided below:

- **April 19, 2011-FEMA-1997-DR(period of incident April 19, June 6, 2011)**- On June 8, 2011, Governor Mitchell E. Daniels, Jr. requested a major disaster declaration due to severe storms, tornadoes, straight-line winds, and flooding occurring on April 19, 2011, and April 22 to May 2, 2011, and flooding resulting from those storms beginning on April 19, 2011, and continuing. The Governor requested a declaration for Individual Assistance for eleven
 counties, Public Assistance for 34 counties, and Hazard Mitigation statewide. During the period of June 1-5, 2011, joint Federal, State, and local Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the State and the affected local governments, and that Federal assistance is necessary. On June 23, 2011, President Obama declared that a major disaster exists in the State of Indiana. This declaration made Public Assistance requested by the Governor available to State and eligible local governments and certain private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe storms, tornadoes, straight-line winds, and flooding in Benton, Clark, Crawford, Daviess, Dearborn, Dubois, Floyd, Franklin, Gibson, Harrison, Jackson, Jefferson, Jennings, Knox, Martin, Monroe, Ohio, Orange, Parke, Perry, Pike, Posey, Putnam, Ripley, Scott, Spencer, Starke, Sullivan, Switzerland, Vanderburgh, Warrick, and Washington Counties. This declaration also made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.

- **June 15, 2010.** In Evansville, two people were injured when a tree fell on the bedroom, hallway, and living room of a house. Both were transported to a hospital with non life-threatening injuries. The structural damage to the house was moderate to major. Elsewhere, there were numerous reports of utility lines blown down in McCutchanville. A trampoline blew in front of cars on the Lloyd Expressway in Evansville.

- **June 22, 2009.** A downburst with peak winds estimated near 95 mph affected an area one mile wide and six miles long. The damage started near the Gibson County line not far from Interstate 64. Many dozens of trees and tree limbs were blown down. Several homes sustained damage, mainly to roofs. Two barns were destroyed. Other farm buildings were damaged. Metal farm bins were partially blown over.

- **August 5, 2008.** Numerous trees and power lines were down throughout Evansville.

- **September 23, 2008-FEMA-1795-DR (period of incident September 12-October 6, 2008).** This federal disaster declaration was made following severe storms and flooding as remnants of Hurricane Ike. It brought high winds to southeast Missouri, southern Illinois, southwest Indiana, and western Kentucky.

- **January 29, 2008.** Numerous buildings around the County sustained mostly minor damage, such as shingles blown off. Several reports of wind gusts from 60 to 75 mph were received. At the Evansville airport, a gust to 71 mph was measured by the automated surface observing system. Sustained winds were clocked at 52 mph. The highest estimated gust was 75 mph in the northwest part of the county, reported by a trained spotter. Numerous trees and power lines were down. A semi was blown over, and roofs were blown completely off two homes. An elementary school sustained considerable roof damage. North of St. Wendel, a pole barn, hay barn, implement shed, and a grain bin were destroyed. Minor damage occurred to tractors and farm equipment. A pole barn in the exact same place was destroyed just a few years earlier, in 2004.
• **October 18, 2007.** Utility poles were down about one half mile east-northeast of the Evansville airport.

• **October 6, 2006-FEMA-1662-DR (period of incident September 12, 2006).** This federal disaster declaration was made following severe storms and major flash flooding inundated sections of Evansville.

• **May 24, 2006.** A wind gust to 61 mph was measured at the Evansville airport. Some minor damage to houses was reported in a subdivision a couple miles southeast of the airport.

• **April 2, 2006.** The roof and porch was blown off a vacant house on North Fulton Avenue. A wind gust to 64 mph was measured at the Evansville airport.

• **March 9, 2006.** Major roof damage occurred to a few homes in Green River Estates, just northeast of the airport. One house was completely unroofed. Windows were broken and siding was stripped off. At the Evansville Regional Airport, a wind gust to 59 mph was measured. Trees and power lines were blown down around the airport.

• **February 16, 2006.** Damage started at Burdette Park, where roofs were blown off and trees were uprooted. About one half to three quarters of a mile to the east of the park, the tops of two pole barns were blown off. Several homes sustained roof damage. Near the end of the damage path, the roof was blown off a garage and into a back yard.

• **November 8, 2005-FEMA-1612-DR (period of incident November 6, 2006).** This federal disaster declaration was made following the destructive tornado and severe thunderstorm that occurred in the early morning hours of November 6, 2006. This F3 tornado has peak winds estimated at 200 mph, the path was approximately 41 miles and 400+yards wide and caused widespread destruction and 23 fatalities.

• **August 28, 2004.** Thunderstorm winds caused damage along and just south of the Gibson County line. The winds knocked down the Indiana State Police communications tower and toppled eight to ten utility poles. The metal communications tower, which was 300 feet high, was located behind the state police post on U.S. Highway 41 near Interstate 64. The utility poles were knocked down from Stacer Road north almost to Interstate 64. Traffic was backed up for about a mile on U.S. 41 after a power line fell on a truck. The driver was not injured.

• **July 5, 2004.** Wind speeds were estimated from 60 to 70 MPH at downtown Evansville, along the Ohio riverfront. Many trees were blown down across the City. At least a few houses received major damage due to falling trees. A large oak tree crashed through the living room and kitchen of a house, injuring one person inside. The Red Cross opened a temporary emergency shelter for those without power. Police barricaded numerous streets blocked by downed trees, utility poles, and power lines. Falling trees also damaged vehicles. Widespread damaging winds occurred in association with a line of thunderstorms that crossed the Wabash River from southern Illinois, then tracked east-southeast across the Ohio River counties. At its peak, 32,000 utility customers were without power in Posey, Vanderburgh, and Warrick Counties. About 85 percent of those were in Posey and southern Vanderburgh Counties.

• **June 3, 2004-FEMA-1520-DR (period of incident May 25-June 25, 2004).** This federal disaster declaration was made following two different severe storm events. One occurred on May 27\textsuperscript{th} when a line of severe thunderstorms crossed southern Illinois, southwest Indiana, and northwest Kentucky during the evening. Widespread extremely damaging winds of
excess of 80 mph caused at least $3 Million in damages. Then on May 30th, there was an outbreak of isolated super cell storms and tornadoes. An F1 with 100 mph winds caused about $1.2 Million in damages near Darmstadt.

- **July 11, 2003-FEMA-1476-DR (period of incident July 4-August 6, 2003).** This federal declaration was from severe thunderstorms that moved across the area on July 28th.

- **April 21, 2002.** Thunderstorm winds downed some trees. About a dozen homes were damaged by falling trees or tree limbs.

- **September 25, 2002-FEMA-1433-DR (period of incident September 20, 2002).** This federal declaration was from severe storms and tornadoes. An F2 tornado struck outside Poseyville, Indiana and then went on to produce many others as it moved northeast across central Indiana.

- **June 20, 2001.** Near Diamond Avenue in Evansville, about a dozen trees were down, including two that fell on houses.

- **August 20, 2000.** Numerous trees were down at the Vanderburgh 4-H Fairgrounds. Elsewhere in the county, several trees were down on power lines, and one tree fell onto a house.

- **May 12, 2000.** Damaging thunderstorm winds affected the west side of Evansville. The hardest hit neighborhood was just off Route 62 about 2 miles west of the Evansville city limits. The main damage was done to an elementary school, which lost a large section of roof. A large tree toppled through a classroom. There was water damage inside the school, and a cinder-block baseball dugout was destroyed. Other damage included many large limbs blown down and privacy fences down. The back deck of a house near the school was heavily damaged. Another nearby house lost part of its roof. About 5,000 electric customers were without power because of fallen tree limbs and utility poles. In the City of Evansville, on the west side of downtown, a few businesses along West Franklin Street received siding and window damage. Trees were blown down in Wesselman Woods Nature Preserve and at the West Side Branch Library.

- **January 3, 2000.** Thunderstorm winds caused extensive damage in a small area, covering approximately a four square block area on the east side of Evansville. About 25 homes were damaged. Most of the damage was due to trees being blown onto roofs. Five homes had to be abandoned due to severe roof damage. Damage to the remainder of the homes was mainly light. A vehicle was damaged by wind-blown fencing. About 30 trees were down.

- **February 27, 1999.** Numerous trees and power lines were down in and around Evansville. Wind speeds were measured to 75 MPH at a television station in Evansville. A few microbursts with estimated wind speeds between 80 and 90 mph occurred in and near Evansville. Two of the most intense microbursts were on the northwest side of Evansville and the east side of Evansville. On the northwest side, shingles were off roofs, some 2 by 4’s were blown through a car windshield, and large storage buildings were damaged. This damage path was 1 to 2 miles long and 300 yards wide. Elsewhere in the County, in the McCutchanville area, large doors of a building were shoved in. About 3 miles north of Daylight on Interstate 164, a tractor trailer was overturned. Just east of Evansville, near the junction of Interstate 164 and Route 62, two power poles were downed, and three houses sustained significant roof damage. A light commercial structure that was under construction was blown down.
- **May 20, 1998.** A roof was blown off an industrial building on Diamond Avenue. Debris was scattered across First Avenue, which disrupted traffic. Trees and wires were blown down. About 3,000 Vanderburgh County electric customers were still without power a few hours later.

- **March 6, 1997 FEMA-1165-DR (period of incident February 28-March 31, 1997).**

- **July 14, 1997.** Large trees and power lines were down. About 10,000 Evansville homes were without power due to trees falling on power lines. At least two homes and a van were damaged by falling trees.

- **June 11, 1994.** Numerous trees and utility poles were blown down on Evansville’s north side. Several homes and automobiles were damaged. Electrical power was not restored for up to 12 hours in some locations.

- **April 15, 1994.** Trees and power lines were blown down and the roofs were blown from two homes on the west side of Evansville. Two construction site trailers were blown over on Green River Road on Evansville’s east side.

Most of the events in the NCDC database included reports of downed trees and tree limbs. Although many of these events did not report damages to property or crops, debris removal and other associated costs are common as a result of the numerous high wind events.

### Hail

The NCDC reports 79 hail events in Vanderburgh County between 1962 and 2016. When limiting the list to those events considered destructive magnitude according to the TORRO Hail Intensity scale (0.88 in. diameter or larger), there were 1 event in the same 54 year period causing a reported $20,000 in property damages. Table 3.24 shows the number of hail events by the size of the hail.

<table>
<thead>
<tr>
<th>Hail Size</th>
<th>Number of Events</th>
<th>Property Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 0.88 in</td>
<td>34</td>
<td>0</td>
</tr>
<tr>
<td>0.88 in.</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>1.00 in.</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>1.25 in.</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1.50 in.</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>1.75 in.</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>2.00 in.</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>2.25 in.</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2.75 in.</td>
<td>2</td>
<td>$20,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>79</strong></td>
<td><strong>$20,000</strong></td>
</tr>
</tbody>
</table>

Source National Climatic Data Center Storm Events Database

According to the USDA Risk Management Agency, insurance payments for damages to crops as a result of hail and excessive wind from 2007-2016 totalled $2,606. Also state-wide in Indiana, 79 percent of the row crops were insured in 2009 according to the USDA’s Risk Management Agency.
Table 3.25  Claims Paid in Vanderburgh County for Crop Loss as a Result of Hail (2007-2016)

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Hazard</th>
<th>Insurance Paid ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Corn</td>
<td>Hail</td>
<td>$160</td>
</tr>
<tr>
<td>2015</td>
<td>Corn</td>
<td>Wind/Excessive Wind</td>
<td>$1,608</td>
</tr>
<tr>
<td>2016</td>
<td>Corn</td>
<td>Wind/Excessive Wind</td>
<td>$838</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>$2,606</td>
</tr>
</tbody>
</table>

Source: USDA Risk Management, 2011

Lightning

From 1995 to 2016, the County only experienced three reported lightning events, which is presumed to be a low reported number of lightning events. Lighting events were not reported in NCDC prior to 1994. Therefore a shorter time-period of statistics is available. The following are the events listed in NCDC:

- **April 26, 2016** - A well-developed squall line with embedded bowing structures moved east-southeast at 45 knots into a destabilizing air mass over the Lower Ohio Valley. The line was located to the south of a quasi-stationary front in a moist air mass, with surface dew points in the mid to upper 60's. Surface temperatures in the lower 80's contributed to moderate instability, which helped to maintain the line of storms into the early evening. Damaging winds, marginally severe hail, and even a tornado accompanied the strongest storms. Two residential structure fires were suspected to be lightning-caused.

- **July 8, 2010**. A house fire was started by lightning. The fire was mostly limited to the attic and a downstairs wall causing $10,000 in property damage.

- **March 28, 1997**. Lighting struck a house setting it on fire and causing $60,000 in property damage.

Probability of Future Occurrences

According to NCDC, there were 145 wind events in Vanderburgh County between 1950 and 2016 (66 years). Based on this information, the probability that at least one significant wind event with 50 knots or higher will occur in Vanderburgh County in any given year is **highly likely**, 100 percent with an annual average of 2.9 events per year.

Based on the reported 79 events in the NCDC database of hail events with hail 0.88 inches in diameter and larger occur an average of 1.50 times per year in the planning area from 1962 to 2016.

National Weather Service data indicates that Vanderburgh County is in a region that receives four to eight lightning strikes per square kilometer per year. However, most of these lightning
strikes do not result in damages and that is reflected in the small amount of historical data reported in the NCDC database.

Seasonally, thunderstorms are more likely to occur during the summer months of May, June, and July. These rates of occurrence are expected to continue in the future.

**Magnitude/Severity**

Estimated damages from thunderstorms (including high winds, hail and lightning) in the NCDC database for the 20 year period (1996-2016) were reported to be $12.223 Million in property damages. Many damages and costs as a result of such events are often not reported. So, these estimates can be considered to be very conservative. Common types of damages were structural damages caused by falling limbs and debris, roof damages, overturned vehicles and light structures, and downed power poles resulting in some loss of electric service. In addition, clearance of the debris left behind can be costly and is generally not reported in damage estimates in NCDC.

The magnitude for this hazard is classified as **critical**, isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours.

**Thunderstorms/High Winds/Lightning Hazard Summary by Jurisdiction**

The following hazard summary table shows that this hazard does not vary significantly by jurisdiction. Although structural property damages are higher in the urban areas, the rural areas have higher damages to agriculture.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corps</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
</tbody>
</table>
3.2.12 Severe Weather – Tornadoes

Description

The National Weather Service defines a tornado as a “violently rotating column of air extending from a thunderstorm to the ground.” Tornadoes are the most violent of all atmospheric storms and are capable of tremendous destruction. Wind speeds can exceed 250 mph, and damage paths can be more than one mile wide and 50 miles long. In an average year, more than 900 tornadoes are reported in the United States, resulting in approximately 80 deaths and more than 1500 injuries. High winds not associated with tornadoes are profiled separately in this document in Section 3.2.x Thunderstorms/High Winds.

In Indiana, most tornadoes and tornado-related deaths and injuries occur during the months of April, May, and June. However, tornadoes have struck in every month. Similarly, while most tornadoes occur between 3:00 and 9:00 p.m., a tornado can strike at any time.

Prior to February 1, 2007, tornado intensity was measured by the Fujita (F) scale. This scale was revised and is now the Enhanced Fujita scale. Both scales are sets of wind estimates (not measurements) based on damage. The new scale provides more damage indicators (28) and associated degrees of damage, allowing for more detailed analysis, better correlation between damage and wind speed. It is also more precise because it takes into account the materials affected and the construction of structures damaged by a tornado.

Table 3.26 shows the wind speeds associated with the original Fujita scale ratings and the damage that could result at different levels of intensity.

<table>
<thead>
<tr>
<th>Fujita (F) Scale</th>
<th>Fujita Scale Wind Estimate (mph)</th>
<th>Typical Damage</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>&lt; 73</td>
<td>Light damage. Some damage to chimneys; branches broken off trees; shallow-rooted trees pushed over; sign boards damaged.</td>
</tr>
<tr>
<td>F1</td>
<td>73-112</td>
<td>Moderate damage. Peels surface off roofs; mobile homes pushed off foundations or overturned; moving autos blown off roads.</td>
</tr>
<tr>
<td>F2</td>
<td>113-157</td>
<td>Considerable damage. Roofs torn off frame houses; mobile homes demolished; boxcars overturned; large trees snapped or uprooted; light-object missiles generated; cars lifted off ground.</td>
</tr>
<tr>
<td>F3</td>
<td>158-206</td>
<td>Severe damage. Roofs and some walls torn off well-constructed houses; trains overturned; most trees in forest uprooted; heavy cars lifted off the ground and thrown.</td>
</tr>
<tr>
<td>F4</td>
<td>207-260</td>
<td>Devastating damage. Well-constructed houses leveled; structures with weak foundations blown away some distance; cars thrown and large missiles generated.</td>
</tr>
<tr>
<td>F5</td>
<td>261-318</td>
<td>Incredible damage. Strong frame houses leveled off foundations and swept away; automobile-sized missiles fly through the air in excess of 100 meters (109 yards); trees debarked; incredible phenomena will occur.</td>
</tr>
</tbody>
</table>

Table 3.27 shows wind speeds associated with the Enhanced Fujita Scale ratings. The Enhanced Fujita Scale’s damage indicators and degrees of damage can be found online at [www.spc.noaa.gov/efscale/ef-scale.html](http://www.spc.noaa.gov/efscale/ef-scale.html).

<table>
<thead>
<tr>
<th>Enhanced Fujita (EF) Scale</th>
<th>Enhanced Fujita Scale Wind Estimate (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EF0</td>
<td>65-85</td>
</tr>
<tr>
<td>EF1</td>
<td>86-110</td>
</tr>
<tr>
<td>EF2</td>
<td>111-135</td>
</tr>
<tr>
<td>EF3</td>
<td>136-165</td>
</tr>
<tr>
<td>EF4</td>
<td>166-200</td>
</tr>
<tr>
<td>EF5</td>
<td>Over 200</td>
</tr>
</tbody>
</table>

Source: National Oceanic and Atmospheric Administration Storm Prediction Center, [www.spc.noaa.gov/faq/tornado/ef-scale.html](http://www.spc.noaa.gov/faq/tornado/ef-scale.html)

**Geographic Location**

While tornadoes can occur in all areas of the State of Indiana, historically, some areas of the state have been more susceptible to this type of damaging storm. Figure 3.26 illustrates the number of F3, F4, and F5 tornadoes recorded in the United States per 3,700 square miles between 1950 and 1998. Vanderburgh County is in the section shaded medium orange indicating 16-25 tornadoes of this magnitude during this 48-year period. The eastern boundary of the planning area is adjacent to the section shaded dark orange, indicating over 25 events.

The geographic location was assigned a rank of **extensive**, the entire planning area is subject to extreme temperatures and all participating jurisdictions are affected.
Figure 3.26 Tornado Activity in the United States

![Map of Tornado Activity in the United States](image)

Note: Black Square is the approximate location of Vanderburgh County

Previous Occurrences

According to the NCDC database, there were 23 separate tornado events in Vanderburgh County between January of 1950 and December of 2016 (listings on the same date more than one hour apart or at different locations were considered multiple events). Combined damages of these events were 20 fatalities, 210 injuries, and over $18.655 Million in reported property damages. Of these previous events, 7 were rated F0, 10 were rated F1, 3 were rated F2, 3 were rated F3 and 1 was not rated. Table 3.28 summarizes these events.

Vanderburgh County has been included in four presidential disaster declarations that involved tornadoes since 1955 (see details below under DR-1612, DR-1520, DR-1476, and DR-1433). For the disasters of DR-1476 and DR-1433, the County was included in these disaster designations for other related damages that result from hail, strong winds and flooding. These impacts are discussed separately under those hazards.
Table 3.28  Recorded Tornadoes in Vanderburgh County, 1950-2015

<table>
<thead>
<tr>
<th>Location</th>
<th>Date</th>
<th>Magnitude</th>
<th>Fatalities</th>
<th>Injuries</th>
<th>Property Damage ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh</td>
<td>15-Nov-55</td>
<td>F3</td>
<td>0</td>
<td>9</td>
<td>250,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>26-May-62</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>11-Dec-67</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>25,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>10-Jan-75</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>25,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>30-Jun-77</td>
<td>F1</td>
<td>0</td>
<td>1</td>
<td>250,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>11-Apr-79</td>
<td>F2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>28-Jun-80</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>26-May-81</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>15-May-86</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>15-May-86</td>
<td>F2</td>
<td>0</td>
<td>0</td>
<td>250,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>19-May-89</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>250,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>6-Jun-90</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Evansville</td>
<td>17-Jun-97</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>500,000</td>
</tr>
<tr>
<td>Evansville</td>
<td>18-Aug-97</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Daylight</td>
<td>7-Aug-98</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>5,000</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>30-May-04</td>
<td>F1</td>
<td>0</td>
<td>0</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Cypress</td>
<td>6-Nov-05</td>
<td>F3</td>
<td>0</td>
<td>0</td>
<td>150,000</td>
</tr>
<tr>
<td>Evansville</td>
<td>6-Nov-05</td>
<td>F3</td>
<td>20</td>
<td>200</td>
<td>15,000,000</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>10-May-06</td>
<td>F0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>25-May-11</td>
<td>EF2</td>
<td>0</td>
<td>0</td>
<td>100,000</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>2-March-12</td>
<td>EF0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>7-April-15</td>
<td>EF1</td>
<td>0</td>
<td>0</td>
<td>400,000</td>
</tr>
<tr>
<td>Vanderburgh</td>
<td>26-April-16</td>
<td>EF1</td>
<td>0</td>
<td>0</td>
<td>250,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>20</td>
<td>210</td>
<td><strong>$18,655 Million</strong></td>
</tr>
</tbody>
</table>

Source: National Climatic Data Center

Descriptions of the more damaging events are provided below:

- **April 26, 2016-EF1**- A well-developed squall line with embedded bowing structures moved east-southeast at 45 knots into a destabilizing air mass over the Lower Ohio Valley. The line was located to the south of a quasi-stationary front in a moist air mass, with surface dew points in the mid to upper 60's. Surface temperatures in the lower 80's contributed to moderate instability, which helped to maintain the line of storms into the early evening. Damaging winds, marginally severe hail, and even a tornado accompanied the strongest storms.

- **April 7, 2015- EF1**- A mesoscale convective system moved east-southeast from southern Illinois into southwest Indiana. The complex transitioned from a continuous line of storms to a more discrete storm mode, with two distinct supercells. The supercell over southwest Indiana produced three tornadoes along its track across Vanderburgh, Warrick, and Spencer Counties. The storms encountered a moderately unstable air mass and sufficient deep-layer wind shear for storm organization. Mixed-layer capes around 1000 to 1500 j/kg were
supported by temperatures in the upper 70's and dew points in the lower 60's. This instability, coupled with effective wind shear near 40 knots, supported supercell activity with tornadoes.

- **May 25, 2011- EF1**-Numerous strong to severe thunderstorms occurred in the warm sector of a low pressure system over central Missouri. The air mass in the warm sector was very unstable, with afternoon mixed-layer cape values in the 2500 to 4000 j/kg range. A 65 to 75 knot mid level jet was located across Arkansas, with the nose of the jet moving into western Kentucky. This feature enhanced the lift and strong deep-layer shear already in place, creating an environment very favorable for supercells and tornadoes. A 40 to 55 knot low level jet across eastern Arkansas moved into western Kentucky during the evening, resulting in isolated tornadoes and widespread damaging winds.

- **November 8, 2006-FEMA-1612-DR (period of incident November 6, 2006).** This federal disaster declaration was made following the destructive tornado and severe thunderstorm that occurred in the early morning hours of November 6, 2006. The tornado crossed into Vanderburgh County from Henderson County, Kentucky a second time near Ellis Park, a horse-racing facility off U.S. Highway 41. The tornado moved rapidly east-northeast at close to 60 mph, staying a mile or less south of Interstate 164 and the southern city limit of Evansville. Twenty people perished at a large mobile home park on the south side of the interstate. Of about 350 mobile homes in the park, 100 were destroyed and another 125 were damaged. Many of the destroyed homes were obliterated. The coroner reported that most of the victims were probably killed instantly, many by spine and skull fractures. Several bodies were carried almost two hundred yards. Several of the fatally injured persons were found in a nearby retention pond that was drained to find victims. An 8-year-old child was found alive in a ditch after being trapped under debris for about 12 hours. One person, who was thrown 150 feet, died of complications from tornado injuries on December 17. The tornado exited into Warrick County at the Angel Mounds State Historic Site, just south of Interstate 164. This was the deadliest tornado in Indiana since April 3, 1974. This tornado tracked a total of 41 miles from Henderson County, Kentucky into Spencer County, Indiana. A total of at least 500 homes and buildings were destroyed or severely damaged. Much of the damage was upper F-2 to lower F-3 intensity. Although the tornado was up to 500 yards wide, the average path width was 275 yards. Of the approximately 230 injuries, 20 were critical, and 63 resulted in hospital admissions.
Figure 3.27  Tornado Damage at the Eastbrooke Mobile Home Park, November 6, 2006

Source: http://www.crh.noaa.gov/pah/?n=evansvilletornado-nov.6,2005#GROUND

- **June 3, 2004-FEMA-1520-DR (period of incident May 25-June 25, 2004).** This federal disaster declaration was made following two different severe storm events. One occurred on May 27th when a line of severe thunderstorms crossed southern Illinois, southwest Indiana, and northwest Kentucky during the evening. Then on May 30th, there was an outbreak of isolated super cell storms and tornadoes. The tornado first touched down on Bromm Road, then tracked east directly across Darmstadt, finally lifting at Browning Road. Hundreds of trees were blown down, including many that landed on houses and power lines. A total of 42 single family homes, 6 commercial structures, and 1 agricultural structure were affected. Peak winds were estimated near 100 mph. Strong gusty winds occurred throughout Vanderburgh County. A gust to 57 mph was measured in Evansville. Widespread damaging winds raked southwest Indiana. Embedded short-lived tornadoes and intense downbursts caused pockets of severe damage. The single most destructive event was an F-2 tornado that struck Newburgh, Indiana. Another tornado in the northern suburbs of Evansville caused over one million dollars damage.
• **July 11, 2003-FEMA-1476-DR (period of incident July 4-August 6, 2003).** This federal declaration was from severe thunderstorms that moved across the area on July 28th.

• **September 25, 2002-FEMA-1433-DR (period of incident September 20, 2002).** This federal declaration was from severe storms and tornadoes. An F2 tornado struck outside Poseyville, Indiana and then went on to produce many others as it moved northeast across central Indiana, but no tornadoes touched down in Vanderburgh County.

• **June 17, 1997.** This F1 tornado occurred in a densely populated suburban area called North Park, about 2 miles northwest of downtown Evansville. There were many witnesses, so the event was well documented by photographers and eyewitnesses. Although the tornado was unusual in the respect that it developed from a non-severe thunderstorm in a weakly sheared environment, it caused considerable damage in such a populated setting. A survey conducted by National Weather Service personnel determined the damage path was narrow, well defined, and highly convergent. Most of the damage was a result of trees falling on houses (at least a dozen) and causing roof damage and some structural damage. The neighborhood was 40 years old so most trees were full grown. A liquor store, bowling alley, and grocery store suffered primarily roof damage due to winds estimated near 100 mph. About 2,800 people were without power for several hours.

• **June 30, 1977.** This F1 tornado was 15 miles in length and 50 yards wide. It caused approximately $250,000 in property damage.

• **November 15, 1955.** This F3 tornado was two miles in length and 50 yards wide. It caused nine injuries and approximately $250,000 in property damage.
Probability of Future Occurrences

Based on NCDC records of 19 tornadoes in a 60-year period, there is a 32 percent probability of a tornado in Vanderburgh County in any given year. Removing the F0 rated events from this calculation, there were 13 tornadoes in the same period resulting in a probability 22 percent probability in any given year, resulting in a rank of likely, 10-100 percent chance of occurrence in next year or has a recurrence interval of 10 years or less.

Magnitude/Severity

If a strong tornado did impact the populated portions of Vanderburgh County, the impacts would be critical, isolated deaths and/or multiple injuries and illnesses; major or long-term property damage that threatens structural stability; and/or interruption of essential facilities and services for 24-72 hours.

Tornadoes Hazard Summary by Jurisdiction

The magnitude was rated as critical for all the participating jurisdictions, as they are all vulnerable to tornado and windstorm damage. The factors of geographic location and probability are also equal across the planning area. This hazard does not substantially vary by jurisdiction.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanderburgh County</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>City of Evansville</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corp.</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
</tbody>
</table>
3.2.13 Severe Weather - Winter Storms

Description

Winter storms in Indiana typically involve snow and/or freezing rain (ice storms). These conditions pose a serious threat to public safety, disrupt commerce and transportation, and can damage utilities and communications infrastructure. Winter storms can also disrupt emergency and medical services, hamper the flow of supplies, and isolate homes and farms. Heavy snow can collapse roofs and down trees onto power lines. Direct and indirect economic impacts of winter storms include cost of snow removal, damage repair, increased heating bills, business and crop losses, power failures and frozen or burst water lines.

The National Weather Service describes different types of winter storm conditions as follows:

- **Blizzard**—Winds of 35 mph or more with snow and blowing snow reducing visibility to less than 1/4 mile for at least three hours.
- **Blowing Snow**—Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
- **Snow Squalls**—Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
- **Snow Showers**—Snow falling at varying intensities for brief periods of time. Some accumulation is possible.
- **Freezing Rain**—Measurable rain that falls onto a surface whose temperature is below freezing. This causes the rain to freeze on surfaces, such as trees, cars, and roads, forming a coating or glaze of ice. Most freezing-rain events are short lived and occur near sunrise between the months of December and March.
- **Sleet**—Rain drops that freeze into ice pellets before reaching the ground. Sleet usually

The average monthly/annual snowfall for Evansville is presented in Table 3.29.

**Table 3.29  Snowfall Summary (inches) 1981-2010**

<table>
<thead>
<tr>
<th>Station</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Annual</th>
</tr>
</thead>
<tbody>
<tr>
<td>McCutchanville</td>
<td>3.6</td>
<td>3.6</td>
<td>1.7</td>
<td>0.0</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.3</td>
<td>0.0</td>
<td>4.7</td>
<td>13.9</td>
</tr>
<tr>
<td>Evansville Regional Airport</td>
<td>3.4</td>
<td>3.8</td>
<td>1.0</td>
<td>0.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.2</td>
<td>0.1</td>
<td>3.2</td>
<td>11.8</td>
</tr>
<tr>
<td>Evansville Museum</td>
<td>3.7</td>
<td>2.8</td>
<td>1.3</td>
<td>0.1</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>0.0</td>
<td>---</td>
<td>2.7</td>
<td>10.6</td>
</tr>
</tbody>
</table>

Duration of the most severe impacts of winter storms is generally less than one week, though dangerous cold, snow, and ice conditions can remain present for longer periods in certain cases. Weather forecasts commonly predict the most severe winter storms at least 24 hours in advance, leaving adequate time to warn the public.

**Geographic Location**

The entire State of Indiana is vulnerable to heavy snow and freezing rain. Northern Indiana receives the greatest average annual snowfall. The southern region of Indiana including Vanderburgh County receives 14.2 of snow during a normal season according to the National Weather Service in Paducah, Kentucky.

Figure 3.29 shows that Vanderburgh County falls in a zone that receives 8-9 hours of freezing rain per year. The geographic location was assigned a rank of **extensive**, the entire planning area is subject to extreme temperatures and all participating jurisdictions are affected.

**Figure 3.29 Average Number of Hours per Year with Freezing Rain in the United States**

![Map showing average number of hours per year with freezing rain in the United States]


Note: Red square indicates approximate location of Vanderburgh County
Previous Occurrences

Of the 12 Major Presidential Disaster Declarations and two emergency declarations that have occurred in Vanderburgh County since 1965, 4 have been related to winter storms. There have also been two USDA Disaster Declarations from 2005 to 2010.

Details of these events are provided in Table 3.30.

Table 3.30  FEMA and USDA Winter Storm Disaster Declaration History in Vanderburgh County, 1965-Present

<table>
<thead>
<tr>
<th>Declaration Number</th>
<th>Declaration Date</th>
<th>Disaster Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1828</td>
<td>03/05/2009 (incident period 1/26/2009 – 1/28/2009)</td>
<td>Severe Winter Storm</td>
</tr>
<tr>
<td>S2587 (USDA)</td>
<td>04/04/2007 – 4/10/2007</td>
<td>Below Normal Temperature, Winter Storm</td>
</tr>
<tr>
<td>S2522 (USDA)</td>
<td>04/05/2007 – 4/10/2007</td>
<td>Below Normal Temperature, Winter Storm</td>
</tr>
</tbody>
</table>


- **April 22, 2014-FEMA-4173-DR (period of incident January 5-9, 2014)** - On March 6, 2014, Governor Michael R. Pence requested a major disaster declaration due to a severe winter storm and snowstorm during the period of January 5-9, 2014. The Governor requested a declaration for Public Assistance for 49 counties, snow assistance for 26 counties and Hazard Mitigation statewide. On March 31, 2014, the Governor’s request was denied. On April 8, 2014, Governor Pence appealed the denial and requested Public Assistance for 49 counties, snow assistance for 32 counties, and Hazard Mitigation statewide. During the period of February 10-27, 2014, joint federal, state, and local government Preliminary Damage Assessments (PDAs) were conducted in the requested counties and are summarized below. PDAs estimate damages immediately after an event and are considered, along with several other factors, in determining whether a disaster is of such severity and magnitude that effective response is beyond the capabilities of the state and the affected local governments, and that Federal assistance is necessary. On April 22, 2014, President Obama declared that a major disaster exists in the State of Indiana. This declaration made Public Assistance requested by the Governor available to state and eligible local governments and certain
private nonprofit organizations on a cost-sharing basis for emergency work and the repair or replacement of facilities damaged by the severe winter storm and snowstorm in Boone, Clay, Hendricks, Huntington, Jasper, Kosciusko, Madison, Morgan, Newton, Noble, Owen, Parke, Putnam, Sullivan, Tipton, Vigo, Wabash, White, and Whitley Counties. This declaration also made snow assistance available for a 48 hour period in Boone, Clay, Hendricks, Huntington, Jasper, Kosciusko, Madison, Morgan, Newton, Parke, Putnam, Sullivan, Tipton, Vigo, Wabash, and White Counties. The snow assistance for Noble and Whitley Counties will be provided for a period of 72 hours. Finally, this declaration made Hazard Mitigation Grant Program assistance requested by the Governor available for hazard mitigation measures statewide.

- **March 5, 2009-FEMA-1828-DR (period of incident January 26-28, 2009), Severe Winter Storm:** A major winter storm dumped 6 to 10 inches of sleet and snow north and west of Evansville. In addition to the sleet and snow, up to one-half inch of ice coated objects. This resulted in very difficult driving conditions. Numerous vehicles slid off roadways. Schools were out for several days. Isolated power outages affected a small number of people north and west of Evansville. From Evansville south and east, a major ice storm occurred. About one inch of ice accumulated. This resulted in widespread tree damage and numerous power outages. In the city of Evansville itself, several inches of sleet and snow were combined with nearly an inch of ice. The weight of the ice and snow caused a house roof to collapse in Evansville. Fallen trees and limbs blocked many streets in Evansville and cities to the east. Several ambulances became stranded in snow and ice. The Evansville Fire Department made 275 runs on the second night of the storm, compared to a normal of 10 runs per night. Across the Evansville region, there was an increase in structure fires caused by alternate heating or lighting devices. Red Cross shelters were opened across southwest Indiana. One shelter in the Evansville area housed 150 individuals at one point. The largest utility company serving southwest Indiana reported more than half their customers were without power the day after the storm. This was believed to be one of the largest outages in the utility’s history, comparable to the remnants of Hurricane Ike in September of 2008. Power was restored to most residents four to seven days after the storm. Hundreds of utility workers were brought in from other states, including some even before the storm hit. The National Guard was activated to help transport people from their homes to shelters.
• January 11, 2005-FEMA-3197-EM, (period of incident 12/21/2004 – 12/23/2004) Snow Storm: Emergency declaration for 49 counties in Indiana for snow removal and emergency protective measures during that 48-hour period. A record-setting winter storm dumped from 17 to 22 inches of snow across southwest Indiana, closing interstates and shutting down most businesses near the peak of the Christmas shopping season. A 25-mile stretch of Interstate 64 from the Illinois state line to Evansville (the Interstate 164 exit) was closed for about 48 hours. The National Guard was mobilized to assist motorists along the interstate who were stranded in their vehicles overnight. About 100 motorists were transported to emergency shelters, including dozens taken to the Red Cross building in Evansville. Drifts up to 5 feet deep made many roads impassable. States of emergency were declared in Vanderburgh, Warrick, and Gibson Counties, where drivers were urged to stay off the roads. There were reports of plows and even a Humvee disabled in ditches and deep snow drifts. Most travel, including that by police and other emergency workers, was done in four-wheel drive vehicles. Two fatalities in Evansville were indirectly attributed to the snow. In both cases, elderly men suffered fatal heart attacks while shoveling snow. Mail delivery was suspended in most areas for at least one day. Gusty north winds from 15 to 25 MPH caused blowing and drifting. There was a 3-hour lull in the snow during the early afternoon; otherwise visibility was frequently around one-quarter mile for over 24 hours. Snowfall rates averaged an inch per hour, with higher rates observed in thundersnow. The total of 22.3 inches measured at the Evansville Airport established a new 24-hour snowfall record. This single storm total resulted in the second snowiest December on record at Evansville, where records date back to 1897. Preliminary snowfall reports from co-operative observers included 18.5 inches at Boonville (Warrick County) and 16.7 inches at Stendal (Pike County). Recovery efforts were slowed by gusty winds and bitterly cold arctic air, as low as 10 below zero on Christmas morning.

• January 21, 2005-FEMA-1573-DR, (period of incident 1/1/2005 – 2/1/2005) Severe Winter Storms and Flooding: Heavy freezing rain occurred over parts of the northern third of
Indiana. Widespread half-inch ice accumulations were reported, with isolated one inch or greater amounts, crippling communities for as much as several days to over one week while cleanup lasted for more than a month. Electricity was knocked out for as many as 150,000 homes in areas affected by the storm. Shelters were opened by the Red Cross and other organizations across the area, with more than 1,000 residents taking advantage of shelters in east central Indiana alone. States of emergency were declared in several counties, and hospitals and other emergency services were forced to go to backup power. Nearly $75 millions of dollars in damage were done to trees, power lines, and structures and the associated cleanup work.

In addition to the events that resulted in Presidential Declarations, the following events occurred in Vanderburgh County between October 1993 and December 2016 and are reported from NCDC records:

- **December 15, 2015** - A low pressure system tracked eastward across western Tennessee. A warm front lifted northward ahead of this system, causing freezing rain. Around one-quarter inch of glaze formed on most surfaces, including trees and power lines. A few small branches were broken, but the main impact was on travel. Roads became hazardous due to ice and slush. There was slightly less precipitation west of the Evansville area, where one-tenth to one-quarter inch of glaze formed in Posey County.

- **February 20, 2015** - A winter storm brought hazardous conditions to southwest Indiana. The precipitation type was primarily freezing rain. Some sleet and snow was reported at the onset. Around one-quarter inch of ice glazed trees and power lines, on top of one-quarter to one-half inch of sleet. Roads became ice-covered and very hazardous. Numerous vehicle crashes and slide-offs occurred. Isolated power outages were reported due to tree limbs on power lines. A utility company estimated outages totaled about 500 customers. Downed tree limbs damaged vehicles at the campus of Southern Indiana University. Several east-to-west bands of light to locally moderate precipitation advanced slowly northward in response to the arrival of warm, moist air in the low levels. Strengthening of a southerly low level jet occurred ahead of a 500 mb shortwave impulse emerging out of the central Plains. Convective enhancement of precipitation rates was observed. After the precipitation changed to rain, the combination of snowmelt and rainfall produced localized street flooding. Most of the street flooding was in urban areas, such as Evansville.

- **February 4, 2014** - About one-quarter inch of ice coated trees and power lines from Evansville eastward across Warrick and Spencer Counties. The freezing rain began as a period of heavy snow and sleet, which accumulated from one to two inches across that area. Trees and power lines sagged due to ice, and isolated power outages occurred. About 2,500 utility customers were without power in Evansville. North and west of Evansville, about two inches of sleet and snow fell, along with ice accumulations less than one-tenth inch. Roads across southwest Indiana were slick and hazardous. A vigorous fast-moving Pacific storm system that originated off the Baja of California raced northeast. A strong warm front moved as far north as the Tennessee Valley. Widespread heavy precipitation north of the warm front
resulted in significant icing across most of the Ohio River counties, and a mixture of sleet, snow, and ice along the Interstate 64 corridor.

- **February 9, 2010.** Three to four inches of snow were measured from Evansville west, and the five to seven inch amounts were east of Evansville into Spencer County.
- **January 29, 2010.** Accumulations across southwest Indiana were generally from 6 to 8 inches south of Interstate 64, including Evansville and Boonville. There was some blowing and drifting of the snow due to gusty winds. Roads were snow-covered and very slippery. Visibility was reduced to around one-half mile in the snow.
- **March 7, 2008.** The four-inch amounts were in Evansville, and amounts increased with eastward extent.
- **December 16, 2007.** The rain changed to snow and accumulated from 1 to 2 inches north and west of Evansville.
- **December 22-23, 2004.** A major snowstorm occurred along the Ohio River Valley with severe impacts over large parts of Illinois, Indiana, Kentucky, and Ohio. Evansville, Indiana received 22.3 inches of snow and then received four days of extremely low temperatures (The Pre-Christmas 2004 Snowstorm Disaster in the Ohio River Valley, Prepared for the Midwestern regional Climate Center, April 2005)
- **December 8, 2005.** The first winter storm of the season produced significant accumulations of sleet and freezing rain, followed by a few inches of snow. The heaviest ice accumulations were from Evansville eastward, where about one-quarter inch of glazing occurred.
- **January 27, 2004.** One to two inches of snow fell across southwest Indiana.
- **January 25, 2004.** Between one quarter and one half inch of ice coated all surfaces. Roads were dangerous and locally impassable. Hundreds of accidents were reported across southwest Indiana, including jackknifed tractor trailers. Some roads were closed. A State of Emergency was declared in Spencer and Pike Counties, which banned all travel except for emergencies. State highway crews were pulled off the roads in Spencer County after three salt trucks overturned on icy roads and a fourth went into a ditch. A fatal accident occurred on Interstate 64 on the Wabash River bridge at the Illinois state line. A van heading eastbound spun out of control on the bridge. Scattered power outages were reported throughout southwest Indiana as brisk winds brought down ice-laden tree limbs. Thousands of homes were without power. About 12,000 customers were without power on the east side of Evansville for about 90 minutes when ice brought down a transformer line. Another large power outage was in Boonville, where about 2,000 utility customers were affected. Evansville Regional Airport was closed for about three hours. Hospital emergency rooms reported numerous slip-and-fall injuries on the ice.
- **December 13, 2003.** Three to 3.5 inches of snow was reported in Evansville. A daily maximum snowfall record was set.
- **February 23, 2003.** This snowstorm was short but intense. Heavy snowfall rates of up to three inches per hour were reported. Visibility was less than one quarter mile during the heaviest snow bursts. Total snowfall was six inches or more north of Interstate 64, and four to five inches elsewhere.
- **February 15, 2003.** The Evansville Tri-State area received the brunt of a winter storm that began during the evening of February 15th and lasted about 24 hours. The precipitation was
mainly in the form of sleet. Several inches of sleet, mixed with freezing rain and snow, resulted in major travel disruptions. Multi-vehicle pileups and highway closures were reported in Evansville near the beginning of the winter storm. A thick layer of ice caused by the compacted sleet and freezing rain mixture made travel difficult at best. The storm occurred on the Presidents Day weekend. The weight of the sleet caused docks at an Evansville marina to start sinking. Three covered boat houses, each holding 40 to 45 boats, were threatened. Some specific reports included 4.3 inches at Evansville (with a liquid equivalent of 1.52 inches).

- **January 22, 2003.** Up to two inches of snow fell across southwest Indiana. Roads became slick and hazardous.
- **January 18, 2003.** Around one inch of snow fell across southwest Indiana. The Indiana State Police investigated 18 vehicle accidents or slide-offs.
- **December 23, 2002.** About two inches of sleet, mixed with some snow, fell south of Interstate 64 during the night of the 23rd. Only an inch or less fell north of the interstate. During the late afternoon and evening of Christmas Eve, an additional 3 inches of snow fell over most of southwest Indiana, except only around an inch in some places along the Ohio River. Emergency officials reported numerous minor accidents and vehicles sliding off roads on Christmas Eve.
- **December 4, 2002.** A winter storm brought significant snow and ice accumulations to southwest Indiana. The precipitation type was mostly snow, but the counties bordering the Ohio River received a significant period of freezing rain and sleet. Around one quarter inch of ice accumulated from Evansville east to Boonville and Rockport. Snow accumulations ranged from 2 to 5 inches. A total of 2.5 inches was measured at the Evansville airport. Travel was heavily impacted by the winter storm. Numerous vehicle accidents occurred, including 25 in the city of Evansville alone. Schools and some businesses were closed. The winter storm began during the morning hours and ended late the following night.
- **December 29, 2001.** The first measurable snow of the season caused some minor traffic problems. About one inch of snow fell across most of southwest Indiana, including Evansville.
- **February 22, 2001.** Several hours of moderate sleet and snow occurred, sometimes accompanied by thunder and lightning. The sleet accumulated to a depth of one inch. The liquid equivalent of the precipitation was 0.25 inch at Evansville.
- **January 26, 2001.** Freezing rain lasted for several hours and amounted to less than a tenth of an inch of precipitation.
- **January 1, 2001.** During the early morning hours, a general one to three inch snowfall blanketed southwest Indiana. The official total at Evansville was 2.3 inches.
- **December 16, 2000.** The snow accumulated from two to three inches across southwest Indiana.
- **December 13, 2000.** A major winter storm produced three to four inches of snow across southwest Indiana, followed by 1/4 to 1/2 inch of ice. The snow began during the mid to late-morning hours, falling at rates near one inch per hour. During the midday hours, the snow changed to freezing rain after a brief period of sleet. Light to occasionally moderate freezing rain fell during the afternoon and early evening hours. Numerous accidents occurred, most of
which were minor. In Vanderburgh County, including Evansville, police reported more than 50 accidents. Most schools and some businesses were closed by the storm.

- **December 2, 2000.** Snow began falling during the late afternoon hours. Accumulations ranged from one to two inches before the snow ended late in the evening. Because temperatures were just above freezing at the start, most of the accumulation was on grassy areas. As temperatures fell below freezing late in the evening, ice formed on the wet roads, causing a number of minor vehicle mishaps.

- **January 22, 2000.** Snow began during the morning hours and continued intermittently through the afternoon. Total accumulations averaged about two inches. Roads became very slippery, causing numerous accidents. Indiana State Police reported 28 accidents in southwest Indiana, and 19 of those were on Interstate 64.

- **January 17, 2000.** A period of freezing rain during the evening hours produced a light glaze less than one quarter inch thick.

- **March 14, 1999.** Heavy snow, between four and eight inches, fell over parts of southwest Indiana away from the Ohio River.

- **January 8, 1999.** Freezing rain coated objects with about a quarter of an inch of ice. Roads were ice or slush covered, but no downed tree limbs or power lines were reported.

- **January 1, 1999.** A period of freezing rain coated surfaces with a quarter to a half inch of ice. Roads became icy and dangerous. A few tree limbs were down.

- **December 30, 1998.** A one to two inch snowfall resulted in snow-covered and slippery roads.

- **December 23, 1998.** A light snowfall coated the region with around an inch of the white stuff. Travel was impacted due to very cold road surfaces, which allowed the snow to readily stick to the roads. The wintry precipitation hit right near the evening commute time.

- **December 21, 1998.** Rain during the day changed to sleet and freezing rain during the evening as a sharp cold front passed through the region. The wintry precipitation lasted a few hours, long enough to ice up most roads and walkways. Temperatures plunged from the upper 50s in the morning to the upper 20s early at night. Numerous skidding accidents were reported.

- **February 4, 1998.** One of the heaviest snowfalls in recent memory blanketed southwest Indiana with a total of 10 to 14 inches of snow. The snow fell in two distinct bursts. The first period of heavy snow from the afternoon of the 4th into the wee morning hours of the 5th produced six to eight inches. Snowfall rates during the peak of this burst were one to two inches per hour. The most intense snowfall occurred during the late afternoon rush hour, which caused major traffic headaches. A motorist was killed in a two-car accident on the Lloyd Expressway around 4 P.M. on the 4th. Countless minor accidents occurred, which slowed traffic to a crawl. A tractor trailer rig overturned on Interstate 164, closing that highway for a couple of hours. Strong wind gusts around 30 MPH caused some problems with snow drifting across roads that had been cleared. Almost every school, college, and university was closed. Some businesses were closed, and many clubs and associations cancelled meetings. The second burst of snow began during the afternoon of the 5th and continued into the wee morning hours of the 6th. Although snowfall rates were not as intense as in the first round of heavy snow, an additional 4 to 5 inches of snow fell. This brought
snowfall totals for the two-day period up to a foot across most of southwest Indiana. This storm total was enough to make this the sixth snowiest February on record at Evansville. Despite the heavy snow totals, relatively warm ground temperatures combined with air temperatures right near the melting point helped road crews clear the primary roads fairly easily.

- **December 30, 1997.** An "Alberta Clipper" type of low pressure system produced around four inches of snow across southwest Indiana during the afternoon and evening. Specific snowfall reports included 4 inches in downtown Evansville, 5 inches at the University of Southern Indiana near Evansville, and 3.5 inches at the Evansville. The evening rush hour was a mess, with so many accidents that Evansville Police could only respond to major accidents.

- **January 8, 1997.** A low pressure system moved northeast across the Tennessee River Valley, producing 3 to 4 inches of snow across southwest Indiana.

- **December 16, 1996.** Rain changed to snow across southwest Indiana and accumulated one to three inches. No major problems were reported. Slick roads contributed to a rash of vehicle accidents.

- **March 19, 1996.** A state of emergency was declared in the six southwestern Indiana counties including Vanderburgh. Snowfall accumulations were near a foot, but strong winds created many drifts 4 to 5 feet deep. The heavy wet snow combined with strong winds brought down many tree limbs and power lines. Visibility became so poor that some county highway crews were called off the job. Emergency shelters were set up for people without heat or electricity. Power outages were widespread during the storm. The National Guard was mobilized to help rescue families stranded on impassable roads. Even some National Guard Humvee vehicles became stuck in snow drifts up to 6 feet deep. Nearly a dozen school busses were stranded in ditches after students were released from school early. Numerous secondary roads and a few state roads were impassable for one to three days. Front end loaders and bulldozers were used to clear roads of downed trees, deep snow drifts, and abandoned vehicles.

- **October 29, 1993.** Snow of two to six inches fell across the southern half of Indiana. The snow began in southwest Indiana during the evening of October 29, and spread northeast during the night. The heaviest snow fell in a band from Evansville to near Cincinnati, Ohio, with the greatest amounts of around six inches reported in the southeast corner of the state. Evansville set a new 24 hour snowfall record for October with 4.10 inches from the 29th to the 30th. Evansville also experienced its second snowiest October on record with a total of 4.60 inches. The only October with more snow at Evansville was in 1925, with a total of five inches.

According to the USDA Risk Management Agency, insurance payments for damages to crops as a result of cold wet weather from 2007-2016 totalled $110,982. There were no claims for frost or freeze conditions. Also, state-wide in Indiana, 79 percent of the row crops were insured in 2016 according to the USDA’s Risk Management Agency.
### Probability of Future Occurrences

With the combined historical information from FEMA declarations, planning committee accounts, and the NCDC database, during a 23-year period from 1993 to 2016 there were at least 54 significant recorded winter storm events in Vanderburgh County resulting in an average of 2 significant winter storms per year. Based on historic frequency, the probability of future occurrence rating for winter storms is highly likely, 100 percent in any given year.

### Magnitude/Severity

Damages associated with winter storms in Vanderburgh County are usually related to downed power lines and power infrastructure. These damages and the associated losses as a result of disruptions in normal daily operations can be costly.

One significant winter weather event can have multiple impacts including property damage and damages to power lines and infrastructure from falling trees and limbs, prolonged power outages, road damage, road hazards, and road closures, school, government and business closures.

### Winter Storms Hazard Summary by Jurisdiction

Although crop loss as a result of winter storm occurs more in the unincorporated portions of the planning area, the crops losses are not high since corn and soybeans are not in the ground during winter months and only get affected from unusual weather events. The density of vulnerable populations is higher in the cities. Transportation incidents related to winter storm could also impact all jurisdictions. With these vulnerabilities that apply to both urban and rural jurisdictions, the magnitude of this hazard is relatively equal. The factors of geographic location and probability are also equal across the planning area. This hazard does not substantially vary by jurisdiction.
3.2.14 Hazard Profiles Summary

This section summarizes the results of the hazard profiles and assigns a level of overall planning significance to each hazard of low, moderate, or high. Significance was determined based on the hazard profile, focusing on key criteria such as frequency and resulting damage, including deaths/injuries and property, crop, and economic damage. This assessment was used by the HMPC to prioritize those hazards of greatest significance to the planning area; thus enabling the County to focus resources where they are most needed. Those hazards that occur infrequently or have little or no impact on the planning area were determined to be of low significance. Those hazards determined to be of high significance were characterized as priority hazards that required further evaluation in Section 3.3 Vulnerability Assessment.

Table 3.22 Planning Significance of Identified Hazards

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>- Wildfires</td>
<td>Significant</td>
<td>Occasional</td>
<td>Limited</td>
<td>Moderate</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Flood</td>
<td>Significant</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>High</td>
</tr>
<tr>
<td>- Dam Failure</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>- Levee Failure</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Infestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Emerald Ash Borer</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>- West Nile</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Mine Subsidence</td>
<td>Limited</td>
<td>Unlikely</td>
<td>Critical</td>
<td>Low</td>
</tr>
<tr>
<td>Severe Weather</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Extreme Temperatures</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
</tr>
<tr>
<td>- Thunderstorms/High Winds/Lightning</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>- Tornadoes</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>- Winter Storms</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
</tbody>
</table>

See Section 3.2 for definitions of these factors
3.3 Vulnerability Assessment

Requirement §201.6(c)(2)(ii) : [The risk assessment shall include a] description of the jurisdiction’s vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community.

Requirement §201.6(c)(2)(ii)(A) : The plan should describe vulnerability in terms of the types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Requirement §201.6(c)(2)(ii)(B) : [The plan should describe vulnerability in terms of an] estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(i)(A) of this section and a description of the methodology used to prepare the estimate.

Requirement §201.6(c)(2)(ii)(C) : [The plan should describe vulnerability in terms of] providing a general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.

Requirement §201.6(c)(2)(ii) : (As of October 1, 2008) [The risk assessment] must also address National Flood Insurance Program (NFIP) insured structures that have been repetitively damaged floods.

3.3.1 Methodology

The vulnerability assessment further defines and quantifies populations, buildings, critical facilities, and other community assets at risk to natural hazards. The vulnerability assessment for this plan followed the methodology described in the FEMA publication *Understanding Your Risks—Identifying Hazards and Estimating Losses* (2002).

The vulnerability assessment was conducted based on the best available data and the overall planning significance of the hazard. Data to support the vulnerability assessment was collected from the same sources identified in Section 3.1 Hazard Identification and Section 3.2 Hazard Profiles and from FEMA’s HAZUS-MH MR5 loss estimation software.

The Vulnerability Assessment is divided into four parts:

- **Section 3.3.2 Community Assets** first describes the assets at risk in Vanderburgh County, including the total exposure of people and property; critical facilities and infrastructure; natural, cultural, and historic resources; and economic assets. Note, HAZUS-MH MR5 currently uses 2000 Census Bureau Data.

- **Section 3.3.3 Vulnerability by Hazard** describes the vulnerability to each hazard identified in section 3.1 and profiled in section 3.2. This vulnerability analysis includes a vulnerability overview for each hazard. For hazards of high and moderate significance, the vulnerability analysis includes evaluation of vulnerable buildings, infrastructure, and critical facilities; estimated losses and a description of the methodology used to estimate losses; discussion of future development in relation to hazard-prone areas.
• **Section 3.3.4 Future Land Use and Development** discusses development trends, including population growth, housing demand, and future projects.

• **Section 3.3.5 Summary of Key Issues** summarizes the key issues and conclusions identified in the risk assessment process.

### 3.3.2 Community Assets

This section assesses the population, structures, critical facilities and infrastructure, and other important assets in Vanderburgh County that may be at risk to natural hazards.

#### Total Exposure of Population and Structures

Table 3.33 shows the total population, number of structures, and assessed value of improvements to parcels by jurisdiction. Land values have been purposely excluded because land remains following disasters, and subsequent market devaluations are frequently short term and difficult to quantify. Additionally, state and federal disaster assistance programs generally do not address loss of land or its associated value. The greatest exposure of people and property is concentrated in the City of Evansville, though significant population and structures are spread out in the unincorporated areas of the County.

<table>
<thead>
<tr>
<th>Community</th>
<th>Population</th>
<th>Number of Structures</th>
<th>Total Structure Value ($1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville</td>
<td>119,477</td>
<td>71,486</td>
<td>5,250,090</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>1,466</td>
<td>1,350</td>
<td>99,914</td>
</tr>
<tr>
<td>Evansville School Corporation</td>
<td>26,253</td>
<td>204</td>
<td>254,435</td>
</tr>
<tr>
<td>Unincorporated Vanderburgh County</td>
<td>60,778</td>
<td>40,581</td>
<td>3,399,985</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>181,721</strong></td>
<td><strong>113,417</strong></td>
<td><strong>9,044,424</strong></td>
</tr>
</tbody>
</table>

Source: Population – 2016 estimated population US Census Bureau; Structures and Value – Pictometry Building Footprint Layer Analysis received August 2017 - Source Imp AV-Van Co Incama Database August 2, 2017; Prepared by Jim Gowen Vanderburgh County Assessor’s Office
Critical Facilities and Infrastructure

A critical facility may be defined as one that is essential in providing utility or direction either during the response to an emergency or during the recovery operation. Table 3.34 is an inventory of critical facilities in Vanderburgh County. Figure 3.31 provides locations of the critical facilities in the entire planning area.

Table 3.34 Inventory of Critical Facilities and Infrastructure

<table>
<thead>
<tr>
<th>Critical Facility</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Operations Center</td>
<td></td>
</tr>
<tr>
<td>Evansville-Vanderburgh County Emergency</td>
<td>3500 North Harlan Avenue</td>
</tr>
<tr>
<td>Management Agency</td>
<td></td>
</tr>
<tr>
<td>Police Stations</td>
<td></td>
</tr>
<tr>
<td>Evansville Police Central Office</td>
<td>15 North West Martin Luther King Jr. Blvd</td>
</tr>
<tr>
<td>Evansville Police East Sector Office</td>
<td>4900 Shamrock Drive Suite 105</td>
</tr>
<tr>
<td>Evansville Police South Sector Office</td>
<td>215 Taylor Avenue</td>
</tr>
<tr>
<td>Evansville Police West Sector Office</td>
<td>401 East Columbia</td>
</tr>
<tr>
<td>Central Dispatch</td>
<td>1331 Harmony Way</td>
</tr>
<tr>
<td>Jail</td>
<td>3500 North Harlan Avenue</td>
</tr>
<tr>
<td>Vanderburgh Sheriff Command Post</td>
<td>5607 North Highway 41</td>
</tr>
<tr>
<td>Vanderburgh Sheriff Community Correction</td>
<td>3500 North Harlan Avenue</td>
</tr>
<tr>
<td>Vanderburgh Sheriff Headquarters</td>
<td>3500 North Harlan Avenue</td>
</tr>
<tr>
<td>Fire Stations</td>
<td></td>
</tr>
<tr>
<td>Hose House #1</td>
<td>750 South East 8th Street</td>
</tr>
<tr>
<td>Hose House #2</td>
<td>3601 Maxx Road</td>
</tr>
<tr>
<td>Hose House #3</td>
<td>310 North 4th Avenue</td>
</tr>
<tr>
<td>Hose House #4</td>
<td>1200 Oak Hill Road</td>
</tr>
<tr>
<td>Hose House #5</td>
<td>2413 West Maryland Street</td>
</tr>
<tr>
<td>Hose House #6</td>
<td>6521 Washington Avenue</td>
</tr>
<tr>
<td>Hose House #7</td>
<td>1050 South Barker Avenue</td>
</tr>
<tr>
<td>Hose House #8</td>
<td>2003 North Kentucky Avenue</td>
</tr>
<tr>
<td>Hose House #9</td>
<td>2020 Keystone Drive</td>
</tr>
<tr>
<td>Hose House #10</td>
<td>120 East Columbia</td>
</tr>
<tr>
<td>Hose House #14</td>
<td>545 South Willow Road</td>
</tr>
<tr>
<td>Hose House #15</td>
<td>1711 South Weinbach Avenue</td>
</tr>
<tr>
<td>Hose House #16</td>
<td>2801 Washington Avenue</td>
</tr>
<tr>
<td>Hose House #17</td>
<td>425 West Mill Road</td>
</tr>
<tr>
<td>German Township-Company 8</td>
<td>5220 Kasson Drive</td>
</tr>
<tr>
<td>German Township-Company 9</td>
<td>8400 Saint Wendel Road</td>
</tr>
<tr>
<td>McCutchanville Fire Department</td>
<td>9219 Petersburg Road</td>
</tr>
<tr>
<td>McCutchanville-station 5</td>
<td>7707 North Saint Joseph Road</td>
</tr>
<tr>
<td>Perry Township-Station 1</td>
<td>1510 Johnson Lane</td>
</tr>
<tr>
<td>Perry Township-Station 2</td>
<td>11 Williams Road</td>
</tr>
<tr>
<td>Perry Township-Station 3</td>
<td>Old Henderson Road</td>
</tr>
<tr>
<td>Scott Township-Station 1</td>
<td>1540 Baseline Road</td>
</tr>
<tr>
<td>Scott Township-Station 2</td>
<td>12425 North Greenriver Road</td>
</tr>
<tr>
<td>Scott Township-Station 3</td>
<td>12949 Darmstadt Road</td>
</tr>
</tbody>
</table>

Utilities
<table>
<thead>
<tr>
<th>Evansville Wastewater Treatment-East</th>
<th>1301 Waterworks Road</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville Wastewater Treatment-West</td>
<td>900 South Tekoppel Avenue</td>
</tr>
<tr>
<td>Levee Pump Stations</td>
<td>Multiple locations</td>
</tr>
<tr>
<td>Water and Sewer Maintenance Buildings</td>
<td>1931 Allens Lane</td>
</tr>
<tr>
<td>Water Filtration And Pump Stations</td>
<td>Multiple locations</td>
</tr>
</tbody>
</table>

### Main Government Buildings

- **Civic Center**: 1 North West Martin Luther King Jr. Blvd
- **City Garage**: 1304 Waterworks Road
- **County Highway Garage**: 5105 North Saint Joseph Avenue

### Medical Facilities

- **Deaconess Hospital Main Campus**: 600 Mary Street
- **Deaconess Cross Point**: 7200 East Indiana Street
- **Deaconess Health South**: 4100 Covert Avenue
- **Deaconess Urgent Care North Park**: 4506 1st Avenue
- **Evansville Surgery Center**: 520 Mary Street Suite 130
- **Evansville State Hospital**: 3400 Lincoln Avenue
- **Evansville Psychiatric Children Center**: 3300 East Morgan Avenue
- **St. Mary’s Medical Center**: 3700 Washington Avenue
- **St. Mary’s Hospital for Women and Children**: 3700 Washington Avenue
- **St. Mary’s Center for Children**: 3900 Washington Avenue
- **St. Mary’s Convenient Care West**: 5320 Weston Road
- **Select Specialty Hospital**: 400 South East Fourth Street
- **Southwestern Indiana Mental Health Center**: 415 Mulberry Street
- **Surgicare Cross Pointe**: 300 Circle Front Drive
- **Surgicare Professional Boulevard**: 1125 Professional Boulevard
- **Vanderburgh Health Department**: 420 Mulberry Street
- **Veteran Affairs Health Care Center**: 6211 East Waterford Boulevard

### Other

- **American Red Cross**: 29 North Stockwell
- **AMR Ambulance Dispatch**: 807 East Franklin Street
- **Animal Control Shelter**: 815 Uhlhorn Street
- **Evansville Regional Airport**: 7801 Bussing Drive
- **Mets Mobility Transportation/Garage**: 601 John Street
- **Pacific Pride Fuel Station**: 1250 East Morgan Avenue
- **Pacific Pride Fuel Station**: 516 North 7th Avenue
- **Pacific Pride Fuel Station**: 6205 Old Boonville Highway
- **Vanderburgh County Coroner Office**: 201 South Morton
- **Vanderburgh Humane Society**: 400 Millner Industrial Drive

### Schools

- **Academy For Innovative Studies (Diamond)**: 2319 Stringtown
- **Academy For Innovative Studies (First)**: 3013 1st Avenue
- **Benjamin Bosse High School**: 1300 Washington Avenue
- **Caze Elementary School**: 2013 South Green River Road
- **Cedar Hall Community School**: 2100 Fulton Avenue
- **Central high School**: 5400 1st Avenue
- **Culver Family Learning Center**: 1301 Judson Street
- **Cynthiana Heights Elementary School**: 1225 Big Cynthiana Road
- **Daniel Wertz Elementary School**: 1702 South Red Bank Road
- **Delaware Elementary School**: 700 North Garvin
- **Dexter Elementary School**: 917 South Dexter
- **Evans School**: 2727 North Evans Avenue
<table>
<thead>
<tr>
<th>School Name</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fairlawn Elementary School</td>
<td>2021 South Alvord</td>
</tr>
<tr>
<td>Francis Joseph Reitz High School</td>
<td>350 Dreier Boulevard</td>
</tr>
<tr>
<td>Glenwood Leadership Academy</td>
<td>901 Sweetser Avenue</td>
</tr>
<tr>
<td>Harper Elementary School</td>
<td>21 South Alvord Boulevard</td>
</tr>
<tr>
<td>Hebron Elementary School</td>
<td>4400 Bellemeade Avenue</td>
</tr>
<tr>
<td>Helfrich Park STEM Academy</td>
<td>2603 West Maryland Street</td>
</tr>
<tr>
<td>Highland Elementary School</td>
<td>6701 Darmstadt Road</td>
</tr>
<tr>
<td>Lincoln School</td>
<td>635 Lincoln Avenue</td>
</tr>
<tr>
<td>Lodge Community School</td>
<td>2000 Lodge Avenue</td>
</tr>
<tr>
<td>McGary Middle School</td>
<td>1535 South Joyce Avenue</td>
</tr>
<tr>
<td>New tech Institute</td>
<td>1901 Lynch Road</td>
</tr>
<tr>
<td>North High School</td>
<td>15331 Highway 41</td>
</tr>
<tr>
<td>North Junior High School</td>
<td>15325 Highway 41</td>
</tr>
<tr>
<td>Oak Hill Elementary</td>
<td>7700 Oak Hill Road</td>
</tr>
<tr>
<td>Perry Heights Middle School</td>
<td>5800 Hogue Road</td>
</tr>
<tr>
<td>Plaza Park International Prep Academy</td>
<td>7301 Lincoln Avenue</td>
</tr>
<tr>
<td>Scott Elementary School</td>
<td>14940 Old State Road</td>
</tr>
<tr>
<td>Stockwell Elementary School</td>
<td>2501 North Stockwell Road</td>
</tr>
<tr>
<td>Stringtown Elementary School</td>
<td>4720 Stringtown Road</td>
</tr>
<tr>
<td>Tekoppel Elementary School</td>
<td>111 North Tekoppel Avenue</td>
</tr>
<tr>
<td>Thompkins Middle School</td>
<td>1300 West Mill Road</td>
</tr>
<tr>
<td>Vogel Elementary School</td>
<td>150 Oak Hill Road</td>
</tr>
<tr>
<td>Washington Middle School</td>
<td>1801 Washington Avenue</td>
</tr>
<tr>
<td>West Terrace Elementary School</td>
<td>8000 west Terrace Drive</td>
</tr>
<tr>
<td>William Henry Harrison High School</td>
<td>211 Fielding Road</td>
</tr>
<tr>
<td>Joshua Academy</td>
<td>1230 East Illinois Street</td>
</tr>
<tr>
<td>Signature School Inc</td>
<td>610 Main Street</td>
</tr>
<tr>
<td><strong>Independent Non-Public Schools</strong></td>
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</tr>
<tr>
<td>Evansville Christian School</td>
<td>4400 Lincoln Avenue</td>
</tr>
<tr>
<td>Evansville Day School</td>
<td>3400 North Green River Road</td>
</tr>
<tr>
<td>Montessori Academy</td>
<td>4611 Adams Avenue</td>
</tr>
<tr>
<td>Optimal Rhythms Inc/ACCESS Academy</td>
<td>62 South Cullen Avenue Suite 120</td>
</tr>
<tr>
<td><strong>Diocese of Evansville</strong></td>
<td></td>
</tr>
<tr>
<td>Annunciation Catholic School Christ the King</td>
<td>3101 Bayard Park Drive</td>
</tr>
<tr>
<td>Annunciation Catholic School Holy Spirit</td>
<td>1760 South Lodge Avenue</td>
</tr>
<tr>
<td>Corpus Christi School</td>
<td>5530 Hogue Road</td>
</tr>
<tr>
<td>Good Shepard School</td>
<td>2301 North Stockwell Road</td>
</tr>
<tr>
<td>Holy Redeemer School</td>
<td>918 West Mill Road</td>
</tr>
<tr>
<td>Holy Rosary School</td>
<td>1303 South Green River Road</td>
</tr>
<tr>
<td>Mater Dei High School</td>
<td>1300 Harmony Way</td>
</tr>
<tr>
<td>Reitz Memorial High School</td>
<td>1500 Lincoln Avenue</td>
</tr>
<tr>
<td>Resurrection School</td>
<td>5301 New Harmony Road</td>
</tr>
<tr>
<td>Saint Joseph School</td>
<td>6130 West Saint Joe Road</td>
</tr>
<tr>
<td>Saint Benedict Cathedral School</td>
<td>530 Harlan Avenue</td>
</tr>
<tr>
<td>Westside Catholic School</td>
<td>1620 Glendale Avenue</td>
</tr>
<tr>
<td><strong>Lutheran Schools of Indiana</strong></td>
<td></td>
</tr>
<tr>
<td>Evansville Lutheran School</td>
<td>120 east Michigan Street</td>
</tr>
<tr>
<td><strong>Universities and Colleges</strong></td>
<td></td>
</tr>
<tr>
<td>University of Evansville</td>
<td>1800 Lincoln Avenue</td>
</tr>
<tr>
<td>University of Southern Indiana</td>
<td>8600 University Boulevard</td>
</tr>
<tr>
<td>Harrison College</td>
<td>4601 Theatre Drive</td>
</tr>
<tr>
<td>Ivy tech Community College</td>
<td>3501 North 1st Avenue</td>
</tr>
</tbody>
</table>
Figure 3.31  Critical Facilities
Natural, Historic, and Cultural Assets
Assessing the vulnerability of Vanderburgh County to disaster also involves inventorying the natural, historic, and cultural assets of the area. This step is important for the following reasons:

- The community may decide that these types of resources warrant a greater degree of protection due to their unique and irreplaceable nature and contribution to the overall economy.
- If these resources are impacted by a disaster, knowing so ahead of time allows for more prudent care in the immediate aftermath, when the potential for additional impacts are higher.
- The rules for reconstruction, restoration, rehabilitation, and/or replacement are often different for these types of designated resources.
- Natural resources can have beneficial functions that reduce the impacts of natural hazards, such as wetlands and riparian habitat, which help absorb and attenuate floodwaters.

Natural Resources

Additional vulnerability to the catastrophic event would include the current listing of natural resources within Evansville and Vanderburgh County. Those species listed below are identified as endangered, threatened, and rare species documented within Vanderburgh County by the Indiana Department of Natural Resources:

- Evening Bat;
- Swamp Rabbit;
- American Badger;
- Great Egret;
- Upland Sandpiper;
- Sedge Wren;
- Bald Eagle;
- Hooded Merganser;
- Peregrine Falcon;
- Loggerhead Shrike;
- Copperbelly Water Snake;
- Rough Green Snake;
- Eastern Hellbender;
- Spottail Darter;
- Marbled Underwing Moth;
- American Burying Beetle; and
- Indiana Crayfish.

Historic and Cultural Resources

Vanderburgh County has a history rich in Indian lore, mining, railroads, and agriculture. Preservation of the cultural heritage of this area has been identified as an important value and is ensured by a variety of initiatives. Several national and state historic inventories were reviewed to identify historic and cultural assets in Vanderburgh County:
• The **National Register of Historic Places** is the Nation’s official list of cultural resources worthy of preservation. The National Register is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect historic and archeological resources. Properties listed include districts, sites, buildings, structures, and objects that are significant in American history, architecture, archeology, engineering, and culture. The National Register is administered by the National Park Service, which is part of the U.S. Department of the Interior.

• The **Indiana Register of Historic Sites and Structures** is a listing of the state’s significant cultural resources worthy of preservation for the future education and enjoyment of Indiana’s residents and visitors. Properties listed in the State Register include individual buildings, structures, objects, districts, and historic and archaeological sites.

Table 3.35 lists the properties in Vanderburgh County that are on both the National Register of Historic Places and the Indiana State Register of Historic Sites and Structures.

<table>
<thead>
<tr>
<th>Historic Place And Location</th>
<th>Date of Construction</th>
<th>Date listed on the State or National Register</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alhambra Theatorium, 50 Adams Avenue</td>
<td>1913</td>
<td>National (10-1-79)</td>
</tr>
<tr>
<td>Angel Mounds State Memorial 8 miles southeast of Evansville</td>
<td>Not Available</td>
<td>National (10-15-66)</td>
</tr>
<tr>
<td>Bayard Park Historic District; Roughly bounded by Gum, Kentucky, Blackford and Garvin Streets</td>
<td>1893-1935</td>
<td>National (6-27-85)</td>
</tr>
<tr>
<td>William Bedford, Sr. House, 838 Washington Avenue</td>
<td>1874</td>
<td>National (11-28-78)</td>
</tr>
<tr>
<td>Bernardin-Johnson House, 17 Johnson Place</td>
<td>1916</td>
<td>National (6-29-89)</td>
</tr>
<tr>
<td>Bitterman Building, 202-204 Main Street</td>
<td>1923</td>
<td>National (9-22-80)</td>
</tr>
<tr>
<td>John W. Boehne House, 1119 Lincoln Avenue</td>
<td>1913</td>
<td>National (2-17-83)</td>
</tr>
<tr>
<td>Willard Carpenter House, 405 Carpenter Street</td>
<td>1849</td>
<td>National (2-20-78)</td>
</tr>
<tr>
<td>Culver Historic District, Roughly bounded by Madison Ave., Riverside Dr., Emmett and Venice Streets</td>
<td>1890-1929</td>
<td>National (6-1-84)</td>
</tr>
<tr>
<td>Downtown Evansville Multiple Resource Area – Multiple Buildings</td>
<td>1817-1943</td>
<td>State (3-2-82), National (7-1-82)</td>
</tr>
<tr>
<td>Evansville College, 1800 Lincoln Avenue</td>
<td>1916-1940</td>
<td>National (2-3-83)</td>
</tr>
<tr>
<td>Evansville Municipal Market, 813 Pennsylvania Street</td>
<td>1918</td>
<td>National (12-22-83)</td>
</tr>
<tr>
<td>Evansville Post Office, 100 block of NW 2nd Street</td>
<td>1879</td>
<td>National (7-2-71)</td>
</tr>
<tr>
<td>Former Vanderburgh County Sheriff’s Residence 4th Street between Vine and Court Streets</td>
<td>1891</td>
<td>National (10-6-70)</td>
</tr>
<tr>
<td>Garvin Park North Main Street and Morgan Avenue</td>
<td>1915</td>
<td>National (8-29-80)</td>
</tr>
<tr>
<td>Historic Place and Location</td>
<td>Date of Construction</td>
<td>Date listed on the State or National Register</td>
</tr>
<tr>
<td>-----------------------------------------------------</td>
<td>----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>General Cigar Company 223 NW 2nd Street</td>
<td>1902, 1923, 1929</td>
<td>National (2000)</td>
</tr>
<tr>
<td>Greyhound Bus Terminal 102 Northwest 3rd Street</td>
<td>1939</td>
<td>National (10-1-79)</td>
</tr>
<tr>
<td>Michael D. Helfrich House 700 Helfrich Lane</td>
<td>1920</td>
<td>National (5-24-84)</td>
</tr>
<tr>
<td>Hooker-Ensle-Pierce House 6531 Oak Hill Road</td>
<td>1839</td>
<td>National (4-28-77)</td>
</tr>
<tr>
<td>Hose House #10 119 East Columbia Street</td>
<td>1888</td>
<td>National (2-11-82)</td>
</tr>
<tr>
<td>Hose House #12 1409 1st Avenue</td>
<td>1908</td>
<td>National (6-17-82)</td>
</tr>
<tr>
<td>Edgar Iglehart House 5500 Lincoln Avenue</td>
<td>1932</td>
<td>National (12-18-90)</td>
</tr>
<tr>
<td>Independence Historic District Roughly bounded by Iowa and Illinois Streets, Wabash and St. Joseph Streets</td>
<td>1857-1920</td>
<td>National (2-1-82)</td>
</tr>
<tr>
<td>Koester-Patberg House 504 Herndon Drive</td>
<td>1974</td>
<td>National (3-3-83)</td>
</tr>
<tr>
<td>Liberty Baptist Church 701 Oak Street</td>
<td>1886</td>
<td>National (12-8-78)</td>
</tr>
<tr>
<td>Lincolnshire Historic District Roughly bounded by Lincoln, Bennighof, Bellmeade, Lodge, Washington, Harlan, East Chandler and College Streets</td>
<td>1913-1940</td>
<td>National (10-2-89)</td>
</tr>
<tr>
<td>Peter Augustus Maier House 707 South 6th Street</td>
<td>1873</td>
<td>National (10-29-82)</td>
</tr>
<tr>
<td>McCurdy Building, (Sears, Roebuck and Company Building) 101 Northwest 4th Street</td>
<td>1920, 1937, 1943</td>
<td>National (10-1-79)</td>
</tr>
<tr>
<td>McJohnston Chapel and Cemetery Kansas Rd. and Erskine Lane</td>
<td>1880</td>
<td>National (1-18-79)</td>
</tr>
<tr>
<td>Mead Johnson River-Rail-Truck Terminal and Warehouse 1830 West Ohio Street</td>
<td>1931</td>
<td>National (12-27-84)</td>
</tr>
<tr>
<td>Ohio Street Bridge Ohio Street over Pigeon Creek</td>
<td>1891</td>
<td>National (1998)</td>
</tr>
<tr>
<td>Old Bitterman Building 200 Main Street</td>
<td>c.1885</td>
<td>National (9-22-80)</td>
</tr>
<tr>
<td>Old Vanderburgh County Courthouse Block bounded by Vine, 4th, Court and 5th Streets</td>
<td>1891</td>
<td>National (9-4-70)</td>
</tr>
<tr>
<td>John Augustus Reitz House 224 Southeast 1st Street</td>
<td>1872</td>
<td>National (10-15-73)</td>
</tr>
<tr>
<td>Ridgeway Building 313-315 Main Street</td>
<td>1895</td>
<td>National (1-3-80)</td>
</tr>
<tr>
<td>Riverside Historic District Roughly bounded by Southlane Dr., Walnut, 3rd, and Parrett Streets</td>
<td>1818-1920</td>
<td>National (11-14-78)</td>
</tr>
<tr>
<td>Michael Schaeffer House 118 East Chandler Avenue</td>
<td>1894</td>
<td>National (2-11-82)</td>
</tr>
<tr>
<td>Robert Smith Mortuary 118-120 Walnut Street</td>
<td>1930</td>
<td>National (9-22-80)</td>
</tr>
<tr>
<td>Historic Place And Location</td>
<td>Date of Construction</td>
<td>Date listed on the State or National Register</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------</td>
<td>----------------------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Soldiers and Sailors Memorial Coliseum 350 Court Street</td>
<td>1917</td>
<td>National (5-10-79)</td>
</tr>
<tr>
<td>Sunset Park Pavilion 411 Southeast Riverside Drive Sunset Park</td>
<td>1912</td>
<td>National (6-17-92)</td>
</tr>
<tr>
<td>Charles Sweeton House 8700 Old State Road</td>
<td>1926-1935</td>
<td>National (2005)</td>
</tr>
<tr>
<td>Washington Avenue Historic District Roughly bounded by Madison and Grand avenues, East Gum and Parrett Streets</td>
<td>1880-1920</td>
<td>National (11-28-80)</td>
</tr>
<tr>
<td>Willard Library 21 1st Avenue</td>
<td>1888</td>
<td>National (9-28-72)</td>
</tr>
</tbody>
</table>

Source: Indiana Department of Natural Resources; http://www.in.gov/dnr/historic/2823.htm
3.3.3 Vulnerability by Hazard

This section describes overall vulnerability and identifies structures and estimates potential losses to buildings, infrastructure, and critical facilities located in identified hazard areas. This assessment was limited to the hazards that were considered moderate or high in planning significance, based on HMPC input and the hazard profiles. Hazards ranked of low significance due to a lack of notable past damage or very low probabilities are not included in the vulnerability assessment. These include the following:

- Mine Subsidence

Vulnerability for this hazard is discussed in qualitative terms in Section 3.2 Hazard Profiles.

The vulnerability assessment is also limited by the data available for the high or moderate ranked hazards. The methods of analysis vary by hazard type and data available. Many of the identified hazards, particularly infestations and weather-related hazards, affect the entire planning area, and specific hazards areas cannot be mapped geographically. For these hazards, which include drought, infestations, and severe weather, vulnerability is mainly discussed in qualitative terms because data on potential losses to structures is not available. Geographic hazard areas can be mapped for the following identified hazards: flood; dam failure; levee failure; earthquake; and wildfire.

Drought

Existing Development

Drought affects the water supply of communities in the County, as well as agricultural irrigation on a more widespread scale, affecting the economy. It normally does not impact structures and can be difficult to identify specific hazard areas. Data is not available to estimate potential losses to structures in identified hazard areas.

According to the ten year period from USDA’s Risk Management Agency, the amount of claims paid for crop damage as a result of drought in Vanderburgh County was $11,957,586. According to the 2016 Indiana Crop Insurance Profile from USDA’s Risk Management Agency, 79 percent of the insurable crops in Indiana are insured with USDA Crop Insurance. To factor in estimated losses to insurable crops that are not insured, the 79 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total $1,513,618 (see Table 3.36).

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from drought was determined minimal compared to the value of the insurable crops.
Table 3.36  Estimated Insurable Annual Crops Lost Resulting From Drought

<table>
<thead>
<tr>
<th>10-Year Drought Insurance Paid</th>
<th>Adjusted 10-Year Drought Losses (considering 79% insured)</th>
<th>Estimated Annualized Losses</th>
<th>2012 Value of Crops</th>
<th>Annualized Crop Loss Ratio (Losses/Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$11,957,586</td>
<td>$15,136,185</td>
<td>$1,513,618</td>
<td>$36,093,000</td>
<td>4.19%</td>
</tr>
</tbody>
</table>

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA’s Risk Management Agency for 2007-2016; Crop Insurance Coverage is from USDAs 2016 State Crop Insurance Profile for Indiana

Future Development

As population grows, so do the water needs for household, commercial, industrial, recreation, and agricultural uses. Vulnerability to drought will increase with these growing demands on existing water supplies. Future water use planning in Indiana is addressed the State’s Water Shortage Plan, July 23, 2009. The purpose of the plan is to provide the State of Indiana with an effective and systematic plan to assess and manage the State’s water resources during a water shortage or potential water shortage to respond, to the maximum extent practicable, to the needs of its water users while protecting its environment. It is intended to serve as a tool for the State to guide the use and management of the State’s water resource as the availability of that resource diminishes during events such as drought.

Infestations

West Nile Virus

Existing Development

Both the risk and vulnerability to Indiana from West Nile Virus (WNV) is considered low, based on the percentage of total population that actually contracts the disease. The first appearance of WNV in North America occurred in 1999. Since 2003, there have been 5 human disease cases identified in Vanderburgh County. In the years to follow there have been 13 human cases of West Nile Virus, these cases took place between 2011-2016.

Future Development

To reduce the risk transmission of West Nile Virus by mosquitoes, the Vanderburgh County Health Department recommends residents:

- Take special precautions when outdoors between dusk and dawn, when mosquitoes are most active;
- Use insect repellant containing DEET, Picaridin, or Oil of Lemon Eucalyptus; and
- Make sure your property is free of any standing water, which could be breeding grounds for the mosquitoes that carry disease such as West Nile Virus. Empty flowerpots, buckets, old tires, and clogged gutters.

The Vanderburgh County Health Department’s Mosquito Control Division is currently focusing efforts on treating standing water to prevent adult mosquitoes from developing.
**Emerald Ash Borer**

**Existing Development**

The Urban Forestry Department and City Arborist of Evansville have inventoried the ash trees located within the City of Evansville. A row of ash trees located on Division Street between Martin Luther King Junior Boulevard and First Avenue was noted as stag horning. This area has been identified as a good project for Master Gardeners to prune out dead in as a volunteer project.

**Future Development**

On a national level, research is being conducted at universities to understand the beetle's life cycle and find ways to detect new infestations, control emerald ash borer adults and larvae, and contain the infestation. Additionally, quarantines are in place to prevent infested ash firewood, logs or nursery trees from being transported and starting new infestations.

Within Vanderburgh County, the Urban Forestry Department and City Arborist of Evansville are developing a plan to remove ash trees in order to receive grant funding for tree replacement within the same year. Additionally, the Urban Forestry Department and City Arborist of Evansville will monitor the ash tree population for indications of the Emerald Ash Borer, and initiate plan when the infestation has been found in Evansville.

**Severe Weather**

**Existing Development**

The severe weather evaluated as part of this risk assessment included: extreme temperatures, thunderstorms/high winds/lightning, tornadoes, and winter storms. During severe weather events, the threat to public safety is typically the greatest concern. However, these storms also impact the local economy by disrupting transportation and commercial activities.

Impacts to existing development within the community, as a result of severe weather, includes damage to infrastructure, particularly overhead power lines, road closures, and interruption in business and school activities. Utility outages impact anything relying on electricity without a redundant power supply (e.g., a generator), and include secondary impacts such as interruption to water and sewage services, heat and refrigeration, fuel supplies, computers and cell phones. If interruption to business occurs for an extended period, economic impacts can be severe. Also of concern is the impact to populations with special needs such as the elderly and those requiring the use of medical equipment. Although typically short-lived, delays in emergencies response services are of concern. Depending on the nature of a given storm, all areas within Evansville and Vanderburgh County are potentially at risk; however, those areas relying on above ground utilities would potentially suffer the greatest damage.
Extreme Temperatures

According to the ten year period from USDA’s Risk Management Agency, the amount of claims paid for crop damages as a result of heat was $1,064,320. According to the 2016 Indiana Crop Insurance Profile Report issued by the USDA’s Risk Management Agency, 79 percent of Indiana insurable crops were insured. To factor in estimated losses to insurable crops that are not insured, the 79 percent crop insurance coverage was factored in to provide an adjusted estimate of losses. According to this calculation, estimated annualized losses total $134,724 (see Table 3.37).

Considering the value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from heat was determined to be minimal (0.37%) compared to the value of the insurable crops.

Table 3.37  Estimated Insurable Annual Crops Lost Resulting From Heat

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$1,064,320</td>
<td>$1,347,241</td>
<td>$134,724</td>
<td>$36,093,000</td>
<td>0.37%</td>
</tr>
</tbody>
</table>

Source: Crop value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA’s Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDA’s 2016 State Crop Insurance Profile for Indiana

Extreme heat can also cause a strain on electricity delivery infrastructure which can be overloaded during peak use of electricity to power air conditioning during extreme heat events. Another type of infrastructure damage that can occur as a result of extreme heat is road damage. When asphalt is exposed to prolonged extreme heat, it can cause buckling of asphalt-paved roads, driveways, and parking lots.

Thunderstorms (Hail/Lightning/High Wind)

Table 3.38 provides the estimated annualized property damages resulting from Thunderstorms, including lightning, hail and wind. This annualized damage has been compared to the total building exposure for Vanderburgh County and the level of damage is minimal compared to the value of building exposure.

Table 3.38  Estimated Annualized Property Damages Resulting from Severe Thunderstorms (Hail/Lightning/Wind, 1993-June 2017)

<table>
<thead>
<tr>
<th>Building Exposure</th>
<th>Hail/Lightning/Thunderstorm Wind Property Damages</th>
<th>Annualized Property Damages</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,044,424,000</td>
<td>Hail $20,000, Lightning $100,000, Thunderstorm Wind $39,212,000</td>
<td>$1,710,087</td>
</tr>
</tbody>
</table>

Source: Building Exposure, Vanderburgh County Assessor’s Office; Hail, Lightning, & Thunderstorm Wind Property Damage from NCDC records

Table 3.39 provides the insured crop losses for resulting from hail and wind. The insured loss has been adjusted to estimate losses to all insurable crops by considering that 79 percent of insurable crops in the State were insured (2016 Indiana Crop Insurance Profile from USDA’s Risk Management Agency).
### Table 3.39  Estimated Insurable Annualized Crop Damages Resulting from Severe Thunderstorms (Hail/Wind/Excess Wind)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>$36,093,000</td>
<td>$160</td>
<td>$3,300</td>
<td>$330</td>
</tr>
<tr>
<td>Hail</td>
<td>$2,446</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wind/Excess Wind</td>
<td>$2,606</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Crop exposure value is from USDA 2012 Census of Agriculture; Crop Insurance Paid is from the USDA’s Risk Management Agency for 2007-2016.; Crop Insurance Coverage is from USDAs 2016 State Crop Insurance Profile for Indiana

### Tornado

In Vanderburgh County, the NCDC estimate for past property damages resulting from tornadoes from 1950 – June 2017 (67.5 years) was $18,655,250. This translates to an annualized loss of over $276,374.

### Winter Storms

USDA crop insurance claims for cold conditions and snow for the ten-year period of 2007-2016 totaled $110,982. The 2016 Indiana Crop Insurance Profile from USDA, RMA shows that 79 percent of crops are insured in Indiana and the adjusted losses calculate to $140,484 for the period and $14,048 in estimated annualized losses.

Considering the $36 million market value of crops from the 2012 Census of Agriculture as baseline crop exposure, the estimated annual losses from cold conditions and snow was determined minimal (0.04%) compared to the value of the insurable crops.

### Loss of Use

Overhead power lines and infrastructure are also vulnerable to damages from severe weather. Potential losses would include cost of repair or replacement of damaged facilities, and lost economic opportunities for businesses. Public safety hazards include risk of electrocution from downed power lines. Specific amounts of estimated losses are not available due to the complexity and multiple variables associated with this hazard.

### Table 3.40  Loss of Use Estimates for Power Failure (One Day)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>2016 Population Estimate</th>
<th>Estimated Affected Population 10%</th>
<th>Electric Loss of Use Estimate ($126 per person per day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Evansville</td>
<td>119,477</td>
<td>11,948</td>
<td>$1,505,410</td>
</tr>
<tr>
<td>Town of Darmstadt</td>
<td>1,466</td>
<td>147</td>
<td>$18,472</td>
</tr>
<tr>
<td>Unincorporated Vanderburgh</td>
<td>60,778</td>
<td>6,078</td>
<td>$765,803</td>
</tr>
<tr>
<td>County</td>
<td>181,721</td>
<td>18,172</td>
<td>$2,289,685</td>
</tr>
</tbody>
</table>

**Future Development**

Future residential or commercial buildings built to code should be able to withstand wind and snow loads from severe weather. Population growth in the County will increase problems with road, business, and school closures and increase need for snow removal and emergency services related to severe winter weather events.

**Flood**

**Existing Development**

FEMA’s software program, HAZUS-MH MR5, was utilized for estimating the potential losses due to flooding. HAZUS was used to generate a one percent annual flood, or base flood, event for major rivers and creeks in the county. The software produces a flood polygon and flood-depth grid that represents the base flood. The current Flood Insurance Study and associated Digital Flood Insurance Rate Maps (DFIRMs), dated March 2011, did not include flood-depth grids and were therefore, not utilized in this analysis.

Based on the flood polygon and flood-depth grid, HAZUS provides reports on the number of buildings impacted, building repair costs, and the associated loss of building contents and business inventory. Community parcel and tax assessor information were entered into the software program to refine the building inventory.

Additionally, building damage can cause losses to a community as a whole by restricting the building’s ability to function properly. Income loss data accounts for business interruption and rental income losses as well as the resources associated with damage repair and job and housing losses. These losses are calculated by HAZUS using a methodology based on the building damage estimates. Flood damage is directly related to the depth of flooding. For example, a two-foot flood generally results in about 20 percent damage to the structure (which translates to 20 percent of the structure’s replacement value).

The HAZUS analysis for a 100-year flood event produced the following loss estimates:

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Displaced Persons</th>
<th>Impacted Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville</td>
<td>13,303</td>
<td>1901</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unincorporated Area</td>
<td>3,683</td>
<td>793</td>
</tr>
<tr>
<td><strong>Total County</strong></td>
<td><strong>16,986</strong></td>
<td><strong>2,694</strong></td>
</tr>
</tbody>
</table>

Source: HAZUS-MH MR5
Table 3.42  Estimated Building Losses by Jurisdiction (Millions of dollars)

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Building Damage ($)</th>
<th>Content Damage ($)</th>
<th>Inventory Damage ($)</th>
<th>Income Loss ($)</th>
<th>Relocation Cost ($)</th>
<th>Rental Income Loss ($)</th>
<th>Wage Loss ($)</th>
<th>Total Loss ($)</th>
<th>% of Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evansville</td>
<td>281</td>
<td>319.10</td>
<td>216.91</td>
<td>12.59</td>
<td>11.46</td>
<td>4.76</td>
<td>32.44</td>
<td>878.42</td>
<td>28.0</td>
</tr>
<tr>
<td>Darmstadt</td>
<td>0.27</td>
<td>0.37</td>
<td>0.43</td>
<td>0.41</td>
<td>0.18</td>
<td>0.03</td>
<td>0.97</td>
<td>2.65</td>
<td>0.1</td>
</tr>
<tr>
<td>Unincorporated Area</td>
<td>112.08</td>
<td>106.95</td>
<td>1,884.89</td>
<td>33.10</td>
<td>26.65</td>
<td>6.81</td>
<td>81.32</td>
<td>2,251.78</td>
<td>71.9</td>
</tr>
<tr>
<td><strong>Total County</strong></td>
<td><strong>393.35</strong></td>
<td><strong>426.42</strong></td>
<td><strong>2,102.23</strong></td>
<td><strong>46.1</strong></td>
<td><strong>38.29</strong></td>
<td><strong>11.6</strong></td>
<td><strong>114.73</strong></td>
<td><strong>3,132.85</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Source: HAZUS-MH MR5

Critical Facilities in 100-Year Floodplain

Table 3.43 shows critical facilities located in Vanderburgh County’s 100- and 500-year flood hazard areas. Critical facilities data was obtained from the HMPC and Evansville-Vanderburgh County Emergency Management Agency.

Table 3.43  Critical Facilities in the 100- and 500-Year Floodplains

<table>
<thead>
<tr>
<th>Facility</th>
<th>Address</th>
<th>Floodplain</th>
</tr>
</thead>
<tbody>
<tr>
<td>McCutchanville – Station 5</td>
<td>7707 N Saint Joseph Rd</td>
<td>100-Year</td>
</tr>
<tr>
<td>Perry Twp – Station 1</td>
<td>1510 Johnson Ln</td>
<td>100-Year</td>
</tr>
<tr>
<td>Perry Twp – Station 3</td>
<td>Old Henderson Rd</td>
<td>100-Year</td>
</tr>
<tr>
<td>Animal Control</td>
<td>815 Uhlhorn Street</td>
<td>500-Year</td>
</tr>
<tr>
<td>Deaconess Cross Point</td>
<td>7200 E. Indiana</td>
<td>500-Year</td>
</tr>
<tr>
<td>Heritage Petroleum – 1</td>
<td>6205 Old Boonville Hwy</td>
<td>500-Year</td>
</tr>
<tr>
<td>North High School</td>
<td>2319 Stringtown Road</td>
<td>500-Year</td>
</tr>
<tr>
<td>Oak Hill Middle School</td>
<td>7700 Oak Hill Road</td>
<td>500-Year</td>
</tr>
<tr>
<td>Scott Twp – Station 2</td>
<td>12425 N Green River Rd</td>
<td>500-Year</td>
</tr>
</tbody>
</table>

Source: HAZUS-MH MR5; HMPC; and City of Evansville-Vanderburgh County EMA

Future Development

The risk of flooding to future development should be minimized by the floodplain management programs of the County and its municipalities, if properly enforced. Risk could be further reduced by strengthening floodplain ordinances and floodplain management programs beyond minimum NFIP requirements.

Dam Failure

Existing Development

Although there is no specific evidence to indicate the likelihood of dam failure within the County, there are several high hazard dams located in the County. A dam failure could result in impacts greater than the 100-year flood event and could be catastrophic. Inundation maps were unavailable for this project; therefore, structures and potential loss estimates in these areas could
Emergency Action Plans for every high and significant hazard dams are kept on file at the Indiana Department of Natural Resources, Agriculture, Division of Water Resources, and Water Structures Program.

**Future Development**

Flooding due to a dam failure event is likely to exceed the special flood hazard areas regulated through local floodplain ordinances. Evansville and Vanderburgh County should consider the dam failure hazard when permitting development downstream of the 8 high hazard and 8 significant hazard dams in the County. Low hazard dams could become significant or high hazard dams if development occurs below them.
Earthquake

*Existing Development*

Common impacts from earthquakes include damages to infrastructure and buildings (e.g., unreinforced masonry [brick] crumbling; architectural facades falling; underground utilities breaking, gas-fed fires; landslides and rock falls; and road closures). Less common, but possible damages would include dam failures and subsequent flash floods.

FEMA’s software program, HAZUS-MH MR5, was utilized for estimating the potential losses due to earthquakes. HAZUS evaluates the geographic distribution of ground shaking resulting from a specified scenario earthquake and expresses ground shaking using quantitative parameters, such as peak ground acceleration and spectral acceleration. For Vanderburgh County, the following specified earthquake scenarios were utilized:

**Table 3.44  HAZUS Specified Earthquakes**

<table>
<thead>
<tr>
<th>New Madrid Fault Zone</th>
<th>Wabash Valley Fault Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.7 Magnitude at 10 KM depth;</td>
<td>7.1 Magnitude at 10 KM depth;</td>
</tr>
<tr>
<td>235.53 square mile region with 48 census tracts;</td>
<td>235.53 square mile region with 48 census tracts;</td>
</tr>
<tr>
<td>70,000 households;</td>
<td>70,000 households;</td>
</tr>
<tr>
<td>Population of 171,922 people;</td>
<td>Population of 171,922 people;</td>
</tr>
<tr>
<td>72,000 buildings within the region;</td>
<td>72,000 buildings within the region;</td>
</tr>
<tr>
<td>Total building replacement cost of 14,412 million dollars; and</td>
<td>Total building replacement cost of 14,412 million dollars; and</td>
</tr>
<tr>
<td>Approximately 90% of the buildings (and 66% of the building value) are associated with residential housing.</td>
<td>Approximately 90% of the buildings (and 66% of the building value) are associated with residential housing.</td>
</tr>
</tbody>
</table>

Source: HAZUS-MH MR5; HMPC; and City of Evansville-Vanderburgh County EMA

Based on the specified earthquake, HAZUS provides reports on the number of buildings impacted, building repair costs, and the associated loss of building contents and business inventory. Community parcel and tax assessor information were entered into the software program to refine the building inventory.
Table 3.45 HAZUS Earthquake Results

<table>
<thead>
<tr>
<th>Impacts / Earthquake</th>
<th>New Madrid Seismic Zone 7.7 @ 10KM</th>
<th>Wabash Valley Seismic Zone 7.1 @ 10KM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings Damaged</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single Family Residential</td>
<td>None – 48,508</td>
<td>None – 10,473</td>
</tr>
<tr>
<td></td>
<td>Slight- 5,979</td>
<td>Slight- 16,419</td>
</tr>
<tr>
<td></td>
<td>Moderate- 1,819</td>
<td>Moderate- 16,718</td>
</tr>
<tr>
<td></td>
<td>Extensive- 331</td>
<td>Extensive- 7,482</td>
</tr>
<tr>
<td></td>
<td>Complete- 48</td>
<td>Complete- 5,593</td>
</tr>
<tr>
<td>Damage to Schools</td>
<td>All with 50% functionality &gt; 1 day</td>
<td>All with at least moderate damage &gt; 50%</td>
</tr>
<tr>
<td>(Based upon 75 buildings)</td>
<td></td>
<td>23 with complete damage &gt; 50%</td>
</tr>
<tr>
<td>Damage to Hospitals</td>
<td>All with 50% functionality &gt; 1 day</td>
<td>All with at least moderate damage &gt; 50%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 with complete damage &gt; 50%</td>
</tr>
<tr>
<td>Damage to Transportation</td>
<td>All with 50% functionality &gt; 1 day</td>
<td>All with 50% functionality &gt; 1 day</td>
</tr>
<tr>
<td>Systems</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Households w/out Power &amp;</td>
<td>No loss of water</td>
<td>No loss of water</td>
</tr>
<tr>
<td>Water Service</td>
<td>No loss of power</td>
<td></td>
</tr>
<tr>
<td>Debris</td>
<td>4.39 million tons</td>
<td>72.58 million tons</td>
</tr>
<tr>
<td>Displaced Households</td>
<td>180</td>
<td>9,618</td>
</tr>
<tr>
<td>Injuries</td>
<td>Without requiring hospitalization: 333</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requiring hospitalization: 59</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life Threatening: 6</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fatalities: 11</td>
<td></td>
</tr>
<tr>
<td>Economic Loss</td>
<td>Income Losses: $1,699 M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capital Stock: $343 M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total: $2,043 M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Without requiring hospitalization: 10,470</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Requiring hospitalization: 3,127</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life Threatening: 516</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fatalities: 941</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Income Losses: $20,879 M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Capital Stock: $7,851 M</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total: $28,731 M</td>
<td></td>
</tr>
</tbody>
</table>

The Wabash Valley Seismic Zone scenario generates thousands of cases of complete damage to residential structures, much greater than the level of complete damage from the New Madrid Seismic Zone scenario. The fault rupture within the Wabash Valley is much closer to Vanderburgh County, and the State of Indiana, and thus the shaking is far more intense.

**Future Development**

Building codes substantially reduce the costs of damage to future structures from earthquakes. Vanderburgh County and the City of Evansville follow the building rules and regulations of the Indiana Fire Prevention and Building Safety Commission. The State of Indiana Residential Building Code designates Vanderburgh County as Seismic Design Category C₁. An increase in designation to D₀, is currently under consideration and would include the following design changes:

- Increased wall bracing requirements
- Increased stem wall requirements
- Increased height limitations
- Increased steel reinforcement requirements
- Increased concrete compressive strength requirements
- Increased framing and bracing requirements
- Increased requirements for hiring Design Professionals
- Increased wall anchorage requirements
- Increased interior braced wall line requirements
- Increased exterior braced wall line requirements
- Increased veneer anchorage
- Increased veneer limitations

Wildfire

**Existing Development**

Vulnerability to wildfire is predominantly associated with wildland-urban interface areas. The wildland-urban interface is a general term that applies to development interspersed or adjacent to forests and wildlands.

The August 17, 2001, Federal Register included a list of “urban wildland interface communities within the vicinity of federal lands that are at high risk from wildfire.” The communities were identified as required by the National Fire Plan, a cooperative, long-term effort between various government agency partners with the intent of actively responding to severe wildfires and their impacts to communities while ensuring sufficient firefighting capacity for the future. None of the communities within Vanderburgh County were included on this list.

**Future Development**

Growth continues to occur in wildland-urban interface areas of unincorporated Vanderburgh County, increasing the vulnerability of people, property, and infrastructure to wildfires. Currently, there are no community wildfire protection plans and no wildfire mitigation review requirements or regulations for development in the wildland-urban interface in the County or towns. However, education and other mitigation initiatives in place in the County,
3.3.4 Development and Land Use Trends

As part of the planning process, the HMPC looked at changes in growth and development and land use trends and examined these changes in the context of hazard-prone areas. Information from the 2015-2035 Comprehensive Plan for Evansville and Vanderburgh County form the basis of this discussion.

Population

The 2015-2035 Comprehensive Plan projected the future population for Vanderburgh County utilize three different methods in order to compare low, medium, and high population alternatives for the County. The projection represents the high population growth from 2010 base year at 12.53% increase, to other population projection on the plan calling for moderate growth population of 6.99%.

Table 3.46 Population Projections for Vanderburgh County, 2035

<table>
<thead>
<tr>
<th>Source</th>
<th>2010 Census</th>
<th>2035 Projected Population</th>
<th>Amount and Percent of Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBRC</td>
<td>179,703</td>
<td>192,271</td>
<td>12,568 (6.99%)</td>
</tr>
<tr>
<td>SEAC</td>
<td>179,703</td>
<td>202,224</td>
<td>22,521 (12.53%)</td>
</tr>
</tbody>
</table>

Source: 2015-2035 Comprehensive Plan of Evansville and Vanderburgh County

The highest growth is projected in the Northeast side in the unincorporated Center and southern Scott Township. Moderate growth of Pigeon Township is to have the third fastest growth over the next 20 years. The 2015-2035 Comprehensive Plan also notes that employment and business establishments in the County have steadily increased; construction of housing continues at an unprecedented rate; and a strong local economy is predicted for the future.

Land Use

The 2015-2035 Comprehensive Plan of Evansville and Vanderburgh County establishes the desired land use pattern and development goals, objectives, and policies that provide guidance for land use decisions. The land use categories addressed in the Plan are residential, commercial, industrial, and agricultural land uses. The underlying principal of the land use plan is to assure that Evansville and Vanderburgh County can reasonably accommodate the expected and desired changes in an orderly manner that meets the needs and vision of the community.

The goal of the 2015-2035 Comprehensive Plan for general land use action is to create an overall pattern of orderly development through the arrangement of land uses that are adequately and efficiently served by a system of transportation, community services, and utilities, and sensitive to the natural physical qualities of the area.
Residential

The largest areas for new future residential use designated in the Plan is located on the Northeast Side in unincorporated Center and southern Scott Townships; West Side along University Parkway corridor from Hogue Road to Marx Road. Additional residential projections include:

- 2035 County Occupied Housing projections range from: 6,705 to 10,898increase from 2010 Census

Commercial

The largest area expected to develop primarily for commercial development is the eastside between Morgan Avenue, I 69, Virginia Street and Burkhardt Road; North Side US 41 corridor south of I 69; Northeast side Boonville-New Harmony Road between SR 57 and Green River Road; West Side north of Lloyd Expressway and west of University Parkway

Industrial

The 2015-2035 Comprehensive Plan primary area is located on the North Side US 41 North Corridor between I 69 and Baseline Road; Near North Side infill east of US 41 and north of Lynch Road to the airport; Northeast Side the I 69 corridor between SR 57 and Boonville-New Harmony Road; West Side west of University Parkway and south of Hogue Road along railroad.

To prepare for the industrial development of Interstate 69, the 2015-2035 Comprehensive Plan suggests that Vanderburgh County officials should coordinate with Warrick and Gibson Counties on a regional strategy for economic development and growth, apply for INDOT grant funds for local planning in the Interstate 69 corridor, and prepare new or updated County plans.

Mixed Use (Commercial and Residential)

North Main Street corridor, West Franklin Street, the old west Wal-Mart site, Washington Square mall/Lawndale and riverfront west of the riverboat casino.

Infrastructure

Growth for a community is limited by the availability of infrastructure such as transportation services and water/sewer services. Planning for infrastructure to serve and encourage development should occur in the areas where growth is desired and where noted natural hazards can be avoided. For transportation, the 2015-2035 Comprehensive Plan presents both short-term and long-term road improvement projects proposed by the Evansville Metropolitan Planning Organization. The most significant infrastructure project that occurred in the Evansville area was the construction of Interstate-69. This interstate project will be an international trade route linking Canada and Mexico.
3.4 Risk Assessment Summary

The Vanderburgh County Risk Assessment revealed a number of problem areas to be addressed in the mitigation strategy. These key findings are summarized in the following list:

- The majority of past disaster declarations, as well as past damages, have been related to severe storms and flooding.
- Multi-year droughts occur every 10 years on average and impact primarily agriculture and economy.
- Most properties at risk to flooding are located in the City of Evansville, while the majority of inventory damage is located in the unincorporated areas of Vanderburgh County.
- Identified facilities in the 100-year floodplain include the fire stations of McCutchanville and Perry Township; identified facilities in the 500-year floodplain include animal control, Deaconess Cross Point, North High School, Oak Hill Middle School, a fire station in the Scott Township, and the Heritage Petroleum station.
- There are a large number of high and significant hazard dams in Vanderburgh County, although no dam failures have occurred in the past.
- Sensitive natural areas and species primarily occur along streams and drainages.
- There have been 52 recorded earthquakes within a 50-mile radius of Evansville since 1827, most recently along the Wabash Valley Seismic Zone.
- The emerald ash borer is an identified hazard to the planning area.
- Winter weather events create problems with water lines, snow loads on roofs, and traveler safety.
4 Mitigation Strategy

44 CFR Requirement 201.6(c)(3): The plan shall include a mitigation strategy that provides the jurisdiction’s blueprint for reducing the potential losses identified in the risk assessment, based on existing authorities, policies, programs and resources, and its ability to expand on and improve these existing tools.

This section presents the mitigation strategy developed by the Hazard Mitigation Planning Committee (HMPC) based on the risk assessment. The mitigation strategy was developed through a collaborative group process and consists of goals, objectives, and mitigation actions. The HMPC used the following definitions based upon those found in the March 2013 Local Mitigation Planning Handbook:

- **Goals** are general guidelines that explain what the community wants to achieve with the plan. They are usually broad, policy-type statements that are long-term, and they represent visions for reducing or avoiding losses from the identified hazards.
- **Objectives** define strategies or implementation steps to attain the identified goals and are specific and measurable.
- **Mitigation Actions** are specific actions that help achieve goals and objectives.

4.1 Goals and Objectives

44 CFR Requirement 201.6(c)(3)(i): [The hazard mitigation strategy shall include a] description of mitigation goals to reduce or avoid long-term vulnerabilities to the identified hazards.

The HMPC updated the existing goals and objectives to provide direction for reducing hazard-related losses in Vanderburgh County. These were based upon the results of the risk assessment and a review of goals and objectives from other state and local plans, specifically, the 2014 Indiana State Hazard Mitigation Plan. This review was to ensure that this plan’s mitigation strategy was integrated with existing plans and policies. Goals and objectives are listed below, but are not prioritized:

**Goal 1:** Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.

**Goal 2:** Reduce vulnerability to natural hazards, before and after disaster strikes.

- Strengthen protection of critical facilities and infrastructure to create a safer, more sustainable community.
- Build and support local capabilities to respond and recover from natural and hazard events.
- Increase the local floodplain management activities and participation in the NFIP.
- Protect community historic/cultural/environmental resources from identified natural man-made hazards
4.2 Identification and Analysis of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include a section that identifies and analyzes a comprehensive range of specific mitigation actions and projects being considered to reduce the effects of each hazard, with particular emphasis on new and existing buildings and infrastructure. All plans approved by FEMA after October 1, 2008, must also address the jurisdiction’s participation in the NFIP, and continued compliance with NFIP requirements, as appropriate.

To identify and analyze potential mitigation actions to achieve the mitigation goals, the HMPC discussed the key issues that emerged in the Risk Assessment at their second meeting. Each hazard identified in Section 3.1 was evaluated. Only those hazards with an overall vulnerability ranking of moderate or high were determined to be a priority hazard and were considered further in the development of hazard-specific mitigation measures. The following are Vanderburgh County’s priority hazards:

- Severe Thunderstorms (high winds, hail, lightning);
- Severe Winter Storms;
- Extreme Temperatures;
- Tornadoes;
- Earthquake; and
- Flooding.

The HMPC eliminated other hazards from further consideration in the development of mitigation actions because the risk of a hazard event in the county is unlikely, the vulnerability of the county to the hazard is low, or capabilities are already in place to mitigate its negative impacts. It is important to note that many of the final mitigation actions are multi-hazard actions designed to reduce potential losses from all types of hazard events.

At their second meeting, the HMPC was provided the following list of categories of mitigation actions, which originated from the National Flood Insurance Program’s Community Rating System, as well as definitions and examples for each category:

1) **Prevention**: Administrative or regulatory actions or processes that influence the way land and buildings are developed and built
2) **Property protection**: Actions that involve the modification of existing buildings or structures to protect them from a hazard or remove them from the hazard area
3) **Structural**: Actions that involve the construction of structures to reduce the impact of hazard
4) **Natural resource protection**: Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems
5) **Emergency services**: Actions that protect people and property during and immediately after a disaster or hazard event
6) **Public education and awareness**: Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them

The HMPC then analyzed a list of potential structural and nonstructural mitigation alternatives, which were organized by hazard and based upon the risk assessment, existing capabilities, and plan goals and objectives. Through a facilitated planning process, each committee member developed ideas for mitigation actions based upon these alternatives and their own ideas. Duplicate ideas were condensed to a refined list of mitigation actions that were written on index cards and categorized by mitigation action type.

Some alternatives identified did not make it to this refined list because they were determined by the HMPC to not be politically, technically, or financially feasible or because no champion for the action was present in the group. However, these ideas are still captured in Appendix C and may be readdressed if funding opportunities change or during the next plan update process.

### 4.3 Implementation of Mitigation Actions

44 CFR Requirement §201.6(c)(3)(ii): The mitigation strategy shall include an action strategy describing how the actions identified in paragraph (c)(2)(ii) will be prioritized, implemented, and administered by the local jurisdiction. Prioritization shall include a special emphasis on the extent to which benefits are maximized according to a cost benefits review of the proposed projects and their associated costs.

Each proposed mitigation action was evaluated against the following considerations:

- Compatibility with goals and objectives identified in the current State of Indiana Hazard Mitigation Plan (2014);
- Assessment of the impact of identified actions on the Vanderburgh County; and
- Compatibility with other local and regional plans and programs.

To prioritize the mitigation actions, each participating HMPC member evaluated the actions using a simple cost/benefit analysis (Table 4.1). Presented as a web-based survey, HMPC members rated each mitigation action for both benefit (low, medium, or high) and funding impact (easy, potential, or difficult). A weighted score was then applied to the total number of votes within each cost/benefit category for a total priority score. A scoring example is presented in Table 4.2. Depending on the results of the action evaluations, each action is recognized as a high priority project (over 40 points), medium priority project (30-39 points), or low priority project (0 to 29 points). The results of the prioritization process are included in Tables 4.3 and 4.4. Figure 4.1 presents a sample of the web-based survey.

This process of identification and analysis of mitigation options allowed the HMPC to come to consensus and to prioritize recommended mitigation actions. Emphasis was placed on the importance of a cost-benefit analysis in determining project priority; however, this was not a quantitative analysis. The Disaster Mitigation Act regulations state that benefit-cost review is the primary method by which mitigation projects should be prioritized. Recognizing the federal
regulatory requirement to prioritize by benefit-cost and the need for any publicly funded project to be cost-effective, the HMPC intends to pursue implementation according to when and where damage occurs, available funding, political will, local priority, and priorities identified in the Indiana State Hazard Mitigation Plan. Cost-effectiveness will be considered in additional detail when seeking FEMA mitigation grant funding for eligible projects identified in this plan.

### Table 4.1 Benefit/Cost Analysis

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Definition</th>
<th>Weighted Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Difficult to assess benefits of this action; long-term time-frame for implementation</td>
<td>1</td>
</tr>
<tr>
<td>Medium</td>
<td>Long-term impact on reduction of losses is anticipated; implementation within 5 years</td>
<td>2</td>
</tr>
<tr>
<td>High</td>
<td>Meaningful impact on reduction of losses; implementation within 5 years is important</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Definition</th>
<th>Weighted Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to Fund</td>
<td>Funding sources not secured; grant funding will be needed</td>
<td>1</td>
</tr>
<tr>
<td>Potential to Fund</td>
<td>Funding requires budgeting over multiple years; grant funding potential</td>
<td>2</td>
</tr>
<tr>
<td>Easily Funded</td>
<td>Funds to implement action are available in existing budget</td>
<td>3</td>
</tr>
</tbody>
</table>

### Table 4.2 Example Mitigation Action Prioritization

**Action:** Enhance current training and exercises for Emergency Management and campus staff to include focus on terrorism/active shooter response.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>HMPC Votes</th>
<th>Weighted Value</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Med</td>
<td>3</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>High</td>
<td>10</td>
<td>3</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Definition</th>
<th>Weighted Value</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to Fund</td>
<td>Funding sources not secured; grant funding will be needed</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Potential to Fund</td>
<td>Funding requires budgeting over multiple years; grant funding potential</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Easily Funded</td>
<td>Funds to implement action are available in existing budget</td>
<td>3</td>
<td>33</td>
</tr>
</tbody>
</table>

**TOTAL SCORE 73 - HIGH**

Table 4.3 summarizes identified actions and provides information on the hazards addressed and plan goals achieved. The individual action items, as recommended and prioritized by the HMPC, are then presented in order of priority. Each action item includes responsible office, potential funding, timeline, and estimated cost level for each identified action. Each mitigation action is also identified as either corrective or preventative. Corrective mitigation actions are focused on correcting past practices that have increased hazard vulnerability. These actions address existing buildings and infrastructure. Preventative mitigation actions prevent future problems from occurring in the first place through public education and outreach, informed
decision-making and disaster resistant building/development practices. These actions address future buildings and infrastructure. Completed action items, as noted in Table 4.3 are presented in Appendix C.

**Figure 4.1 Mitigation Action Survey**

In addition to prioritization of the mitigation actions by the HMPC, the public was invited to an Open House on July 12, 2017, in the Browning Room at the Central Library to review the proposed mitigation actions, vote on priority actions, and provide input on additional mitigation actions (see Figure 4.2). The public placed priority on mitigation projects addressing flooding, severe weather, earthquakes, hazard material incidents, and dam/levee failure. The public placed the least priority on mitigation projects addressing infestations, mine subsidence, wildfire, and drought.
Figure 4.2  Public Open House, July 12, 2017
### Table 4.3. Mitigation Action Matrix

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
<th>HMPC Priority</th>
<th>Goals Addressed</th>
<th>Hazards Addressed</th>
<th>Address Current Development</th>
<th>Address Future Development</th>
<th>Continued Compliance with NFIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop dedicated website page for multi-hazard mitigation information.</td>
<td>Continued; Website is developed and updated regularly</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>2. Purchase and install stream gages and water table gages to provide flood warning capabilities.</td>
<td>Continued; Progress anticipated with funding</td>
<td>High</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3. Explore partnerships to provide retrofitting classes for homeowners, renters, building professionals, and contractors.</td>
<td>Continued; Progress anticipated with manpower/funding</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>4. Coordinate with Vanderburgh County Surveyor to utilize “Section Line Grid” to address and prioritize disaster response and recovery activities.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5. Develop safe refuge mapping for County.</td>
<td>New</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>6. Coordinate emergency management drills with other agencies and industries in the community.</td>
<td>New</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>7. Add to the public awareness campaign information on living “off the grid” for 3 days (“jump kit”) during hazard events.</td>
<td>New</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>8. Add notification/subscription capabilities to Vanderburgh County Emergency Management/Hazard Mitigation website.</td>
<td>New</td>
<td>High</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>9. Coordinate with Utilities (Vectran) regarding trees/limbs in streets following hazard event.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>10. In coordination with the American Red Cross, identify shelter locations with capabilities/infrastructure for large capacity and generator hook-up.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Status</td>
<td>HMPC Priority</td>
<td>Goals Addressed</td>
<td>Hazards Addressed</td>
<td>Address Current Development</td>
<td>Address Future Development</td>
<td>Continued Compliance with NFIP</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>--------</td>
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<td>----------------------------</td>
<td>----------------------------</td>
<td>--------------------------------</td>
</tr>
<tr>
<td>11. Participate in multi-agency planning for large special events.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>12. Identify potential alternatives for east/west arterial transportation to assist with evacuation during a large hazard event.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>13. Define process for establishing a burn ban within Vanderburgh County.</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Wildfire</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>14. Incorporate saferoom design into new school buildings</td>
<td>New</td>
<td>High</td>
<td>2</td>
<td>Tornado</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Develop County-Wide Stormwater Master Plan to provide relief from run-off and flooding resulting from rainfall events.</td>
<td>Continued; Progress anticipated with manpower/funding</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>16. Based on existing City Stormwater Master Plan, develop formalized policies (level-of-service and extent-of-service) for maintenance of the storm water drainage system.</td>
<td>Continued; Progress anticipated with manpower/funding</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>17. Update repetitive loss areas adjacent to the repetitive loss properties as new claim information is reported.</td>
<td>Continued; Areas updated on regular basis</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>18. Encourage purchase of earthquake hazard insurance throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Continued; Progress anticipated with manpower</td>
<td>Medium</td>
<td>2</td>
<td>Earthquake</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Purchase and distribute NOAA weather radios throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Continued; Annual campaign</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Expand warning siren coverage into new areas as development and housing expand.</td>
<td>Continued; Progress anticipated with funding</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Status</td>
<td>HMPC Priority</td>
<td>Goals Addressed</td>
<td>Hazards Addressed</td>
<td>Address Current Development</td>
<td>Address Future Development</td>
<td>Continued Compliance with NFIP</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
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<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>21. Prepare CRS-compliant Program for Public Information (PPI) to revise and replace current public awareness campaign, including coordination with Evansville Vanderburgh School Corporation.</td>
<td>New</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>22. Develop public damage reporting app/website to obtain information from the public during hazard events.</td>
<td>New</td>
<td>Medium</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>23. Review current fire station resilience capabilities to serve as “oasis” during mass/expanded incidents.</td>
<td>New</td>
<td>Medium</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Develop depth grids in coordination with FIRM updates to address roadway access and critical facilities during a flood event.</td>
<td>New</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>25. Develop interactive flood inundation mapping for the County in coordination with FIRM updates.</td>
<td>New</td>
<td>Medium</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>26. Pursue and document CRS activities with ultimate goal of improving CRS class rating.</td>
<td>New</td>
<td>Medium</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>27. Establish maximum runoff criteria for areas proposed for development.</td>
<td>New</td>
<td>Medium</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>28. Talk with local nurseries to discourage sales of ash trees in private sector.</td>
<td>New</td>
<td>Medium</td>
<td>2</td>
<td>Infestation</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>29. Obtain dam inundation mapping for future vulnerability analysis and development regulation.</td>
<td>New</td>
<td>Medium</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>30. Continue efforts to train local contractors and property owners in tree trimming practices.</td>
<td>Continued; Annual campaign</td>
<td>Low</td>
<td>1</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>31. Pursue alternative funding sources for structural retrofits to critical facilities.</td>
<td>Continued; Progress anticipated with manpower</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Status</td>
<td>HMPC Priority</td>
<td>Goals Addressed</td>
<td>Hazards Addressed</td>
<td>Address Current Development</td>
<td>Address Future Development</td>
<td>Continued Compliance with NFIP</td>
</tr>
<tr>
<td>--------</td>
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<td>----------------------------</td>
<td>---------------------------</td>
<td>-------------------------------</td>
</tr>
<tr>
<td>32. Investigate financial incentives for property owners to make seismic retrofits to existing buildings, particularly un-reinforced masonry structures, located within the earthquake hazard area. Pursue alternative funding sources for structural retrofits for critical facilities.</td>
<td>Continued; Progress anticipated with manpower</td>
<td>Low</td>
<td>2</td>
<td>Earthquake</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>33. Distribute National Flood Insurance Program information.</td>
<td>Continued; Annual campaign</td>
<td>Low</td>
<td>1</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>34. Coordinate annual meetings of the Vanderburgh County Multi Hazard Mitigation Planning Committee to monitor, evaluate, and update the multi-hazard mitigation plan.</td>
<td>Continued; Regular HMPC meetings</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>35. Retrofit critical facilities to accept alternative energy sources, i.e. solar.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. Locate and encourage closure of unused private wells.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Encourage new housing developments to use underground utilities.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Multi-Hazard</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38. Pursue creek and stream clearing projects and funding.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>39. Provide equipment and training for confined space entry to perform routine inspections of large diameter storm sewers.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Flood</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>40. Develop dam maintenance ordinance.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41. Obtain funding to remove poorly maintained dams.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Dam Failure</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>42. Work with SWIMGA to develop a surveillance program with private residences with ash trees.</td>
<td>New</td>
<td>Low</td>
<td>2</td>
<td>Infestation</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 4.4. Mitigation Action Implementation Strategy

<table>
<thead>
<tr>
<th>Action ID</th>
<th>HMPC Priority</th>
<th>Mitigation Action</th>
<th>Mitigation Category</th>
<th>Responsible Office</th>
<th>Partners</th>
<th>Potential Resources/Funding</th>
<th>Estimated Cost Level</th>
<th>Timeframe</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>High</td>
<td>Develop dedicated website page for multi-hazard mitigation information.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>Computer Services, Area Plan Commission</td>
<td>Existing Budget</td>
<td>Low</td>
<td>Annual campaign</td>
<td>Continued</td>
</tr>
<tr>
<td>2</td>
<td>High</td>
<td>Purchase and install stream gages and water table gages to provide flood warning capabilities.</td>
<td>Emergency Services</td>
<td>Building Commission</td>
<td>Emergency Management Agency</td>
<td>USGS</td>
<td>Medium</td>
<td>Within the next 5 years, as funding becomes available</td>
<td>Continued</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>Explore partnerships to provide retrofitting classes for homeowners, renters, building professionals, and contractors.</td>
<td>Public Education and Awareness, Property Protection</td>
<td>Emergency Management Agency</td>
<td>Building Commission</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>Continued</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
<td>Coordinate with Vanderburgh County Surveyor to utilize “Section Line Grid” to address and prioritize disaster response and recovery activities.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>County Surveyor</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>5</td>
<td>High</td>
<td>Develop safe refuge mapping for County.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>American Red Cross</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
<td>Coordinate emergency management drills with other agencies and industries in the community.</td>
<td>Public Education and Awareness, Emergency Services</td>
<td>Emergency Management Agency</td>
<td></td>
<td>Staff Time, Existing Budgets, DHS Funding</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
</tr>
<tr>
<td>7</td>
<td>High</td>
<td>Add to the public awareness campaign information on living “off the grid” for 3 days (“jump kit”) during hazard events.</td>
<td>Public Education and Awareness, Emergency Services</td>
<td>Emergency Management Agency</td>
<td>Fire, Police</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>8</td>
<td>High</td>
<td>Add notification/subscription capabilities to Vanderburgh County Emergency Management/Hazard Mitigation website.</td>
<td>Public Education and Awareness, Emergency Services</td>
<td>Emergency Management Agency</td>
<td>Computer Services</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>9</td>
<td>High</td>
<td>Coordinate with Utilities (Vectran) regarding trees/limbs in streets following hazard event.</td>
<td>Public Education and Awareness, Emergency Services</td>
<td>Urban Forestry, Vectran</td>
<td></td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
</tr>
<tr>
<td>10</td>
<td>High</td>
<td>In coordination with the American Red Cross, identify shelter locations with capabilities/infrastructure for large capacity and generator hook-up.</td>
<td>Public Education and Awareness, Emergency Services</td>
<td>Emergency Management Agency</td>
<td>American Red Cross, Fire, Police</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
</tr>
<tr>
<td>11</td>
<td>High</td>
<td>Participate in multi-agency planning for large special events.</td>
<td>Prevention</td>
<td>Emergency Management Agency</td>
<td>Fire, Police</td>
<td>Staff Time, Existing Budgets, DHS Funding</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
</tr>
<tr>
<td>12</td>
<td>High</td>
<td>Identify potential alternatives for east/west arterial transportation to assist with evacuation during a large hazard event.</td>
<td>Structural Projects, Transportation &amp; Services</td>
<td>Area Plan Commission</td>
<td></td>
<td>Staff Time, Existing Budgets, FHWA Funding, DOT Funding</td>
<td>High</td>
<td>Within the next 5 to 10 years</td>
<td>New</td>
</tr>
<tr>
<td>Action ID</td>
<td>HMPC Priority</td>
<td>Mitigation Action</td>
<td>Mitigation Category</td>
<td>Responsible Office</td>
<td>Partners</td>
<td>Potential Resources/Funding</td>
<td>Estimated Cost Level</td>
<td>Timeframe</td>
<td>Status</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
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<td>----------</td>
<td>-----------------------------</td>
<td>---------------------</td>
<td>-----------</td>
<td>--------</td>
</tr>
<tr>
<td>13</td>
<td>High</td>
<td>Define process for establishing a burn ban within Vanderburgh County.</td>
<td>Prevention</td>
<td>Evansville Environmental Protection Agency</td>
<td>Fire</td>
<td>Staff Time</td>
<td>Existing Budgets</td>
<td>Low</td>
<td>Within 12 months</td>
</tr>
<tr>
<td>14</td>
<td>High</td>
<td>Incorporate saferoom design into new school buildings.</td>
<td>Structural Projects</td>
<td>EVSC</td>
<td>Emergency Management Agency</td>
<td>Capital Budgets</td>
<td>High</td>
<td>Within 5 years</td>
<td>New</td>
</tr>
<tr>
<td>14</td>
<td>Medium</td>
<td>Develop County-Wide Stormwater Master Plan to provide relief from run-off and flooding resulting from rainfall events.</td>
<td>Prevention</td>
<td>County Engineer</td>
<td>County Surveyor</td>
<td>Drainage Board</td>
<td>Existing Budgets</td>
<td>PDM and HMGP Funding</td>
<td>High</td>
</tr>
<tr>
<td>15</td>
<td>Medium</td>
<td>Based on existing City Stormwater Master Plan, develop formalized policies (level-of-service and extent-of-service) for maintenance of the storm water drainage system.</td>
<td>Prevention</td>
<td>City Engineer</td>
<td>Street Maintenance</td>
<td>Water &amp; Sewer Utilities</td>
<td>Existing Budgets</td>
<td>Medium</td>
<td>Plan to clean inlets and laterals in a 2 year cycle</td>
</tr>
<tr>
<td>16</td>
<td>Medium</td>
<td>Update repetitive loss areas adjacent to the repetitive loss properties as new claim information is reported.</td>
<td>Prevention</td>
<td>Area Plan Commission</td>
<td>Building Commission</td>
<td>Emergency Management Agency</td>
<td>Staff Time</td>
<td>Existing Budgets</td>
<td>Medium</td>
</tr>
<tr>
<td>17</td>
<td>Medium</td>
<td>Encourage purchase of earthquake hazard insurance throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>Local Realtors</td>
<td>Local Insurance Agencies</td>
<td>Staff Time</td>
<td>Existing Budgets</td>
<td>Low</td>
</tr>
<tr>
<td>18</td>
<td>Medium</td>
<td>Purchase and distribute NOAA weather radios throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>Local News Media</td>
<td>Habitat for Humanity</td>
<td>Coordinated project with local News and Radio Stations</td>
<td>Business Partners</td>
<td>HMGP and PDM Funds</td>
</tr>
<tr>
<td>19</td>
<td>Medium</td>
<td>Expand warning siren coverage into new areas as development and growth increase.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>Emergency Management Agency</td>
<td>HMGP and PDM Funds</td>
<td>High</td>
<td>As funding allows additional warning sirens will be added.</td>
<td>Continued</td>
</tr>
<tr>
<td>20</td>
<td>Medium</td>
<td>Prepare CRS-compliant Program for Public Information (PPI) to revise and replace current public awareness campaign in coordination with Evansville Vanderburgh School Corporation.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>EVSC</td>
<td>IDHS</td>
<td>American Red Cross</td>
<td>Area Plan Commission</td>
<td>Existing operating budgets; 5% set aside from future HMGP funding and PDM funds</td>
</tr>
<tr>
<td>21</td>
<td>Medium</td>
<td>Develop public damage reporting app/website to obtain information from the public during hazard events.</td>
<td>Public Education and Awareness</td>
<td>Emergency Management Agency</td>
<td>Computer Services</td>
<td>Staff Time</td>
<td>Existing Budgets</td>
<td>Medium</td>
<td>Within the next 5 years</td>
</tr>
<tr>
<td>22</td>
<td>Medium</td>
<td>Review current fire station resilience capabilities to serve as “oasis” during mass/expanded incidents.</td>
<td>Property Protection</td>
<td>Emergency Management Agency</td>
<td>Fire</td>
<td>Emergency Management Agency</td>
<td>Staff Time</td>
<td>Existing Budgets</td>
<td>Low</td>
</tr>
<tr>
<td>23</td>
<td>Medium</td>
<td>Develop depth grids in coordination with FIRM updates to address roadway access and critical facilities during a flood event.</td>
<td>Prevention</td>
<td>Building Commission</td>
<td>Emergency Management Agency</td>
<td>FEMA Risk MAP Funding</td>
<td>High</td>
<td>Within the next 5-10 years, as funding becomes available</td>
<td>New</td>
</tr>
<tr>
<td>Action ID</td>
<td>HMPC Priority</td>
<td>Mitigation Action</td>
<td>Mitigation Category</td>
<td>Responsible Office</td>
<td>Partners</td>
<td>Potential Resources/Funding</td>
<td>Estimated Cost Level</td>
<td>Timeframe</td>
<td>Status</td>
</tr>
<tr>
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</tr>
<tr>
<td>24</td>
<td>Medium</td>
<td>Develop interactive flood inundation mapping for the County in coordination with FIRM updates.</td>
<td>• Prevention&lt;br&gt;• Public Education and Awareness</td>
<td>Building Commission</td>
<td>Emergency Management Agency&lt;br&gt;Computer Services</td>
<td>FEMA Risk MAP Funding</td>
<td>High</td>
<td>Within the next 5-10 years, as funding becomes available</td>
<td>New</td>
</tr>
<tr>
<td>25</td>
<td>Medium</td>
<td>Pursue and document CRS activities with ultimate goal of improving CRS class rating.</td>
<td>• Prevention&lt;br&gt;• Public Education and Awareness</td>
<td>Area Plan Commission</td>
<td>Emergency Management Agency</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Annual documentation effort</td>
<td>New</td>
</tr>
<tr>
<td>26</td>
<td>Medium</td>
<td>Establish maximum runoff criteria for areas proposed for development.</td>
<td>• Prevention&lt;br&gt;• Public Education and Awareness&lt;br&gt;City/County Engineers</td>
<td>Building Commission</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Within the next 5 years</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Medium</td>
<td>Talk with local nurseries to discourage sales of ash trees in private sector.</td>
<td>• Prevention</td>
<td>Urban Forestry&lt;br&gt;City Arborist</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Medium</td>
<td>Obtain dam inundation mapping for future vulnerability analysis and development regulation.</td>
<td>• Prevention</td>
<td>Emergency Management Agency</td>
<td>Indiana DNR</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>29</td>
<td>Low</td>
<td>Continue efforts to train local contractors and property owners in tree trimming practices.</td>
<td>• Prevention&lt;br&gt;Public Education and Awareness</td>
<td>City Arborist&lt;br&gt;Urban Forestry</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Annual campaign</td>
<td>Continued</td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Low</td>
<td>Pursue alternative funding sources for structural retrofits to critical facilities.</td>
<td>• Property Protection&lt;br&gt;Emergency Management Agency&lt;br&gt;Fire</td>
<td>Building Commission</td>
<td>HMGP and PDM Funds&lt;br&gt;DHS Funds</td>
<td>Medium</td>
<td>Within the next 5-10 years, as funding becomes available</td>
<td>Continued</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Low</td>
<td>Investigate financial incentives for property owners to make seismic retrofits to existing buildings, particularly un-reinforced masonry structures, located within the earthquake hazard area. Pursue alternative funding sources for structural retrofits for critical facilities.</td>
<td>• Property Protection&lt;br&gt;Emergency Services</td>
<td>Emergency Management Agency&lt;br&gt;Building Commission</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Medium</td>
<td>Annual campaign</td>
<td>Continued</td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Low</td>
<td>Distribute National Flood Insurance Program information.</td>
<td>• Public Education and Awareness</td>
<td>Building Commission</td>
<td>Emergency Management Agency&lt;br&gt;FEMA NFIP</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Annual campaign</td>
<td>Continued</td>
</tr>
<tr>
<td>33</td>
<td>Low</td>
<td>Coordinate annual meetings of the Vanderburgh County Multi Hazard Mitigation Planning Committee to monitor, evaluate, and update the multi-hazard mitigation plan.</td>
<td>• Prevention</td>
<td>Emergency Management Agency</td>
<td>HMPC</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Annual Meeting</td>
<td>Continued</td>
</tr>
<tr>
<td>34</td>
<td>Low</td>
<td>Retrofit critical facilities to accept alternative energy sources, i.e. solar.</td>
<td>• Property Protection&lt;br&gt;Emergency Services</td>
<td>Emergency Management Agency&lt;br&gt;Fire&lt;br&gt;Police</td>
<td>HMGP and PDM Funds&lt;br&gt;DHS Funds</td>
<td>High</td>
<td>Within the next 5-10 years, as funding becomes available</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Low</td>
<td>Locate and encourage closure of unused private wells.</td>
<td>• Public Education and Awareness&lt;br&gt;Building Commission</td>
<td>Indiana DEM&lt;br&gt;Area Plan Commission</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Medium</td>
<td>Within the next 2-3 years</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Low</td>
<td>Encourage new housing developments to use underground utilities.</td>
<td>• Prevention</td>
<td>Building Commission&lt;br&gt;City/County Engineers</td>
<td>Staff Time&lt;br&gt;Existing Budgets</td>
<td>Low</td>
<td>Within the next 2-3 years</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Low</td>
<td>Pursue creek and stream clearing projects and funding.</td>
<td>• Natural Resource Protection</td>
<td>City/County Engineers</td>
<td>Staff Time&lt;br&gt;Existing Budgets&lt;br&gt;Volunteers&lt;br&gt;Indiana DNR&lt;br&gt;EPA</td>
<td>Medium</td>
<td>Within the next 2-3 years</td>
<td>New</td>
<td></td>
</tr>
<tr>
<td>Action ID</td>
<td>HMPC Priority</td>
<td>Mitigation Action</td>
<td>Mitigation Category</td>
<td>Responsible Office</td>
<td>Partners</td>
<td>Potential Resources/Funding</td>
<td>Estimated Cost Level</td>
<td>Timeframe</td>
<td>Status</td>
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</tr>
<tr>
<td>38</td>
<td>Low</td>
<td>Provide equipment and training for confined space entry to perform routine inspections of large diameter storm sewers.</td>
<td>Prevention</td>
<td>County Surveyor, Drainage Board, Street Maintenance, Water &amp; Sewer Utilities</td>
<td>City/County Engineers</td>
<td>Staff Time, Existing Budgets</td>
<td>Medium</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>39</td>
<td>Low</td>
<td>Develop dam maintenance ordinance.</td>
<td>Prevention</td>
<td>Indiana DEM, Area Plan Commission</td>
<td>Building Commission</td>
<td>Staff Time, Existing Budgets</td>
<td>Medium</td>
<td>Within the next 2-3 years</td>
<td>New</td>
</tr>
<tr>
<td>40</td>
<td>Low</td>
<td>Obtain funding to remove poorly maintained dams.</td>
<td>Structural Projects</td>
<td>Indiana DEM, Area Plan Commission</td>
<td>Building Commission</td>
<td>NOAA, USFWS, USACE, NOAA, USFWS</td>
<td>High</td>
<td>Within the next 5-10 years, as funding becomes available</td>
<td>New</td>
</tr>
<tr>
<td>41</td>
<td>Low</td>
<td>Work with SWIMGA to develop a surveillance program with private residences with ash trees.</td>
<td>Public Education and Awareness</td>
<td>Urban Forestry</td>
<td>SWIMGA</td>
<td>Staff Time, Existing Budgets</td>
<td>Low</td>
<td>Within 12 months</td>
<td>New</td>
</tr>
</tbody>
</table>
This chapter provides an overview of the overall strategy for plan maintenance and outlines the method and schedule for monitoring, updating, and evaluating the plan. The chapter also discusses incorporating the plan into existing planning mechanisms and how to address continued public involvement.

5.1 Monitoring, Evaluating, and Updating the Plan

44 CFR Requirement 201.6(c)(4): The plan maintenance process shall include a section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan within a five-year cycle.

5.1.1 Hazard Mitigation Planning Committee

With adoption of this plan, the HMPC will be tasked with monitoring, evaluation, and maintenance of the plan. The participating jurisdictions and agencies, led by the City of Evansville-Vanderburgh County Emergency Management Agency, agree to:

- Meet annually and after a disaster event to monitor and evaluate the implementation of the plan;
- Act as a forum for hazard mitigation issues;
- Disseminate hazard mitigation ideas and activities to all participants;
- Pursue the implementation of high priority, low- or no-cost recommended actions;
- Maintain vigilant monitoring of multi-objective, cost-share, and other funding opportunities to help the community implement the plan’s recommended actions for which no current funding exists;
- Monitor and assist in implementation and update of this plan;
- Keep the concept of mitigation in the forefront of community decision making by identifying plan recommendations when other community goals, plans, and activities overlap, influence, or directly affect increased community vulnerability to disasters;
- Report on plan progress and recommended changes to the governing bodies of participating jurisdictions; and
- Inform and solicit input from the public.

The HMPC is an advisory body and will not have any powers over County, City, Town, or District staff. Its primary duty is to see the plan successfully carried out and to report to the community governing boards and the public on the status of plan implementation and mitigation opportunities. Other duties include reviewing and promoting mitigation proposals, hearing stakeholder concerns about hazard mitigation, passing concerns on to appropriate entities, and posting relevant information on the City and County websites.
As noted in Chapter 1, *Introduction and Planning Process*, an annual meeting initiated by Area Planning Commission on June 14, 2016, served as the annual HMPC meeting to review the current status of mitigation actions, the NFIP CRS program, as well as, public outreach programs, and website information. The meeting was attended by representatives from Area Planning, Emergency Management Agency, and Engineering.

### 5.1.2 Plan Maintenance Schedule

The HMPC agrees to meet annually and after a hazard event to monitor progress and update the mitigation strategy. The City of Evansville-Vanderburgh County emergency manager is responsible for initiating these plan reviews. In conjunction with the other participating jurisdictions, a five-year written update of the plan will be submitted to the Mitigation and Recovery Branch of the Indiana Department of Homeland Security and FEMA Region V per Requirement §201.6(c) (4) (i) of the Disaster Mitigation Act of 2000, unless disaster or other circumstances (e.g., changing regulations) require a change to this schedule.

### 5.1.3 Plan Maintenance Process

Evaluation of progress can be achieved by monitoring changes in vulnerabilities identified in the plan. Changes in vulnerability can be identified by noting:

- Decreased vulnerability as a result of implementing recommended actions,
- Increased vulnerability as a result of failed or ineffective mitigation actions, and/or
- Increased vulnerability as a result of new development (and/or annexation).

Updates to this plan will:

- Consider changes in vulnerability due to action implementation,
- Document success stories where mitigation efforts have proven effective,
- Document areas where mitigation actions were not effective,
- Document any new hazards that may arise or were previously overlooked,
- Incorporate new data or studies on hazards and risks,
- Incorporate new capabilities or changes in capabilities,
- Incorporate growth and development-related changes to inventories, and
- Incorporate new action recommendations or changes in action prioritization.

In order to best evaluate any changes in vulnerability as a result of plan implementation, the participating jurisdictions will follow the following process:
A representative from the responsible office identified in each mitigation action will be responsible for tracking and reporting on an annual basis to the jurisdictional lead on action status and provide input on whether the action as implemented meets the defined objectives and is likely to be successful in reducing vulnerabilities.

If the action does not meet identified objectives, the jurisdictional lead will determine what additional measures may be implemented, and an assigned individual will be responsible for defining action scope, implementing the action, monitoring success of the action, and making any required modifications to the plan.

Changes will be made to the plan to accommodate for actions that have failed or are not considered feasible after a review of their consistency with established criteria, time frame, community priorities, and/or funding resources. Actions that were not ranked high but were identified as potential mitigation activities will be reviewed as well during the monitoring and update of this plan to determine feasibility of future implementation. Updating of the plan will be by written changes and submissions, as the City of Evansville-Vanderburgh County Emergency Management Agency deems appropriate and necessary, and as approved by the governing boards of the participating jurisdictions.

### 5.2 Incorporation into Existing Planning Mechanisms

44 CFR Requirement §201.6(c)(4)(ii): [The plan shall include a] process by which local governments incorporate the requirements of the mitigation plan into other planning mechanisms such as comprehensive or capital improvement plans, when appropriate.

Where possible, plan participants will use existing plans and/or programs to implement hazard mitigation actions. Based on the capability assessments of the participating jurisdictions, communities in Vanderburgh County continue to plan and implement programs to reduce losses to life and property from hazards. This plan builds upon the momentum developed through previous and related planning efforts and mitigation programs and recommends implementing actions, where possible, through the following plans:

- General or master plans of participating jurisdictions
- Ordinances of participating jurisdictions
- City of Evansville-Vanderburgh County Emergency Operations Plan
- Capital improvement plans and budgets
- Other community plans within the County, such as water conservation plans, stormwater management plans, and parks and recreation plans
- Other plans and policies outlined in the capability assessments in the jurisdictional annexes

HMPC members involved in updating these existing planning mechanisms will be responsible for integrating the findings and actions of the mitigation plan, as appropriate. The HMPC is also responsible for monitoring this integration and incorporating the appropriate information into the five-year update of the multi-hazard mitigation plan.
5.3 Continued Public Involvement

44 CFR Requirement §201.6(c)(4)(iii): [The plan maintenance process shall include a] discussion on how the community will continue public participation in the plan maintenance process.

The update process provides an opportunity to publicize success stories from the plan’s implementation and seek additional public comment. Information will be posted in the Evansville Courier & Press, Facebook, CERT Website and on the City and County websites following the annual review of the mitigation plan. A public hearing(s) to receive public comment on plan maintenance and updating will be held during the update period. When the HMPC reconvenes for the update, they will coordinate with all stakeholders participating in the planning process, including those who joined the HMPC after the initial effort, to update and revise the plan. Public notice will be posted and public participation will be invited, at a minimum, through available website postings and press releases to the local media outlets, primarily newspapers.
APPENDIX A
ADOPTION RESOLUTION

To be inserted upon approval by IDHS and FEMA Region V.
# APPENDIX B
## PLANNING PROCESS DOCUMENTATION

### Hazard Mitigation Planning Committee

<table>
<thead>
<tr>
<th>Agency</th>
<th>Representative</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Evansville-Vanderburgh County Emergency Management Agency</td>
<td>Cliff Weaver</td>
</tr>
<tr>
<td>City of Evansville-Vanderburgh County Emergency Management Agency</td>
<td>Nick Adams</td>
</tr>
<tr>
<td>City of Evansville Engineering Department</td>
<td>City Engineer, Brent Schmitt</td>
</tr>
<tr>
<td>Vanderburgh County Engineer</td>
<td>County Engineer, John Stoll</td>
</tr>
<tr>
<td>City of Evansville Urban Forestry Department</td>
<td>Shawn Dickerson</td>
</tr>
<tr>
<td>City of Evansville Department of Transportation and Services</td>
<td>Todd M Robertson</td>
</tr>
<tr>
<td>Vanderburgh County Highway Department</td>
<td>Scott Wichser</td>
</tr>
<tr>
<td>Legal Aid Society of Evansville</td>
<td>Kevin Gibson</td>
</tr>
<tr>
<td>Building Department/Code Enforcement and Building Commission</td>
<td>Commissioner, Ron Beane</td>
</tr>
<tr>
<td>Building Department/Code Enforcement and building Commission</td>
<td>Commissioner, David Ballew</td>
</tr>
<tr>
<td>Building Authority</td>
<td>David Rechtor</td>
</tr>
<tr>
<td>Evansville Police Department</td>
<td>Bob Bolin</td>
</tr>
<tr>
<td>Evansville Police Department</td>
<td>Assistant Chief, Chris Pugh</td>
</tr>
<tr>
<td>Evansville Fire Department</td>
<td>Sheriff, David Wedding</td>
</tr>
<tr>
<td>Fire Department</td>
<td>Mike Connelly</td>
</tr>
<tr>
<td>Vanderburgh County Suburban Fire Chief’s Association</td>
<td>Jerry Bulger</td>
</tr>
<tr>
<td>Area Planning Commission/Floodplain Administration</td>
<td>Ron London</td>
</tr>
<tr>
<td>Area Planning Commission/Floodplain Administration</td>
<td>John Ansbro</td>
</tr>
<tr>
<td>Levee Authority</td>
<td>Jay Perry</td>
</tr>
<tr>
<td>Vanderburgh County Health Department</td>
<td>Keith Goy</td>
</tr>
<tr>
<td>Vanderburgh County Health Department</td>
<td>Christopher Allen</td>
</tr>
<tr>
<td>Vanderburgh County Solid Waste District</td>
<td>Joe Ballard</td>
</tr>
<tr>
<td>Information Technology/GIS</td>
<td>Jim Gowen</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>David Smith</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Safety and Security, Greg Fleck</td>
</tr>
<tr>
<td>Public Works</td>
<td>Allen Mounts</td>
</tr>
<tr>
<td>Parks and Recreation</td>
<td>Brian Holtz</td>
</tr>
<tr>
<td>Evansville Environmental Agency</td>
<td>Jacob Keating</td>
</tr>
</tbody>
</table>
Hazard Mitigation Planning Committee Meetings

- May 16, 2016 – Internal Coordination Meeting Handout
  - Conference Call with Amec Foster Wheeler and Vanderburgh County
- May 31, 2017 – Kickoff Meeting Minutes
- June 27, 2017 – Risk Assessment Meeting Minutes
- June 27, 2017 – Mitigation Strategy Meeting Minutes

Public Involvement

- Public Information Flyer #1
- Public Questionnaire
  - Hardcopy Flyer
  - Screen Capture on Survey Website
  - Results
- City of Evansville-Vanderburgh County Website
  - Screen Capture on Website
  - Overview of Planning Process
  - Link to public questionnaire
  - Information on public meeting
    - Photographs of event are included within Chapter 4, Mitigation Strategy
  - Link to Draft Document for review
- Social Media Announcement for Public Meeting - Facebook
- Public Review of Draft Multi-Hazard Mitigation Plan
  - Announcement from Evansville Courier & Press
- Stakeholders Mailing List, Template Letter
Evansville-Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan Update

ORGANIZE RESOURCES

Hazard Mitigation Planning Committee

The Hazard Mitigation Planning Committee (HMPC) should be composed of staff from those community departments which are involved in hazard mitigation activities, have the authority to regulate development, and are responsible for enforcing local ordinances. The HMPC is the core group responsible for developing and reviewing drafts of the plan, creating the mitigation strategy, and submitting the final plan for local adoption. Suggested community departments include:

<table>
<thead>
<tr>
<th>County Departments - PREVIOUS</th>
<th>Jurisdictions</th>
<th>County Departments – ADD?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency Management</td>
<td>Evansville-Vanderburgh County</td>
<td>Floodplain Administration</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td>Housing / Community Development</td>
</tr>
<tr>
<td>Urban Forestry</td>
<td></td>
<td>Information Technology / Geographic Information Systems (GIS)</td>
</tr>
<tr>
<td>Transportation (Roads / Bridges)</td>
<td></td>
<td>Parks and Recreation</td>
</tr>
<tr>
<td>Legal Aid Society of Evansville, Inc.</td>
<td>Town of Darmstadt</td>
<td>Public Information Office</td>
</tr>
<tr>
<td>Building Department / Code Enforcement</td>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Public Works</td>
</tr>
<tr>
<td>Police Department</td>
<td></td>
<td>Stormwater Management</td>
</tr>
<tr>
<td>Fire Department</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area Planning Commission</td>
<td></td>
<td></td>
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<tr>
<td>Building Commission</td>
<td></td>
<td></td>
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<tr>
<td>Levee Authority District</td>
<td></td>
<td></td>
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<tr>
<td>Health Department</td>
<td></td>
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<tr>
<td>Solid Waste District</td>
<td></td>
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<tr>
<td>United Neighborhoods of Evansville</td>
<td></td>
<td></td>
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<tr>
<td>American Red Cross</td>
<td></td>
<td></td>
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<tr>
<td>Deaconess Hospital</td>
<td></td>
<td></td>
</tr>
<tr>
<td>St. Mary’s Hospital</td>
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</tr>
</tbody>
</table>

For additional information, please contact:
Cindy Popplewell,
cindy.popplewell@amecfw.com; (615) 333-0630
Evansville-Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan Update

Note to maximize CRS Credits:

- The office responsible for the community’s land use and comprehensive planning must be actively involved in the planning process.
- The HMPC must include representatives (50%) from the public and other stakeholders (with no attachment to local government). See next sections on Public Involvement and Coordination with Other Agencies and Stakeholders.
- The planning process and/or the HMPC must be formally created or recognized by action of the community’s governing body.
- All meetings must be open to the public and the meeting schedule must be publicly posted (website).

Public Involvement

The planning process must include an opportunity for the public to comment on the plan during its development and before its approval. For this credit, the term “public” includes residents, businesses, property owners, and tenants in the floodplain and other hazard areas as well as other stakeholders that represent the community.

Note to maximize CRS Credits:

- Include public representatives on the HMPC (with stakeholders 50% of HMPC members).
- Meeting at beginning of planning process to introduce the project and hazard mitigation planning.
  - Following Kickoff Meeting
- Meeting near the end of the planning process to present and discuss the draft plan.
  - Following Mitigation Strategy Meeting
- Postings to website explaining the planning process and the time and place for its meetings, meeting agendas, status reports, and the draft plan, when it is ready for review.
  - Information flyers prepared during each stage of the planning process.
  - Newspaper article announcing upcoming meeting
- Questionnaires asking the public for information on the hazards, problems, and possible solutions.
- Outreach projects which explain the planning effort and seek comments. Examples include brochures, mailers, booths at shopping malls, presentations at civic or neighborhood organizations, etc.
Evansville-Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan Update

Coordination with Other Agencies and Stakeholders

Other agencies and organizations must be contacted to determine if they have studies, plans, or information pertinent to the floodplain management plan; to determine if their programs or initiatives may affect the community’s program; and to see if they could support the community’s efforts. Suggested stakeholders to include on HMPC include:

<table>
<thead>
<tr>
<th>Community Stakeholders</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neighboring Communities</td>
</tr>
<tr>
<td>National Weather Service</td>
</tr>
<tr>
<td>U.S. Army Corps of Engineers</td>
</tr>
<tr>
<td>State NFIP Coordinator</td>
</tr>
</tbody>
</table>

Note to maximize CRS Credits:

- Include stakeholder representatives on the HMPC (with public 50% of HMPC members).
- Coordinating with agencies and organizations outside the community’s governmental structure. One point is provided for each agency or organization that is contacted. Two points are provided for meeting or having a telephone conversation with the agency or organization.

Meetings

- Project Kick-off Meeting – May 31
- Risk Assessment Meeting - June 27
- Mitigation Strategy Meeting – June 27
|------------------------|---------------------------------------------------------------|---------------------------------------------------------------|----------------------|
| Phase I Organize Resources | Task 1: Determine the Planning Area and Resources  
44 CFR 201.6(c)(1) | Step 1. Organize to Prepare the Plan | 15 |
| | Task 2: Build the Planning Team  
44 CFR 201.6(b)(1) | | |
| | Task 3: Create an Outreach Strategy  
44 CFR 201.6(b)(2) & (3) | Step 2. Involve the public | 120 |
| | Task 4: Review Community Capabilities  
44 CFR 201.6(b)(2) & (3) | Step 3. Coordinate with Other Agencies | 35 |
| Phase II Assess Risks | Task 5: Conduct a Risk Assessment  
44 CFR 201.6(c)(2)(i)  
44 CFR 201.6(c)(2)(ii) & (iii) | Step 4. Assess the hazard(s) | 35 |
| | Task 6: Develop a Mitigation Strategy  
44 CFR 201.6(c)(3)(i);  
44 CFR 201.6(c)(3)(ii); and  
44 CFR 201.6(c)(3)(iii) | Step 5. Assess the problem(s) | 52 |
| Phase III Develop a Mitigation Plan | Step 6. Set goals | 2 |
| | Task 7: Keep the Plan Current | Step 7. Review possible activities | 35 |
| | Task 8: Review and Adopt the Plan | Step 8. Draft an action plan | 60 |
| Phase IV Implement the Plan and Monitor Progress | Task 9: Create a Safe and Resilient Community  
44 CFR 201.6(c)(4) | Step 9. Adopt the plan | 2 |
| | Task 10. Implement, evaluate, revise | 26 |

For additional information, please contact: Cindy Popplewell, cindy.popplewell@amecfw.com; (615) 333-0630
Evansville-Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan Update

ASSESS RISKS

Data Collection Needs

The hazard identification and risk assessment requires collection of specific data in order to profile each hazard: general description, geographic location, previous occurrences, probability of future occurrences and magnitude/severity of the hazard event.

- Parcel Data / Building Footprints / Building Values
- Land Use Planning / Future Land Use
- Critical Facilities (see next section on Critical Facilities
- Utility Infrastructure
- Historic Structures
- Repetitive Loss Structures
- Areas not mapped on the FIRM that have flooded in the past
- Hazardous Materials – fixed facilities and transportation routes
- Update on FEMA Risk MAP process within community/watershed
- Inventory of dams and levees
- Subsidence areas – coal mines
- Capital Improvement Plans

Critical Facilities

FEMA generally defines four kinds of critical facilities:

- Structures or facilities that produce, use, or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials
- Hospitals, nursing homes, and housing likely to have occupants who may not be sufficiently mobile to avoid injury or death during a hazard event
- Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for emergency response activities before, during, and after a hazard event
- Public and private utility facilities that are vital to maintaining or restoring normal services to hazard areas before, during, and after a hazard event

FEMA’s HAZUS-MH loss estimation software uses the following three categories of critical assets. ‘Essential facilities’ are those that if damaged would have devastating impacts on disaster response and/or recovery. ‘High potential loss facilities’ are those that would have a high loss or impact on the community. Transportation and lifeline facilities are third category of critical assets; examples are provided in the following table.

<table>
<thead>
<tr>
<th>Essential Facilities</th>
<th>High Potential Loss Facilities</th>
<th>Transportation and Lifeline</th>
</tr>
</thead>
</table>
| - Hospitals and other medical facilities
  - Police stations
  - Fire station                        | - Power plants
                                             - Dams/leves
                                             - Military installations
                                             - Hazardous material sites
                                                                                           | - Highways, bridges, and tunnels
                                                                                  - Railroads and facilities
                                                                                  - Bus facilities
                                                                                  - Airports
Evansville-Vanderburgh County, Indiana Multi-Hazard Mitigation Plan Update

<table>
<thead>
<tr>
<th>Essential Facilities</th>
<th>High Potential Loss Facilities</th>
<th>Transportation and Lifeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Emergency Operations Centers</td>
<td>- Schools</td>
<td>- Water treatment facilities</td>
</tr>
<tr>
<td></td>
<td>- Shelters</td>
<td>- Natural gas facilities and pipelines</td>
</tr>
<tr>
<td></td>
<td>- Day care centers</td>
<td>- Oil facilities and pipelines</td>
</tr>
<tr>
<td></td>
<td>- Nursing homes</td>
<td>- Communications facilities</td>
</tr>
<tr>
<td></td>
<td>- Main government buildings</td>
<td></td>
</tr>
</tbody>
</table>

**Capability Assessment**

The mitigation planning process will review existing capabilities, including authorities, policies, programs, staff, funding, and other resources available to the local jurisdiction to accomplish mitigation and reduce long-term vulnerability.

**Regulatory Capabilities**

<table>
<thead>
<tr>
<th>Regulatory Tool (ordinances, codes, plans)</th>
<th>Y/N</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>General/Comprehensive plan</td>
<td>YES</td>
<td>2004-2025 Comprehensive Plan of Evansville and Vanderburgh County</td>
</tr>
<tr>
<td>Zoning ordinance</td>
<td>YES</td>
<td>2011-2035 Comprehensive Plan of Evansville and Vanderburgh, in-progress</td>
</tr>
<tr>
<td>Subdivision ordinance</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Growth management ordinance</td>
<td>NO</td>
<td></td>
</tr>
<tr>
<td>Floodplain ordinance</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Other special purpose ordinance (stormwater, steep slope, wildfire)</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Building code</td>
<td>YES</td>
<td>Version:</td>
</tr>
<tr>
<td>BCEGS Rating</td>
<td>YES</td>
<td>5-Commercial and 8-Residential</td>
</tr>
<tr>
<td>Fire department ISO rating</td>
<td></td>
<td>Rating:</td>
</tr>
<tr>
<td>Erosion or sediment control program</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Stormwater management program</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Site plan review requirements</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Capital improvements plan</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Economic development plan</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Local emergency operations plan</td>
<td>YES</td>
<td>Vanderburgh County EMA Plan</td>
</tr>
<tr>
<td>Flood insurance study (FIS) or other engineering study for streams</td>
<td>YES</td>
<td></td>
</tr>
<tr>
<td>Elevation certificates</td>
<td>YES</td>
<td></td>
</tr>
</tbody>
</table>

For additional information, please contact: Cindy Popplewell, cindy.popplewell@amecfw.com; (615) 333-0630
## Administrative/Technical Capabilities

<table>
<thead>
<tr>
<th>Personnel Resources</th>
<th>Yes/No</th>
<th>Department/Position</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planner/Engineer with knowledge of land development/land management practices</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Engineer/Professional trained in construction practices related to buildings and/or infrastructure</td>
<td>YES</td>
<td>Area Plan Commission &amp; Building Commission (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Planner/Engineer/Scientist with an understanding of natural hazards</td>
<td>YES</td>
<td>Area Plan Commission (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Personnel skilled in GIS / GIS Services</td>
<td>YES</td>
<td>GIS Department</td>
<td></td>
</tr>
<tr>
<td>Full time building official</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Floodplain Manager</td>
<td>YES</td>
<td>Building Commission (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Emergency Manager</td>
<td>YES</td>
<td>EMA (Joint City/County)</td>
<td></td>
</tr>
<tr>
<td>Public Information Officer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grant writer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other personnel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Warning Systems/Services (Reverse 9-11, cable override, outdoor warning signals)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>StormReady Certification</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Fiscal Capabilities

<table>
<thead>
<tr>
<th>Financial Resources</th>
<th>Accessible/Eligible to Use (Y/N)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Community Development Block Grants</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Capital improvements project funding</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Authority to levy taxes for specific purposes</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Fees for water, sewer, gas, or electric services</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Stormwater user fees</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Impact fees for new development</td>
<td>Y</td>
<td></td>
</tr>
<tr>
<td>Incur debt through general obligation bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incur debt through special tax bonds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incur debt through private activities</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

For additional information, please contact:
Cindy Popplewell,
cindy.popplewell@amecfw.com; (615) 333-0630
<table>
<thead>
<tr>
<th>Withhold spending in hazard prone areas</th>
<th>Other</th>
</tr>
</thead>
</table>

For additional information, please contact: Cindy Popplewell, cindy.popplewell@amecfw.com; (615) 333-0630
This memorandum presents the meeting minutes from the May 31, 2017, kickoff meeting for the Vanderburgh County Multi-Hazard Mitigation Plan. It provides an overview of natural hazard mitigation planning, identification of the planning committee, ideas for public involvement, identification of hazards affecting the County, mitigation goals, and next steps.

### Attendees

<table>
<thead>
<tr>
<th>Agency</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Red Cross</td>
<td>Jason Bradshaw</td>
</tr>
<tr>
<td>Area Planning Commission/Floodplain Administration</td>
<td>John Ansbro</td>
</tr>
<tr>
<td>Building Department/Code Enforcement</td>
<td>David Ballew</td>
</tr>
<tr>
<td>Chief Information Officer</td>
<td>Mark Uhrin</td>
</tr>
<tr>
<td>County Commissioner District 2</td>
<td>Bruce Ungethiem</td>
</tr>
<tr>
<td>Deaconess Hospital</td>
<td>Mark Merrill</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Cliff Weaver</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Nick Adams</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Trent Lamb</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Alicia Schoening</td>
</tr>
<tr>
<td>Engineering – Vanderburgh County</td>
<td>Valerie Harry</td>
</tr>
<tr>
<td>Evansville-Vanderburgh School Corporation</td>
<td>Greg Fleck</td>
</tr>
<tr>
<td>Fire Department</td>
<td>Mike Connelly</td>
</tr>
<tr>
<td>Fire Department</td>
<td>Ron Campbell</td>
</tr>
<tr>
<td>Fire Department – Scott Township</td>
<td>Adam Farrer</td>
</tr>
<tr>
<td>Health Department</td>
<td>Keith Goy</td>
</tr>
<tr>
<td>Information Technology/GIS</td>
<td>Jim Gowen</td>
</tr>
<tr>
<td>Levee Authority</td>
<td>Jay Perry</td>
</tr>
<tr>
<td>Metropolitan Planning Organization</td>
<td>Seyed Shokouhzadeh</td>
</tr>
<tr>
<td>Metro Park Zoo, Veterinarian</td>
<td>Carrie Ullman</td>
</tr>
<tr>
<td>Police Department – City of Evansville</td>
<td>Chris Pugh</td>
</tr>
<tr>
<td>Public Works</td>
<td>Allen Mounts</td>
</tr>
<tr>
<td>Sheriff Department</td>
<td>David Wedding</td>
</tr>
<tr>
<td>Solid Waste District</td>
<td>Susan Jeffries</td>
</tr>
<tr>
<td>Superintendent of Cemeteries/Neighborhood Association</td>
<td>Chris Cooke</td>
</tr>
<tr>
<td>Town of Darmstadt, Councilman</td>
<td>Paul Freeman</td>
</tr>
<tr>
<td>Transportation – City of Evansville</td>
<td>Todd M Robertson</td>
</tr>
<tr>
<td>Transportation – Vanderburgh County</td>
<td>Scot Wichser</td>
</tr>
<tr>
<td>Urban Forestry</td>
<td>Shawn Dickerson</td>
</tr>
</tbody>
</table>
Introductions

Cliff Weaver, Vanderburgh County Emergency Management Agency, began the meeting by welcoming and thanking the attendees, introducing the concept of a hazard mitigation plan and explaining its importance to the County.

Overview of Hazard Mitigation Planning

Cindy Popplewell of Amec Foster Wheeler presented information on hazard mitigation, the requirements of hazard mitigation planning, and a timeline for the planning process. She explained the benefits of participating in the mitigation plan, including eligibility for federal hazard mitigation assistance. The powerpoint slide show that was used for informational purposes during the meeting is included as Attachment B.

The mitigation planning process is structured around FEMA’s four-phase guidance for developing a hazard mitigation plan: 1) organize resources, 2) assess risks, 3) develop a mitigation plan, and 4) implement the plan and monitor progress. As demonstrated in the table below, the planning tasks are also consistent with FEMA’s Flood Mitigation Assistance (FMA) and Community Rating System (CRS) planning process, and will thus position Peoria County to seek maximum credit under the CRS Program.

10-Step Mitigation Planning Process

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Phase I</strong> Organize Resources</td>
<td>Task 1: Determine the Planning Area and Resources</td>
<td>Step 1. Organize to Prepare the Plan</td>
</tr>
<tr>
<td></td>
<td>Task 2: Build the Planning Team 44 CFR 201.6(c)(1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Task 3: Create an Outreach Strategy 44 CFR 201.6(b)(1)</td>
<td>Step 2. Involve the public</td>
</tr>
<tr>
<td></td>
<td>Task 4: Review Community Capabilities 44 CFR 201.6(b)(2) &amp; (3)</td>
<td>Step 3. Coordinate with Other Agencies</td>
</tr>
<tr>
<td><strong>Phase II</strong> Assess Risks</td>
<td>Task 5: Conduct a Risk Assessment 44 CFR 201.6(c)(2)(i) 44 CFR 201.6(c)(2)(ii) &amp; (iii)</td>
<td>Step 4. Assess the hazard(s)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 5. Assess the problem(s)</td>
</tr>
<tr>
<td><strong>Phase III</strong> Develop a Mitigation Plan</td>
<td>Task 6: Develop a Mitigation Strategy 44 CFR 201.6(c)(3)(i); 44 CFR 201.6(c)(3)(ii); and 44 CFR 201.6(c)(3)(iii)</td>
<td>Step 6. Set goals</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 7. Review possible activities</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Step 8. Draft an action plan</td>
</tr>
<tr>
<td><strong>Phase IV</strong></td>
<td>Task 8: Review and Adopt the Plan</td>
<td>Step 9. Adopt the plan</td>
</tr>
<tr>
<td></td>
<td>Task 7: Keep the Plan Current</td>
<td></td>
</tr>
</tbody>
</table>
Role of the HMPC

Cindy described the role of the Hazard Mitigation Planning Committee (HMPC) during the planning process. Participation in the committee requires:

- Attending and participating in meetings,
- Providing available data requested,
- Reviewing and commenting on plan drafts,
- Advertising and assisting with the public input process, and
- Coordinating the formal adoption.

It is anticipated that the HMPC will participate in two face-to-face hazard mitigation planning meetings. Communication between meetings will be handled primarily via email.

Planning for Public Involvement

Potential methods for involving the public in the planning process were discussed in a tiered format geared to inform, educate, and engage the public. Initial thoughts on disseminating public information about the hazard mitigation plan and planning process included posting informational flyers to the Vanderburgh County Website, developing a questionnaire for public input, hosting public open house events, and participating on the HMPC.

Information on the planning process for the Update as well as the existing mitigation plan are available on the County website:
Data Collection Needs for Risk Assessment

Alicia Schoening with Vanderburgh County Emergency Management Agency will coordinate with the GIS staff to obtain GIS and mapping data for the risk assessment. This may include:

- Political boundaries
- Growth/land use maps
- Zoning data
- Parcel data
- Building footprints
- Critical facilities
- Floodplains and floodways
- Hazardous materials facilities

Mitigation Goals

Cindy presented recommendations for updating the existing mitigation goals:

**EXISTING:**
#1: Implement a comprehensive Public Education campaign regarding the hazards posing significant risk to Evansville and Vanderburgh County.

**RECOMMENDED UPDATE:**
#1: Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.

**EXISTING:**
#2: Reduce exposure to hazard related losses, before and after disaster strikes.

**RECOMMENDED UPDATE**
#2: Reduce vulnerability to natural hazards, before and after disaster strikes.
  - **Strengthen** protection of critical facilities and infrastructure to create a safer, more sustainable community.
  - **Build and support** local capabilities to respond and recovery from natural hazard events.
  - Increase the local floodplain management activities and participation in the NFIP.
  - Protect community historic/cultural/environmental resources from identified natural hazards

Next Steps

- Amec Foster Wheeler will prepare template letter for outreach to additional stakeholders. Vanderburgh County will send out letters to identified stakeholders – including utilities identified during the kickoff meeting.
- Alicia Schoening will set meetings/conference call with County Departments, as needed, for Capability Assessment.
- HMPC will review existing Plan and Mitigation Actions from existing Mitigation Plan.
- The next meeting of the Hazard Mitigation Planning Committee is scheduled for Tuesday, June 20th at 12:30pm at the Emergency Management Agency.
Attachment A – Sign-In Sheets
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Phone</th>
<th>Email</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevel Shuckalzak</td>
<td>Ex. Di.1</td>
<td>EMPC</td>
<td>822-936-7533</td>
<td><a href="mailto:shuckalzak@evansvilleopoly.c">shuckalzak@evansvilleopoly.c</a></td>
</tr>
<tr>
<td>Ron Campbell</td>
<td>Chief</td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chris Fug</td>
<td>Asst. Chief</td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shawn Dickerson</td>
<td>Chief</td>
<td>Forrestry</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jay Ryan</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mike Connolly</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mike McMillan</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mike Goff</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark Miller</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anne Morgan</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adam White</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason Bronk</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paul Freeman</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ryan Prettler</td>
<td></td>
<td>EFD</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
# Evansville-Vanderburgh County, Illinois Multi-Hazard Mitigation Plan

## Sign-In Sheet – May 31, 2017

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adam Forese</td>
<td>Fire Chief</td>
<td>Scott Twp Fire + EMS</td>
<td><a href="mailto:alecios@scottville.org">alecios@scottville.org</a></td>
<td>812-430-3138</td>
</tr>
<tr>
<td>Mark Uhlir</td>
<td>CEO</td>
<td>Computer Services</td>
<td><a href="mailto:mulir@evansville.in.gov">mulir@evansville.in.gov</a></td>
<td>812-436-7859</td>
</tr>
<tr>
<td>Todd M. Robertson</td>
<td>Trans &amp; Services</td>
<td>Toast &amp; Services</td>
<td><a href="mailto:robertson@evansville.in.gov">robertson@evansville.in.gov</a></td>
<td>812-436-4978</td>
</tr>
<tr>
<td>Susan Jeffries</td>
<td>Administrator</td>
<td>Waste District</td>
<td>jeffries.evansville.in.gov</td>
<td>812-436-7830</td>
</tr>
<tr>
<td>Bruce Ungarri</td>
<td>Clerk Commissaire</td>
<td>Vanderburgh County</td>
<td><a href="mailto:bungarri@vanderburgh.gov">bungarri@vanderburgh.gov</a></td>
<td>812-435-5775</td>
</tr>
<tr>
<td>Keith Gay</td>
<td>Water Control Supervisor</td>
<td>Health Dept.</td>
<td><a href="mailto:kgay@vanderburgh.gov">kgay@vanderburgh.gov</a></td>
<td>812-435-5667</td>
</tr>
<tr>
<td>Valerie Harry</td>
<td>Design Engineer</td>
<td>County Engineering</td>
<td><a href="mailto:vharry@vanderburgh.gov">vharry@vanderburgh.gov</a></td>
<td>812-435-5773</td>
</tr>
<tr>
<td>Gregory Fleck</td>
<td>Chief of Police</td>
<td>EVSC-PA</td>
<td><a href="mailto:gregory.fleck@evsc.k12.in.gov">gregory.fleck@evsc.k12.in.gov</a></td>
<td>812-435-8376</td>
</tr>
<tr>
<td>Jim Gowen</td>
<td>GIS Specialist</td>
<td>Vanderburgh Co. Assessors</td>
<td><a href="mailto:jgowen@vanderburgh.gov">jgowen@vanderburgh.gov</a></td>
<td>812-435-5286</td>
</tr>
<tr>
<td>Allen Marches</td>
<td>Director</td>
<td>Water &amp; Sewer Dept.</td>
<td><a href="mailto:amarches@evansville.com">amarches@evansville.com</a></td>
<td>812-436-4560</td>
</tr>
<tr>
<td>John W. Anshro</td>
<td>Sr Planner</td>
<td>APC</td>
<td><a href="mailto:jwansbro@evansville.com">jwansbro@evansville.com</a></td>
<td>455-5060</td>
</tr>
</tbody>
</table>
### Sign-In Sheet – May 31, 2017

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carrie Ullman</td>
<td>Veterinary</td>
<td>Mosier Park Zoo</td>
<td><a href="mailto:cullman@mosierparkzoo.com">cullman@mosierparkzoo.com</a></td>
<td>812-435-0825</td>
</tr>
<tr>
<td>Trent Lamb</td>
<td>Planning Section</td>
<td>Vanderburgh Co. EMT</td>
<td><a href="mailto:lamb@vanderburghsheriff.com">lamb@vanderburghsheriff.com</a></td>
<td>812-431-8082</td>
</tr>
<tr>
<td>David Bellen</td>
<td>Building Commissioner</td>
<td></td>
<td><a href="mailto:dbellen@evansville.in.gov">dbellen@evansville.in.gov</a></td>
<td>812-436-7872</td>
</tr>
<tr>
<td>David Weddling</td>
<td>Sher. Ft</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chris Cooke</td>
<td>City Economist</td>
<td>TFS</td>
<td><a href="mailto:ccooke@evansville.in.gov">ccooke@evansville.in.gov</a></td>
<td>435-6045</td>
</tr>
</tbody>
</table>
Evansville-Vanderburgh County Multi-Hazard Mitigation Plan Update Kickoff Meeting
May 31, 2017

Cindy Popplewell
Amec Foster Wheeler
Hazard Mitigation & Emergency Management Program
Nashville, TN

Agenda
1. Introduction to Hazard Mitigation
2. Requirements of Local Hazard Mitigation Planning
   • Overview of 10 Planning Steps
   • Actions for Today
     ✓ Finalize our Hazard Mitigation Planning Committee
     ✓ Prepare for Public Involvement
     ✓ Identify Data Collection Needs for Risk Assessment
     ✓ Review Mitigation Goals and Actions
3. Timeline of Planning Process
4. Next Steps

What Is Mitigation?
Sustained action taken to reduce or eliminate long-term risk to human life and property from natural and manmade hazards.
- Prevention
- Property Protection
- Public Education and Awareness
- Natural Resource Protection
- Emergency Services
- Structural Projects

What Is Mitigation Planning?
A process for the Evansville and Vanderburgh County to:
- Identify the natural and manmade hazards to which we are at risk;
- Assess the potential impacts of those hazards;
- Develop goals, objectives, and actions to reduce impacts; and
- Prioritize and implement mitigation actions.
Why Mitigation Planning?

- Increasing Cost of Disaster Response and Recovery
  - Cost of “Doing Nothing” Too Much
- Population Growth and Development
  - More People, Buildings, Infrastructure in Hazardous Areas
    - 1970 – 168,772
    - 1980 – 167,515
    - 1990 – 165,058
    - 2000 – 171,922
    - 2010 – 173,763
    - 2016 estimate – 181,877
- More Disaster Declarations (1953-2016)
  - Average 59 Declarations/year
  - Severe storms, flooding, hurricanes, and tornadoes
  - Billions of Tax Dollars Spent

Recent Disaster Declarations in Indiana

<table>
<thead>
<tr>
<th>Date</th>
<th>Disaster Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/22/2014</td>
<td>Severe Winter Storm and Snowstorm</td>
</tr>
<tr>
<td>03/09/2012</td>
<td>Severe Storms, Straight-line Winds, and Tornadoes</td>
</tr>
<tr>
<td>06/23/2011</td>
<td>Severe Storms, Tornadoes, Straight-Line Winds, and Flooding</td>
</tr>
<tr>
<td>04/22/2009</td>
<td>Severe Storms, Tornadoes, and Flooding</td>
</tr>
<tr>
<td>03/05/2009</td>
<td>Severe Winter Storm</td>
</tr>
<tr>
<td>09/23/2008</td>
<td>Severe Storms and Flooding</td>
</tr>
<tr>
<td>06/08/2008</td>
<td>Severe Storms and Flooding</td>
</tr>
<tr>
<td>01/30/2008</td>
<td>Severe Storms and Flooding</td>
</tr>
<tr>
<td>11/30/2007</td>
<td>Severe Storms and Flooding</td>
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<tr>
<td>10/06/2006</td>
<td>Severe Storms and Flooding</td>
</tr>
<tr>
<td>11/08/2005</td>
<td>Tornado and Severe Storms</td>
</tr>
<tr>
<td>01/21/2005</td>
<td>Severe Winter Storms and Flooding</td>
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</tbody>
</table>

Most Expensive Presidential Disaster Declarations

<table>
<thead>
<tr>
<th>Event</th>
<th>Year</th>
<th>FEMA Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hurricane Katrina (FL, LA, MS, AL)</td>
<td>2005</td>
<td>$38,318,576,948</td>
</tr>
<tr>
<td>Hurricane Sandy (NY, NJ, MD)</td>
<td>2012</td>
<td>$12,627,000,000</td>
</tr>
<tr>
<td>Attack on America - WTC (NY, NJ, VA)</td>
<td>2001</td>
<td>$8,818,350,120</td>
</tr>
<tr>
<td>Northridge Earthquake (CA)</td>
<td>1994</td>
<td>$6,978,325,877</td>
</tr>
<tr>
<td>Hurricane Rita (TX, LA)</td>
<td>2005</td>
<td>$3,749,698,351</td>
</tr>
<tr>
<td>Hurricane Georges (AL, FL, MS, PR, VI)</td>
<td>1998</td>
<td>$2,245,157,178</td>
</tr>
<tr>
<td>Hurricane Wilma (FL)</td>
<td>2005</td>
<td>$2,110,738,364</td>
</tr>
<tr>
<td>Hurricane Charley (FL, SC)</td>
<td>2004</td>
<td>$1,885,466,628</td>
</tr>
<tr>
<td>Hurricane Andrew (FL, LA)</td>
<td>1992</td>
<td>$1,813,594,813</td>
</tr>
<tr>
<td>Hurricane Frances (FL, NC, PA, OH, NY, GA, SC) 2004</td>
<td>2004</td>
<td>$1,773,440,505</td>
</tr>
</tbody>
</table>

Why Mitigation Planning?

- Many Events are Predictable and Repetitive
- Loss Reduction Activities Work!
  - Cost Effective
  - Environmentally Sound
  - Funding Available
Why Mitigation Planning?

- **Disaster Mitigation Act of 2000**
- **Public Law 106-390; Amendment to the Stafford Act**
  
  Requires local governments to adopt a natural hazard mitigation plan to maintain eligibility for FEMA mitigation funds:
  - Hazard Mitigation Grant Program
  - Post-Disaster Mitigation Program
  - Flood Mitigation Assistance Program

10-Step Planning Process

- **ORGANIZE RESOURCES**
  - 1. Get Organized
  - 2. Plan for Public Involvement
  - 3. Coordinate with Other Departments and Agencies

- **ASSESS HAZARDS AND RISK**
  - 4. Identify Hazards
  - 5. Assess the Risks

- **DEVELOP MITIGATION PLAN**
  - 6. Set Planning Goals
  - 7. Review Possible Activities
  - 8. Draft an Action Plan

- **IMPLEMENT THE PLAN**
  - 9. Adopt the Plan
  - 10. Implement the Plan, Evaluate Work, Revise as Needed

1. Get Organized

- **Determine the Planning Area and Build the Planning Team**

- **Hazard Mitigation Planning Committee**
  - **Committee Members** – core group responsible for making decisions, driving the planning process, and agreeing upon the final contents of the plan

- **Public/Other Stakeholders** – individuals or groups that affect or can be affected by a mitigation action or policy

HMPC Responsibilities

- Attending and contributing to the HMPC meetings
- Providing requested data (as available) in a timely manner
- Advertising, coordinating, and participating in public input process
- Developing and updating mitigation projects (actions)
- Reviewing and commenting on draft plan
- Coordinating formal adoption of the final plan
- Tracking time for grant reporting
1. Get Organized
   ✓ Finalize our HMPC Members
     - EMA
     - Engineering
     - Urban Forestry
     - Transportation
     - Building Dept.
     - Police
     - Fire Department/Districts
     - Area Planning Commission
     - Levee Authority District
     - Health Department
     - Solid Waste District
     - Communications
     - Health Department
     - GIS
     - School Corporation
   ✓ Finalize our HMPC Stakeholders
     - American Red Cross
     - United Neighborhoods of Evansville
     - Deaconess Hospital
     - St. Mary’s Hospital

2. Plan for Public Involvement
   ➢ ENGAGE
     - Include on HMPC
   ➢ EDUCATE
     - Host Public Input Meetings
   ➢ INFORM
     - Post Data on Websites
     - Informational Flyers
       — Introduction of Planning
       — On-line Questionnaire
     — Opportunity to review draft document
   ➢ Other Outreach Ideas?

3. Coordinate with Other Departments and Agencies
   ➢ Invite to HMPC Meetings
   ➢ Request hazard data
   ➢ Send Draft Report for Review
   ➢ Identified Agencies include:
     - State Hazard Mitigation Officer
     - FEMA Regional Hazard Mitigation Officer
     - State NFIP Coordinator
     - US Army Corps of Engineers
     - NRCS
     - NOAA / National Weather Service
     - Neighboring Communities

4. Identify the Hazards
   A. Identify all the possible hazards affecting the planning areas
   B. Profile the Hazards
      ➢ Hazard/problem description
        ➢ Geographic Location
          ✓ Extensive – 50 to 100% of planning area
          ✓ Significant – 10 to 50% of planning area
          ✓ Limited – less than 10% of planning area
        ➢ Previous occurrences
          ➢ Probability of future occurrence
            ✓ Highly Likely – near 100% chance of occurrence
            ✓ Likely – 10 to 100% chance of occurrence
            ✓ Occasional – 1 to 10% chance of occurrence
            ✓ Unlikely – less than 1% chance of occurrence
      ➢ Magnitude/Severity
        ✓ Catastrophic
        ✓ Critical
        ✓ Limited
        ✓ Negligible
      ➢ Planning Significance
        ✓ Low
        ✓ Moderate
        ✓ High
Thunderstorms

- **Hazard/Problem Description:** Localized storms accompanied by hail, high winds, lightning, heavy rain causing flash flooding and sometimes tornadoes.

**Geographic Location:** Entire County; Extensive

**Previous Occurrences:** (NWS and NCDC)
- Hail – 59 events since 1962 ($20K)
- High/Strong Winds – 12 events since 1994 ($3M/$1M)
- Lightning – 2 reported events since 1997 ($70K)
- Thunderstorm Winds – 145 events since 1957 ($2.9M)
- Annual Thunderstorm Days - 50

- **Probability:** Highly Likely (2.41 events each year)
- **Magnitude/Severity:** Critical, interruptions of essential facilities/services for 24-72 hours

---

### Hazard Geographic Probability Magnitude Planning Location Significance

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Geographic Location</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Planning Significance</th>
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<tbody>
<tr>
<td>Severe Weather</td>
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<tr>
<td>- Extreme Temperatures</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Limited</td>
<td>High</td>
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<tr>
<td>- Thunderstorms/High Winds/Lightning</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>- Tornadoes</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>- Winter Storms</td>
<td>Extensive</td>
<td>Highly Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Earthquake</td>
<td>Extensive</td>
<td>Likely</td>
<td>Critical</td>
<td>High</td>
</tr>
<tr>
<td>Floods</td>
<td>Significant</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>High</td>
</tr>
<tr>
<td>Dam Failure</td>
<td>Significant</td>
<td>Likely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Levee Failure</td>
<td>Significant</td>
<td>Unlikely</td>
<td>Catastrophic</td>
<td>Moderate</td>
</tr>
<tr>
<td>Drought</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
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<tr>
<td>Wildfires</td>
<td>Significant</td>
<td>Occasional</td>
<td>Limited</td>
<td>Moderate</td>
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<tr>
<td>Infestation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Nile</td>
<td>Extensive</td>
<td>Likely</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Emerald Ash Borer</td>
<td>Extensive</td>
<td>Occasional</td>
<td>Negligible</td>
<td>Moderate</td>
</tr>
<tr>
<td>Mine Subsidence</td>
<td>Limited</td>
<td>Unlikely</td>
<td>Critical</td>
<td>Low</td>
</tr>
</tbody>
</table>

5. **Assess the Risk**

- Inventory residential & commercial structures
- Inventory critical facilities
- Determine # and value of structures
- Determine # of people in area
- Identify vulnerable infrastructure
- Identify development trends and constraints
- Identify cultural, natural and historic resource areas
- Estimate the losses
5. Assess the Risk

- Data Collection Needs and Source
  - General Mapping Data
    - Parcel Data / Building Footprints / Building Values
    - Repetitive Loss Structures/Areas
    - Land Use/Future Planning – Documents or Digital Data
    - Insurance/Claim Information
    - Utility Infrastructure
    - Critical Facilities

### Essential Locations
- Hospitals and other medical facilities
- Police stations
- Fire stations
- Emergency Operations Centers

### High-Priority Areas
- Power plants
- Data centers
- Hazardous material sites
- Quarantine areas
- Day care centers
- Mass government buildings

- Highways, bridges, and tunnels
- Railroads and facilities
- Bus facilities
- Water treatment facilities
- Natural gas facilities and pipelines
- Oil facilities and pipelines
- Communications facilities

5. Assess the Risk

**Capability Assessment – How prepared are we now?**

- Regulatory
- Administrative/Technical
- Fiscal
  - Plans, studies, ordinances, etc.
  - Codes, regulations
  - Ability to implement hazard mitigation projects
  - Gap analysis
  - Review of possible activities

- Interviews with individual County Departments

6-9. Develop the Mitigation Plan

- Review existing goals and objectives – update as needed
- Review existing mitigation actions – update progress
- Identify new mitigation actions to reduce vulnerability with emphasis on new and existing buildings and infrastructure
  - Who is going to do it? Responsible Department
  - When is it going to be completed? Setting timeline
  - How is it going to be financed? Potential funding sources
- Adopt the Plan

**GOALS**

#1: Implement a comprehensive Public Education campaign regarding the hazards posing significant risk to Evansville and Vanderburgh County.

#2: Reduce exposure to hazard related losses, before and after disaster strikes.

#3: Utilize latest technology and data in hazard mitigation activities
## GOALS

**#1: Implement a comprehensive Public Education campaign regarding the hazards posing significant risk to Evansville and Vanderburgh County.**

- Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.

**#2: Reduce exposure to hazard related losses, before and after disaster strikes.**

- Reduce vulnerability to natural hazards, before and after disaster strikes.
  - Strengthen protection of critical facilities and infrastructure to create a safer, more sustainable community.
  - Build and support local capabilities to respond and recovery from natural hazard events.
  - Increase the local floodplain management activities and participation in the NFIP.
  - Protect community historic/cultural/environmental resources from identified natural hazards

## 6-9. Update the Mitigation Plan

**Plan Outline**

- 1.0 – Introduction and Planning Process
- 2.0 – Community Profile
- 3.0 – Risk Assessment
- 4.0 – Mitigation Strategy
- 5.0 – Plan Maintenance
- Appendices
  - Adoption Documentation
  - Public Involvement Documentation
  - Mitigation Alternatives

## 10. Implement, Evaluate, and Revise

- Plan must be updated every 5 years
- Should evaluate progress for implementation every year or more often
- Identify process to incorporate plan into other plans and programs
- Describe methods to maintain public involvement – reporting on progress and publicizing successes

### Timeline for Planning Process

- Risk Assessment and Mitigation Action Meeting
  - June 27, 2017
- Public Open House
  - Following June 27 Mtg – to allow for public input on mitigation actions
- HMPC Review Period for Draft Plan
  - 2 week period
- Public Review Period for Draft Plan
  - 2 week period
- Submit Plan to State/FEMA
Next Steps

- Public Outreach and Data Collection
  - Post Public Information flyer
  - Set up Questionnaire for public input
  - Letters to Other Stakeholders
  - Coordinate with GIS staffing for digital data/Risk Assessment
  - Set meetings with County Departments for Capability Assessment
  - Review existing Plan and Mitigation Actions from 2011 Plan

- Next Meeting – June 27, 2017

- Contact ANYTIME with questions or concerns

Alicia Schoening
acreedon@hotmail.com
Cliff Weaver
cweaver@vanderburghsheriff.com
(812) 421-6204

Cindy Popplewell
(615) 333-0630 ext. 7050
(303) 704-8939

contact@amecfw.com
Memorandum

To Vanderburgh County
Hazard Mitigation Planning Committee (HMPC)

From Cindy Popplewell
Tel / Email (303) 742-5306 / cindy.popplewell@amecfw.com

Subject Minutes from Multi-Hazard Mitigation Plan Risk Assessment and Mitigation Strategy Meeting

This memorandum presents the meeting minutes from the June 27th meeting for the Vanderburgh County Multi-Hazard Mitigation Plan. The meeting included an overview of natural hazard mitigation planning, an update on the hazard identification and risk assessment, a review of current mitigation actions, a brainstorming session for new mitigation ideas, and next steps.

Attendees

<table>
<thead>
<tr>
<th>Agency</th>
<th>Contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Red Cross</td>
<td>Jason Bradshaw</td>
</tr>
<tr>
<td>Area Planning Commission/Floodplain Admin</td>
<td>John Ansbro</td>
</tr>
<tr>
<td>Building Department/Code Enforcement</td>
<td>David Ballew</td>
</tr>
<tr>
<td>Chief Information Officer</td>
<td>Mark Uhrin</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Cliff Weblew</td>
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<tr>
<td>Emergency Management Agency</td>
<td>Trent Lamb</td>
</tr>
<tr>
<td>Emergency Management Agency</td>
<td>Alicia Schoening</td>
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<tr>
<td>Engineering – City of Evansville</td>
<td>Chris Weil</td>
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<tr>
<td>Engineering – Vanderburgh County</td>
<td>Valerie Harry</td>
</tr>
<tr>
<td>Evansville-Vanderburgh County Building Authority</td>
<td>Bruce Hargrave</td>
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<tr>
<td>Evansville EPA</td>
<td>Jacob Keating</td>
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<tr>
<td>Fire Department</td>
<td>Mike Connely</td>
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<td>Health Department</td>
<td>Keith Goy</td>
</tr>
<tr>
<td>Indiana DOT, SubDistrict Operations Manager</td>
<td>Mike Bastin</td>
</tr>
<tr>
<td>Indiana DNR, State NFIP Coordinator</td>
<td>Anita Nance</td>
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<tr>
<td>Indiana DNR, Hydraulic Engineer</td>
<td>Tony Scott</td>
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<tr>
<td>Information Technology/GIS</td>
<td>Jim Gowen</td>
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<tr>
<td>Levee Authority</td>
<td>Jay Perry</td>
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<tr>
<td>Metropolitan Planning Organization</td>
<td>Seyed Shokouhzadeh</td>
</tr>
<tr>
<td>Metro Park Zoo, Veterinarian</td>
<td>Carrie Ullman</td>
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<tr>
<td>Police Department – City of Evansville</td>
<td>Chris Pugh</td>
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<tr>
<td>Public Works</td>
<td>Allen Mounts</td>
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<td>Solid Waste District</td>
<td>Joe Ballard</td>
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<tr>
<td>Superintendent of Cemeteries/Neighborhood Association</td>
<td>Chris Cooke</td>
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<tr>
<td>Urban Forestry</td>
<td>Shawn Dickerson</td>
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</table>
Introductions

Cliff Weaver, Vanderburgh County Emergency Management Agency, began the meeting by welcoming and thanking the attendees, introducing the concept of a hazard mitigation plan and explaining its importance to the County.

Hazard Identification and Risk Assessment

Cindy Popplewell of Amec Foster Wheeler presented information on hazard mitigation, the hazard identification and risk assessment update and the capability assessment. The powerpoint slide show that was used for informational purposes during the meeting is included as Attachment B.

Comments from the HMPC regarding the hazard identification, risk assessment, and capability assessment include:

Drought
- No review comments from HMPC

Wildfire
- No review comments from HMPC

Earthquake
- Underground water/sewer lines impacted by earthquakes
- Updating to IBC 2015 Residential Building Codes
- Bldg Code design Class C1 for earthquakes, may be dropped
- No strapping of water heaters required
- Insurance Companies have required/reimbursed key buildings for installation of shutoff valves for natural gas

Floods
- Stormwater Master Plan is dated 2007/2008
- CSO updates in progress under consent decree
- BCEGS is under update with the State

Dam Failure
- Currently, communities do not have the mapped dam inundation areas.

Levee Failure
- All USACE levees are certified.
- Private levees are an additional risk.

Emerald Ash Borer
- Trees in Vanderburgh County have become infected.
- Adopt-a-Tree program allows citizens to adopt an ash tree and assist with payment for treatment: http://www.evansvillegov.org/index.aspx?page=517
- No ash trees planted since 2003
West Nile Virus
- Update probability to occasional. In 2012, there were 11 cases.
- Zika is not a concern.
- Capabilities include pesticide program and surveillance.

Mine Subsidence
- No zoning ordinances related to underground mines.

Extreme Temperatures
- Red Cross no longer using heating/cooling shelters.
  - In summer, malls are air conditioned locations; Homeless shelters.
- Red Cross opens shelters during a hazard event/power failures.

Severe Thunderstorms
- No underground utility requirements.
- Vanderburgh County is a StormReady community.

Tornado
- No review comments from HMPC

Severe Winter Storm
- No review comments from HMPC

Review Existing Mitigation Actions

The existing mitigation actions were reviewed by the HMPC. Status updates are provided in the table below:

<table>
<thead>
<tr>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Develop and conduct a multi-hazard, seasonal Public Awareness</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Program that provides citizens and businesses with accurate</td>
<td></td>
</tr>
<tr>
<td>information describing the risk and vulnerability to natural hazards,</td>
<td></td>
</tr>
<tr>
<td>and is implemented on an annual basis.</td>
<td></td>
</tr>
<tr>
<td>2. Develop dedicated website page for multi-hazard mitigation</td>
<td>Ongoing</td>
</tr>
<tr>
<td>information.</td>
<td></td>
</tr>
<tr>
<td>3. Purchase and install stream gages to provide flood warning</td>
<td>Ongoing – Seeking Grant</td>
</tr>
<tr>
<td>capabilities.</td>
<td>Funding</td>
</tr>
<tr>
<td>4. Explore partnerships to provide retrofitting classes for</td>
<td>Ongoing</td>
</tr>
<tr>
<td>homeowners, renters, building professionals, and contractors.</td>
<td></td>
</tr>
<tr>
<td>5. Incorporate the hazard identification, risk assessment, and</td>
<td>Completed</td>
</tr>
<tr>
<td>mitigation strategies into the 2011 – 2035 Comprehensive Plan for</td>
<td></td>
</tr>
<tr>
<td>Evansville and Vanderburgh County.</td>
<td></td>
</tr>
<tr>
<td>Action</td>
<td>Status</td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>6. Develop County-Wide Stormwater Master Plan to provide relief from run-off and flooding resulting from rainfall events.</td>
<td>Keep, update for 2017 Plan</td>
</tr>
<tr>
<td>7. Based on existing City Stormwater Master Plan, develop formalized policies (level-of-service and extent-of-service) for maintenance of the storm water drainage system.</td>
<td>Keep, update for 2017 Plan</td>
</tr>
<tr>
<td>8. Update repetitive loss areas adjacent to the repetitive loss properties as new claim information is reported.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>9. Develop a property acquisition plan and associated policies to acquire prioritized properties in the repetitive loss areas.</td>
<td>Completed</td>
</tr>
<tr>
<td>10. Coordinate City of Evansville design requirements for Detention/Retention Ponds with requirements of Vanderburgh County.</td>
<td>Completed</td>
</tr>
<tr>
<td>11. Encourage purchase of earthquake hazard insurance throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Ongoing in coordination with Public Awareness Program</td>
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<tr>
<td>12. Purchase and distribute NOAA weather radios throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>13. Identify electronic notification services for weather information and provide information to public.</td>
<td>Removed</td>
</tr>
<tr>
<td>14. Expand warning siren coverage into new areas as development and housing expand.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>15. Continue efforts to train local contractors and property owners in tree trimming practices.</td>
<td>Ongoing – requirement for licensing program</td>
</tr>
<tr>
<td>16. Continue coordination to select locations for tornado safe rooms. Potential sites are located throughout Vanderburgh County, including the City of Evansville, the Town of Darmstadt, and Red Cross, private and public sector.</td>
<td>Completed</td>
</tr>
<tr>
<td>17. Pursue alternative funding sources for structural retrofits to critical facilities.</td>
<td>Ongoing</td>
</tr>
<tr>
<td>Action</td>
<td>Status</td>
</tr>
<tr>
<td>-----------------------------------------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>18. Investigate financial incentives for property owners to make seismic retrofits to existing buildings, particularly un-reinforced masonry structures, located within the earthquake hazard area. Pursue alternative funding sources for structural retrofits for critical facilities.</td>
<td>Ongoing in coordination with Public Awareness Program</td>
</tr>
<tr>
<td>20. Coordinate annual meetings of the Vanderburgh County Multi Hazard Mitigation Planning Committee to monitor, evaluate, and update the multi-hazard mitigation plan.</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

**Develop Mitigation Actions**

Mitigation actions are developed to reduce losses before a disaster occurs. Mitigation actions have long-term and cumulative benefits. Some mitigation actions are identified and prioritized because they are low cost or readily implemented. Other mitigation actions may be dependent on funding or are best implemented following a disaster.

The following new mitigation actions were identified during the brainstorming session:

1. Prepare CRS-compliant Program for Public Information (PPI) to revise and replace current public awareness campaign.
2. Coordinate with Vanderburgh County Surveyor to utilize “Section Line Grid” to address and prioritize disaster response and recovery activities.
3. Develop public damage reporting app/website to obtain information from the public during hazard events.
4. Develop safe refuge mapping for County.
5. Coordinate emergency management drills with other agencies and industries in the community.
6. As a public outreach project of the existing public awareness campaign, provide information on living “off the grid” for 3 days (“jump kit”) during hazard events.
7. Add notification/subscription capabilities to Vanderburgh County Emergency Management/Hazard Mitigation website.
8. Coordinate with Utilities (Vectran) regarding trees/limbs in streets following hazard event.
9. In coordination with the American Red Cross, identify shelter locations with capabilities/infrastructure for large capacity and generator hook-up.
10. Participate in multi-county and multi-agency planning for large special events.
11. Retrofit critical facilities to accept alternative energy sources, i.e. solar.
12. Review current fire station resilience capabilities to serve as “oasis” during mass/expanded incidents.
13. Locate and encourage closure of unused private wells.
14. Encourage new housing developments to use underground utilities.
15. Develop depth grids in coordination with FIRM updates to address roadway access and critical facilities during a flood event.
16. Develop interactive flood inundation mapping for the County in coordination with FIRM updates.
17. Pursue creek and stream clearing projects and funding.
18. Pursue and document CRS activities with ultimate goal of improving CRS class rating.
19. Provide equipment and training for confined space entry to perform routine inspections of large diameter storm sewers.
20. Establish maximum runoff criteria for areas proposed for development.
22. Obtain funding to remove poorly maintained dams.
23. Talk with local nurseries to discourage sales of ash trees in private sector.
24. Work with SWIMGA to develop a surveillance program with private residences with ash trees.
25. Identify potential alternatives for east/west arterial transportation to assist with evacuation during a large hazard event.
26. Define process for establishing a burn ban within Vanderburgh County.
27. Obtain dam inundation mapping for future vulnerability analysis; development regulation; and development of dam failure warning and evacuation and critical facilities planning.

**Prioritization of Mitigation Actions**

To prioritize the mitigation actions, each participating HMPC member is asked to evaluate the actions using a simple cost/benefit analysis (Table 1). Presented as a web-based survey, HMPC members will rate each mitigation action for both benefit (low, medium, or high) and funding impact (easy, potential, or difficult). A weighted score will then applied to the total number of votes within each cost/benefit category for a total priority score.

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Definition</th>
<th>Weighted Value</th>
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</thead>
<tbody>
<tr>
<td>Low</td>
<td>Difficult to assess benefits of this action; long-term time-frame for implementation</td>
<td>1</td>
</tr>
<tr>
<td>Medium</td>
<td>Long-term impact on reduction of losses is anticipated; implementation within 5 years</td>
<td>2</td>
</tr>
<tr>
<td>High</td>
<td>Meaningful impact on reduction of losses; implementation within 5 years is important</td>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cost</th>
<th>Definition</th>
<th>Weighted Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to Fund</td>
<td>Funding sources not secured; grant funding will be needed</td>
<td>1</td>
</tr>
<tr>
<td>Potential to Fund</td>
<td>Funding requires budgeting over multiple years; grant funding potential</td>
<td>2</td>
</tr>
<tr>
<td>Easily Funded</td>
<td>Funds to implement action are available in existing budget</td>
<td>3</td>
</tr>
</tbody>
</table>

The web-based survey is available here:

[https://www.surveymonkey.com/r/Vanderburgh_Action_Items](https://www.surveymonkey.com/r/Vanderburgh_Action_Items)
Figure 2. Image of Web-based Survey

Vanderburgh County - Mitigation Actions

Prioritization of Mitigation Actions

At the last mitigation planning meeting, multiple NEW mitigation actions were identified to reduce the impacts of the natural hazards identified in our risk assessment. The next step is to prioritize the mitigation actions for implementation. We ask for your input to prioritize the mitigation actions using a benefit/cost analysis. Please rank each mitigation action based upon BOTH benefit (low/medium/high) and funding impact (low/medium/high).

1. Prepare CRS-compliant Program for Public Information (PPI) to revise and replace current public awareness campaign.

   - **LOW BENEFIT**: Difficult to assess benefits of this action; long-term time-frame for implementation
   - **MEDIUM BENEFIT**: Long-term impact on reduction of losses is anticipated; implementation within 5 years
   - **HIGH BENEFIT**: Meaningful impact on reduction of losses; implementation within 5 years is important

   - **LOW COST**: Easily Funded Funds to implement action are available in existing budget
   - **MEDIUM COST**: Potential to Fund: Funding requires budgeting over multiple years; grant funding potential
   - **HIGH COST**: Difficult to Fund: Funding sources not secured; grant funding will be needed

2. Coordinate with Vanderburgh County Surveyor to utilize “Section Line Grid” to address and prioritize disaster response and recovery activities.

   - **LOW BENEFIT**: Difficult to assess benefits of this action; long-term time-frame for implementation
   - **MEDIUM BENEFIT**: Long-term impact on reduction of losses is anticipated; implementation within 5 years
   - **HIGH BENEFIT**: Meaningful impact on reduction of losses; implementation within 5 years is important

   - **LOW COST**: Easily Funded Funds to implement action are available in existing budget
   - **MEDIUM COST**: Potential to Fund: Funding requires budgeting over multiple years; grant funding potential
   - **HIGH COST**: Difficult to Fund: Funding sources not secured; grant funding will be needed

3. Develop public damage reporting app/website to obtain information from the public during hazard events.

   - **LOW BENEFIT**: Difficult to assess benefits of this action; long-term time-frame for implementation
   - **MEDIUM BENEFIT**: Long-term impact on reduction of losses is anticipated; implementation within 5 years
   - **HIGH BENEFIT**: Meaningful impact on reduction of losses; implementation within 5 years is important

   - **LOW COST**: Easily Funded Funds to implement action are available in existing budget
   - **MEDIUM COST**: Potential to Fund: Funding requires budgeting over multiple years; grant funding potential
   - **HIGH COST**: Difficult to Fund: Funding sources not secured; grant funding will be needed
Planning for Public Involvement

Public Involvement efforts following the HMPC Meeting #3 will include an Open House event on July 12th. The Open House Event will allow the public the opportunity to review the proposed mitigation actions, vote on priority actions, and provide input on additional mitigation actions.

The draft plan will also be available for public comment and review. The draft plan will be posted to the Vanderburgh County website as well as hard copies distributed within the community.

Next Steps

- HMPC will complete the Mitigation Action Survey for prioritization of mitigation actions by **Monday, July 31st**.
- Alicia Schoening will provide Chapters 1 through 5 as draft documents for the HMPC for review and comment on **Monday, August 7th**.
- HMPC will provide comments on the draft document by **Friday, August 18th**.
- Alicia Schoening will incorporate final comments from the HMPC on mitigation actions and the plan document.
- Once incorporated, a full plan document will be posted to the Evansville-Vanderburgh County website for review and comment by the public.
- With final comments from the public incorporated, a full plan document will be submitted to Indiana DHS for review prior to submittal to FEMA.
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Email</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
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<tr>
<td>Shawn L. Bennett</td>
<td>Chief Economist</td>
<td>812-434-1234</td>
<td>-</td>
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<tr>
<td>Jacob Strickler</td>
<td>Division Manager</td>
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<tr>
<td>Lisa Hedges</td>
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</tr>
<tr>
<td>Chris Miller</td>
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<tr>
<td>Mike Brown</td>
<td>Engineer</td>
<td>812-434-1238</td>
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*Evanially, Vanderburgh County, Indiana*
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Department</th>
<th>Phone</th>
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<tbody>
<tr>
<td>Cliff Meyer</td>
<td>EMR Administrator</td>
<td>Allen Mountains Water (435-5773)</td>
<td>456-7890</td>
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<tr>
<td>Valerie Haag</td>
<td>Environmental Engineer</td>
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<tr>
<td>John Hambino</td>
<td>Archaeologist</td>
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**Sign-In Sheet – June 27, 2017**

Multi-Hazard Mitigation Plan
Evanseville-Cumberland County, Indiana
### Why Mitigation Planning?
- Many events are predictable and repetitive
- Loss reduction activities work!
  - Cost effective
  - Environmentally sound
  - Funding available
- Disaster Mitigation Act of 2000
- Public Law 106-550, Amendment to the Stafford Act

Requires local governments to adopt a natural hazard mitigation plan to maintain eligibility for FEMA mitigation funds:
- Hazard Mitigation Grant Program
- Post-Disaster Mitigation Program
- Flood Mitigation Assistance Program

#### 10-Step Planning Process

<table>
<thead>
<tr>
<th>ORGANIZE RESOURCES</th>
<th>DEVELOP MITIGATION PLAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Plan for Public Involvement</td>
<td>7. Review Possible Activities</td>
</tr>
<tr>
<td>3. Coordinate with Other Departments and Agencies</td>
<td>8. Draft an Action Plan</td>
</tr>
<tr>
<td>ASSESS HAZARDS AND RISK</td>
<td>IMPLEMENT THE PLAN</td>
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</table>

#### 4. Identify the Hazards
- Identifies the possible hazards affecting the planning areas

<table>
<thead>
<tr>
<th>HAZARDS</th>
<th>Probability</th>
<th>Magnitude</th>
<th>Severity</th>
<th>Negligible</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>Highly Likely – near 100% chance of occurrence</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Drought
- Drier than normal conditions that result in water-related problems
- 71,927 acres (48%) used for agricultural purposes
- Depletion of water supply, increased demand
- Existing capabilities: Water conservation, ban on open burning

- Location: Extensive (50-100% of planning area)
- Previous Occurrences:
  - Severe to Extreme Drought
  - Average annual paid claims for crop insurance: $21,315
- Probability: Highly Likely – near 100% chance of occurrence
- Magnitude: Critical

- Palmer Drought Severity Index

### Timeline of Planning Process
1. Overview of Hazard Mitigation
2. Actions for Today
   - Hazard Identification and Risk Assessment Update
   - Capability Assessment and Discussion
   - Review Current Mitigation Actions
3. Next Steps
4. Identify the Hazards
5. Assess the Risks
6. Identify Hazards
7. Assess the Risks
8. Draft an Action Plan
9. Adopt the Plan
10. Implement the Plan, Evaluate Work, Revise as Needed

### Nashville, TN
Post-Disaster Mitigation Program
Previous Occurrences:
- Winter Storms Extensive 3 Highly Likely 4
- Depletion of water supply, increased demand
- Existing capabilities: Water conservation; ban on open burning
- Average Annual paid claims for crop insurance: (2001-2010) - $123,150
- Location: Extensive (50-100% of planning area)
- Previous Occurrences:
  - Severe to Extreme Drought
  - Average annual paid claims for crop insurance: $21,315
- Probability: Highly Likely – near 100% chance of occurrence
- Magnitude: Critical

### Hazard Identification and Risk Assessment Update
- Requires local governments to adopt a natural hazard mitigation plan to maintain eligibility for FEMA mitigation funds:
- Hazard Mitigation Grant Program
- Post-Disaster Mitigation Program
- Flood Mitigation Assistance Program
**Wildfire**
- Uncontrolled fire in combustible vegetation that occurs in the countryside or wilderness area.
- WUI – Interface/Intermediate Area
- Existing Capabilities: building codes, burn permits; other?
- Location: Significant - 12 percent of the total land area
- Probability: Likely, 10-100% chance
- Magnitude/Severity: Limited

**Earthquake**
- Wabash Valley Seismic Zone within the New Madrid Seismic Zone
- Only one or two earthquakes with magnitudes equal to or greater than 3.0 are expected in the SASZ per year.
- Existing Capabilities: Building codes
- Location: Extensive, 50-100% of the planning area
- Previous Occurrences: Only one or two earthquakes with magnitudes equal to or greater than 3.0 are expected in the SASZ per year.
- Probability: Likely, 10-100% chance
- Magnitude/Severity: Critical

**Floods**
- Floods are among the most frequent and costly natural disaster in terms of human hardship and economic loss.
- Flash Flooding – localized floods of great volume and short duration
- Riverine – an event when a watercourse exceeds its "bankfull" capacity and is the most common type of flood event
- Riverine floods result from precipitation over large areas.
- Urban Stormwater – land loses its ability to absorb rainfall as it is converted from fields or woodlands to roads, buildings, and parking lots.

**Earthquake**
- Wabash Valley Seismic Zone within the New Madrid Seismic Zone
- Only one or two earthquakes with magnitudes equal to or greater than 3.0 are expected in the SASZ per year.
- Existing Capabilities: Building codes
- Location: Extensive, 50-100% of the planning area
- Previous Occurrences: Only one or two earthquakes with magnitudes equal to or greater than 3.0 are expected in the SASZ per year.
- Probability: Likely, 10-100% chance
- Magnitude/Severity: Critical

**Wildfire**
- Uncontrolled fire in combustible vegetation that occurs in the countryside or wilderness area.
- WUI – Interface/Intermediate Area
- Existing Capabilities: building codes, burn permits; other?
- Location: Significant - 12 percent of the total land area
- Probability: Likely, 10-100% chance
- Magnitude/Severity: Limited

**Dam Failure**
- High Hazard Dams – 8
- Significant/Low Hazard Dams - 14
- Existing Capabilities: Emergency action plans, Inundation Mapping
- Districts have dam break inundation zoning ordinances to restrict development in inundation areas.
- Location: Significant (10 to 50% of planning area)
- Previous Occurrences: None in Vanderburgh County
- Probability: Unlikely
- Magnitude/Severity: Catastrophic
Levee Failure

- Seven sections along both the Ohio River and Pigeon Creek.
- 7% (46 feet of earth) and 4.17 feet of concrete wall. 1.96 feet of confined wall and 4.5 feet mortared masonry.
- Map shows the area of inundation and location.
- Existing capabilities: Emergency action plans, flood inundation maps.
- Do construction have review inundation zoning ordinances to restrict development in inundation areas.
- Location: Significant (10-50% of planning area)
- Previous Occurrences:
  - None in Vanderburgh County in 2004.
- Existing Capabilities: building codes; burn permits; TN Wildfire laws
- Location: Extensive - Off the 10,000 trees in public areas around Evansville - 700 are ash trees.
- Previous Documents:
  - Confirmed in Vanderburgh County. There are more statistical data available.
- Probability: Occasional, 1-10% chance
- Magnitude/Severity: Negligible

Emerald Ash Borer

- Emerald Ash Borer (EAB) is a slender, emerald green beetle that is 1/4 inch long, and responsible for the destruction of approximately 10 million ash trees in Ohio, Michigan, Indiana, Illinois, and Maryland.
- Confirmed in Indiana on April 21, 2004.
- Existing Capabilities: building codes; burn permits; TN Wildfire laws.
- Location: Extensive - Off the 10,000 trees in public areas around Evansville - 700 are ash trees.
- Previous Documents:
  - Confirmed in Vanderburgh County. There are more statistical data available.
- Probability: Occasional, 1-10% chance
- Magnitude/Severity: Negligible

West Nile Virus

- Mosquito-borne virus.
- West Nile fever, a milder form of the illness, which can include fever, headache, body aches, swollen lymph glands, or a rash.
- Severe forms of the disease include encephalitis or meningitis and other neurological syndromes, including muscle paralysis.
- Since 2003, there have been 5 human disease cases identified in Vanderburgh County.
- Existing Capabilities: Health Department
- Location: Extensive
- Previous Documents:
  - 4 cases
- Probability: Unlikely
- Magnitude/Severity: Negligible

Mine Subsidence

- Underground (deep) mining was the dominant mining technique until the 1950s when the development of large-scale excavation and transportation equipment made surface (strip) mining more efficient.
- Common factors causing or affecting mine subsidence include:
  - Tree stabilization mining.
  - Depth of the mine.
  - Geologic conditions of the mine.
- Existing Capabilities: zoning, insurance.
- Location: Limited (0.5%) <50% of the planning area.
- Probability: Unlikely.
- Magnitude/Severity: Critical

Extreme Temperatures

- Generally, the impact of extreme temperatures is minimal.
- Existing Capabilities: None
- Location: 1.0
- Probability: Unlikely
- Magnitude/Severity: Critical
Severe Thunderstorms
- Hail, damaging winds, and lightning
- Location: Extensive
- Previous Occurrences:
  - 2000-2001: 274 days had a high temperature exceeding 90°
  - 2000-2001: 48 days had a low temperature of ten degrees Fahrenheit or less.
- NCDC: 14 were extremely hot events and 8 were extreme cold events (1974-2000) - 62% chance
- Probability: Highly Likely
- Magnitude/Severity: Limited

Tornado
- Tornado: Violently rotating column of air pendant from a thunderstorm cloud that touches the ground
- Existing Capabilities: Shelters, warning systems, NOAA radios, weather announcements
- Mobile Homes - do mobile home parks have tornado safe rooms?
- Location: Extensive (50 to 100% of planning area)
- Previous Occurrences:
  - 16 to 20 93s, 14 and 8 10s per 5,700 sq. mi.
  - NCDC database, there were 10 separate tornado events in Vanderburgh County between January 1993 and December of 2010: 16 were rated F0, five were rated F1, four were rated F2, one was rated F3 and 0 were not rated.
- Probability: Highly Likely
- Magnitude/Severity: Critical

Severe Winter Storm
- Winter precipitation includes freezing rain, sleet, and snow (frosts, snowfalls, blizzards)
- Property damage, power, phone outages, and closures of streets, highways, schools, businesses, and nonessential government operations
- Existing capabilities: Building codes, snow removal
- Location: Extensive (50 to 100% of planning area)
- Previous Occurrences:
  - 1) Presidential/State Declarations: 2 Emergency Declarations
  - NCDC: 38 significant recorded winter storms events in Vanderburgh County resulting in an average of 2 significant winter storms per year.
- Probability: Highly Likely
- Magnitude/Severity: Critical

5. Assess the Risk
- Inventory residential & commercial structures
- Inventory critical facilities
- Determine & value of structures
- Determine # of people in area
- Identify vulnerable infrastructure
- Identify development trends and constraints
- Identify cultural, natural, and historic resource areas
- Estimate the losses
5. Assess the Risk

### Vulnerability and Loss Estimation Method

- **Drought**
  - Impacted area
  - Population
- **Flash Flooding**
  - Impact area
  - Population
- **Earthquake**
  - Impact area
  - Population
- **Severe Thunderstorms**
  - Impact area
  - Population
- **Tornado / Winter Storm**
  - Impact area
  - Population
- **Wildfire**
  - Impact area
  - Population

### Risk Mitigation Actions

- **Add as mitigation action**

### Risk Assessment Methodology

- **Vulnerability**
  - Economic data
  - Social data
  - Physical data
- **Loss Estimation Method**
  - Economic data
  - Social data
  - Physical data

### Risk Assessment

- **Earthquake**
- **Tornado / Winter Storm**
- **Wildfire**
- **Drought**
- **Flood**
- **Severe Thunderstorms**

### Vulnerability and Loss Estimation

- **Population Estimate**
  - Estimated Affected Population
  - Affected Population
  - Population

### Risk Assessment Highlights

- The majority of past disaster declarations, as well as past damages, have been related to severe thunderstorms, tornadoes, flooding and winter storms.
- Emergency Action Plans are required for all high-risk zones. In addition, mapping and digital format aid in assessing the County’s projected population and vulnerability risks.
- Vanderburgh County is a region of Indiana that experienced severe and extreme drought to 14.9 percent of the total during a 100-year period.
- Vanderburgh County may be subject to earthquakes because of the proximity to the New Madrid and the Midwest Valley seismic zones. A major seismic and tsunami event is a priority for the HAC.
- More vulnerable areas are anticipated throughout the County.
- Warning sirens capability covering much of the population in the County.
Risk Assessment Highlights

- People, facilities, and infrastructure located within the floodplains in Vanderburgh County are susceptible to flood impacts.
- Areas with poor drainage (e.g., neighborhoods or communities that lack adequate storm drainage management) are particularly vulnerable to the short-term effects of fast flooding.
- Flooding, and particularly flood-related traffic accidents, has caused traffic accidents and congestion that has resulted in short-term impacts on the transportation infrastructure.
- Responders are often at risk during flood events as they respond to calls for assistance. Their risks can range from illnesses due to exposure to flammable or toxic materials to performing dangerous rescue missions for stranded citizens. Most responders, however, are not at a great health and safety risk from flooding events.
- Flooding is usually the result of fast moving, severe storm systems and often includes other hazards including tornadoes, lightning, straight-line winds and hail. The impact from these related hazards will compound the response and recovery issues related directly to flooding.
- There are 63 unmitigated repetitive loss structures within Vanderburgh County.

Sensitive natural areas and species primarily occur along streams and drainages.

Winter weather events create problems with water lines, snow loads on roofs, and vehicle safety.

### Mitigation Strategy

#### 6. Set Planning Goals

- Enhance Public Education campaign efforts to raise awareness of and preparedness for hazards posing significant risk to Evansville and Vanderburgh County.
- Reduce exposure to hazard-related losses, before and after disaster strikes.
- Reduce vulnerability to hazard-related losses, before and after disaster strikes.
- Utilize a hazardous materials management strategy that minimizes the potential for hazardous materials to cause damage.
- Mitigate the potential for hazardous materials to cause damage.
- Increase the local floodplain management activities and participation in the NFIP.
- Protect community historic/cultural/environmental resources from identified natural hazards.

#### 7. Review Possible Mitigation Action

- **Alter**
- **Avert**
- **Adapt**
- **Avoid**

### Mitigation Action Alternatives

**Alter the Hazard**

- Drainage issues or flood management to reduce water on streets and crawls
- "Seeding" stormwater to increase rain runoff

**Avert the Hazard**

- Dams and levees
- Floodwalls
- Ditch bays
- Drainage improvements
- Channels and culverts
- Fire breaks

**Adapt to the Hazard**

- Building codes
- Construction standards
- Zoning and landuse
- Design standards
- Monitoring and Warning systems
- Safe rooms
Mitigation Action Alternatives

**Avoid the Hazard**
- Acquisition
- Relocation
- Open space
- Land-use
- Natural resource protection

**Categories of Mitigation Actions**
- Prevention
- Property protection
- Natural resource protection
- Emergency services
- Structural projects
- Public information
- Multi-hazard measures and considerations

**Existing Mitigation Actions**
- Update repetitive loss areas adjacent to the repetitive loss properties as new claim information is reported.
- Develop property acquisition plan and associated policies to acquire prioritized properties in the repetitive loss areas.
- Coordinate City of Evansville design requirements for detention/water retention funds with requirements of Vanderburgh County.
- Encourage purchase of earthquake hazard insurance throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.
- Purchase and distribute NOAA weather radios throughout Vanderburgh County, including the City of Evansville and the Town of Darmstadt.
- Specify electronic notification services for weather information and provide information to public.
- Expand warning area coverage into new areas as development and housing expand.

**Suggested Mitigation Actions**
- Obtain dam inundation mapping for high hazard dams.
- Coordinate Hazard Risk Assessments with other agencies, i.e., Health Department.
- Develop countywide drought management plan.
- Coordinate with highway department to identify and inspect critical bridge infrastructure.
- Continue to conduct multi-hazard public education program and outreach brochures.
- Monitor implementation of existing mitigation in the disaster recovery process utilizing hazard mitigation funding available under Section 406 (Public Assistance) of the Stafford Act.

**Existing Mitigation Actions**
- Continue efforts to test local contractors and property owners in time training practices.
- Continue coordination to select locations for tornado safe rooms. Repetition areas are located throughout Vanderburgh County, including the City of Evansville, the Town of Darmstadt, and Evansville, private and public sector.
- Pursue alternative funding sources for structural retrofit to critical facilities.
- Investigate financial incentives for property owners to make seismic retrofit to existing buildings, particularly unseismically-braced masonry structures, located within the earthquake hazard area. Pursue alternative funding sources for structural retrofit to critical facilities.
- Distribute National Flood Insurance Program information.
- Coordinate annual meetings of the Vanderburgh County Multi-Hazard Mitigation Planning Committee to monitor, evaluate, and update the multi-hazard mitigation plan.

**Brainstorming New Actions**
- Review handouts with Mitigation Actions by Category and hazard risk.
- What actions should be included in the Plan?
- Write your ideas down on 3 x 5 cards.
- Locate the lead agency and any supporting agencies.

**DMA Action Requirements**
- DMA must have at least one action for every hazard.
- Plan may include new mitigation actions, such as actions that are emergency response or operational preparedness in nature. These will not be accepted as hazard mitigation actions, but rather will DMA require these to be included in the Plan to support operations.
- Actions must be prioritized.
- Actions must have detail on implementation and administration.
- Actions must address existing and future development.

**Suggested Mitigation Actions**
- Obtain dam inundation mapping for high hazard dams.
- Coordinate Hazard Risk Assessments with other agencies, i.e., Health Department.
- Develop countywide drought management plan.
- Coordinate with highway department to identify and inspect critical bridge infrastructure.
- Continue to conduct multi-hazard public education program and outreach brochures.
- Monitor implementation of existing mitigation in the disaster recovery process utilizing hazard mitigation funding available under Section 406 (Public Assistance) of the Stafford Act.

*** Brainstorming Session ***
2. Plan for Public Involvement

- **ENGAGE**
  - Include on HMPC
  - Host Public Input Meetings

- **INFORM**
  - Post Data on Websites
  - Informational Items
  - Introduction of Planning
  - On-line Questionnaire
  - Opportunity to review draft document

- **OTHER OUTREACH IDEAS?**

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**Timeline for Planning Process**

- **Risk Assessment and Mitigation Action Meeting**
  - June 27, 2017
  - Public Open House
  - Following June 27th: to allow for public input on mitigation actions

- **HMPC Review Period for Draft Plan**
  - 2 week period

- **Public Review Period for Draft Plan**
  - 2 week period

- **Submit Plan to State/FEMA**

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**Next Steps**

- **Public Outreach and Data Collection**
  - Risk Public Involvement Plan
  - Questionnaire for public input
  - Letters to other stakeholders
  - Coordinate with GIS staffing for digital data/Risk Assessment
  - Set meetings with County Departments for Capability Assessment
  - Review Mitigation Plan Document

- **Contact ANYTIME with questions or concerns**

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**Contact Information**

- Alicia Renoufing
  - renoufing@jflamm.com
  - 240-321-6090

- Cindy Pepe
  - cpepe@jflamm.com
  - 240-321-6090

- Website
  - jflamm.com
Evansville-Vanderburgh County is beginning the process to update the Multi-Hazard Mitigation Plan to better protect the people and property of Evansville-Vanderburgh County from the effects of natural hazard events and to obtain eligibility for mitigation funding from the Federal Emergency Management Agency (FEMA).

What Is a Hazard Mitigation Plan?
A hazard mitigation plan is the result of a planning process to determine how to reduce or eliminate the loss of life and property damage resulting from hazards. This plan will address a comprehensive list of natural hazards – ranging from flooding and earthquakes to tornadoes, and severe winter weather. The plan will assess the likely impacts of these hazards to Evansville-Vanderburgh County. This planning process is structured around four phases: Phase 1: Organize Resources, Phase 2: Assess Risks, Phase 3: Develop a Mitigation Plan, and Phase 4: Implement the Plan and Monitor Progress. These four phases are further broken down into 10 steps, shown in the box above.

Why is it Important to Me?
It is important for citizens to become involved in mitigation planning in their community. The planning team needs your input on the types of hazards that are your priority concern. Your opinion on ways to prevent or lessen the impacts of hazards is also valuable input for the planning team.

What Can I do to Participate?
► Please visit the County’s website where you will find information on the current Multi-Hazard Mitigation Plan and information about upcoming events and planning meetings: [http://www.evansvillegov.org/index.aspx?page=2547](http://www.evansvillegov.org/index.aspx?page=2547)
► The planning team would like your input on a public survey. This survey captures public opinion on the hazards that are the most significant to you as well as the types of activities that you think will help prevent or reduce losses: [http://www.evansvillegov.org/index.aspx?page=2547](http://www.evansvillegov.org/index.aspx?page=2547)

Planning Status
The planning team is currently working within Phase 1: Organize Resources. On May 31, 2017, the planning team will participate in a kick-off meeting to organize the planning effort, plan for public involvement opportunities and initiate coordination with other departments and agencies.

Implementation of the Plan is the Ultimate Goal!
The ultimate goal of this planning process is implementation of mitigation actions that will prevent or lessen the impacts of hazards to people and property in your community. An example is the elevation of structures that repeatedly flood, reducing structural damage in the event of future flooding.
Evansville-Vanderburgh County, Indiana, is beginning the process to update the Multi-Hazard Mitigation Plan to better protect the people and property of Evansville-Vanderburgh County from the effects of natural hazard events. The following websites provide information on the existing mitigation plan and the current planning process to update the plan:


As a part of the planning process, Evansville-Vanderburgh County would like your input to better understand hazard concerns and preparedness. Please complete the following questionnaire and return the hardcopy or complete an online survey here:

- [https://www.surveymonkey.com/r/Vanderburgh_LHMP](https://www.surveymonkey.com/r/Vanderburgh_LHMP)

**BACKGROUND INFORMATION**

1. Where do you live in Vanderburgh County? Please select your Township:
   - □ Armstrong  □ German  □ Perry  □ Scott
   - □ Center  □ Knight  □ Pigeon  □ Union

**HAZARD IDENTIFICATION**

3. Have you ever experienced or been impacted by a disaster?
   - □ Yes  □ No

4. How concerned are you about the possibility of being impacted by a disaster?
   - □ Extremely concerned  □ Somewhat concerned  □ Not concerned

5. What natural hazards do you feel pose a threat to Evansville-Vanderburgh County? Please check all that apply.
   - □ Dam Failure  □ Flood  □ Severe Weather - Extreme Temperatures
   - □ Drought  □ Levee Failure  □ Severe Weather – Thunderstorms/High Winds
   - □ Earthquake  □ Mine Subsidence  □ Severe Weather Tornadoes
   - □ Infestation – West Nile  □ Wildfire  □ Severe Weather – Winter Storms
   - □ Infestation – Emerald Ash Borer

6. Is there another hazard, not listed above, that you think is a wide-scale threat to Vanderburgh County? Please explain:
MITIGATION ACTIONS
7. What types of mitigation actions should have the highest priority for Evansville-Vanderburgh County?
   - Increase hazard education and risk awareness
   - Inform citizens of ways they can reduce the damage caused by hazard events
   - Retrofit/strengthen essential public facilities such as police, fire/emergency.
   - Improve utilities resilience (electric, communications, water/wastewater facilities).
   - Purchase and install stream gages and water table gages to provide flood warning capabilities.
   - Continued participation in the National Flood Insurance Program
   - Target FEMA’s Repetitive Loss Properties and critical facilities located in the floodplain for mitigation Projects
   - Develop County-Wide Stormwater Master Plan
   - Develop a property acquisition plan to acquire prioritized properties in the repetitive loss areas.
   - Coordinate design requirements for Detention/Retention Ponds
   - Encourage purchase of earthquake hazard insurance
   - Identify electronic notification services for weather information and provide information to public.
   - Expand warning siren coverage into new areas as development and housing expand.
   - Continue coordination to select locations for tornado safe rooms.

8. Are there other mitigation actions Evansville-Vanderburgh County should consider for reducing future losses caused by natural or man-made hazards? Please explain:

PREPAREDNESS
9. How prepared do you feel for a hazard event?
   - Not at all prepared
   - Somewhat prepared
   - Prepared
   - Very prepared

11. What is the best way for you to receive information about hazard events? Please check all that apply.
   - Television News/Advertisements
   - Radio News/Advertisements
   - Print Media – newspaper, telephone book, informational brochures
   - Public Forums/Workshops
   - Public Library
   - Evansville-Vanderburgh County Website
   - Evansville-Vanderburgh County Social Media – Facebook, Twitter
   - Email messages
   - Text Messages

FUTURE UPDATES
12. If you would like to receive any additional information on the hazard mitigation planning process, please provide your email address:

THANK YOU FOR YOUR PARTICIPATION!
Vanderburgh County
2017 Local Multi-Hazard Mitigation Plan Update

Public Questionnaire

Evansville-Vanderburgh County is updating its Multi-Hazard Mitigation Plan to better protect the people and property of Evansville-Vanderburgh County from the effects of natural hazard events. The Multi-Hazard Mitigation Plan will be the result of a planning process which identifies policies and actions that can be implemented over the long term to reduce the risk and future losses resulting from hazard events. In addition, a FEMA-approved hazard mitigation plan is a condition for the City of Evansville, the Town of Darmstadt, and Vanderburgh County to receive certain types of non-emergency disaster assistance, including funding for mitigation projects.

It is important for citizens to become involved in mitigation planning in their community. The Vanderburgh County Hazard Mitigation Planning Committee requests your participation in this short 10-question survey. The Committee would like your input on the types of hazards that are your priority concern, as well as your opinion on ways to prevent or lessen the impacts of hazards.

Thank you for your participation!

1. Where do you live in Vanderburgh County? Please select your Township:
   - [ ]

2. Have you ever experienced or been impacted by a disaster?
   - Yes [ ]
   - No [ ]
Q1 Where do you live in Vanderburgh County? Please select your Township:

Answered: 25    Skipped: 1

**ANSWER CHOICES** | **RESPONSES**
---|---
Armstrong | 0.00%    0
Center | 36.00%    9
German | 4.00%    1
Knight | 28.00%    7
Perry | 8.00%    2
Pigeon | 4.00%    1
Scott | 20.00%    5
Union | 0.00%    0
TOTAL |    25
Q2 Have you ever experienced or been impacted by a disaster?

Answered: 26   Skipped: 0

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<th>WEIGHTED AVERAGE</th>
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<td>57.69%</td>
<td>42.31%</td>
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<td>1.42</td>
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<td></td>
<td>15</td>
<td>11</td>
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Vanderburgh County 2017 Local Multi-Hazard Mitigation Plan Update
SurveyMonkey
Q3 How concerned are you about the possibility of being impacted by a disaster?

Answered: 26  Skipped: 0

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<th>SOMEWHAT CONCERNED</th>
<th>EXTREMELY CONCERNED</th>
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<th>WEIGHTED AVERAGE</th>
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<td>46.15%</td>
<td>50.00%</td>
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1 12 13
Q4 What natural hazards do you feel pose a threat to Vanderburgh County? Please check all that apply:

Answered: 25  Skipped: 1

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<tr>
<th>Hazard</th>
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<th>Responses</th>
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<tbody>
<tr>
<td>Dam Failure</td>
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<tr>
<td>Drought</td>
<td>36.00%</td>
<td>9</td>
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<tr>
<td>Earthquake</td>
<td>92.00%</td>
<td>23</td>
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<tr>
<td>Infestation - West Nile</td>
<td>36.00%</td>
<td>9</td>
</tr>
<tr>
<td>Infestation - Emerald Ash...</td>
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<td></td>
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<tr>
<td>Flood</td>
<td>80.00%</td>
<td>22</td>
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<td>Levee Failure</td>
<td>30.00%</td>
<td>7</td>
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<tr>
<td>Mine Subsidence</td>
<td>28.00%</td>
<td>6</td>
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<td>Wildfire</td>
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<td>Severe Weather - Extreme...</td>
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<td>Severe Weather - Winter Storms</td>
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<td>Event</td>
<td>Percentage</td>
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<td>-----------------------------------</td>
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<td>Infestation - Emerald Ash Borer</td>
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<td>Flood</td>
<td>80.00%</td>
<td>20</td>
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<td>Levee Failure</td>
<td>36.00%</td>
<td>9</td>
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<tr>
<td>Mine Subsidence</td>
<td>32.00%</td>
<td>8</td>
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<tr>
<td>Wildfire</td>
<td>20.00%</td>
<td>5</td>
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<td>Severe Weather - Extreme Temperatures</td>
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<td>Severe Weather - Tornadoes</td>
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<td>Severe Weather - Winter Storms</td>
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<tr>
<td>Hazardous Materials Incidents</td>
<td>84.00%</td>
<td>21</td>
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</tbody>
</table>

Total Respondents: 25
Q5 Is there another hazard, not listed above, that you think is a threat to Vanderburgh County? Please explain:

Answered: 3    Skipped: 23
Q6 What types of mitigation actions do you think should be a priority for Vanderburgh County?

Answered: 25  Skipped: 1

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
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<tr>
<td>Increasing hazard education and risk awareness</td>
<td>68.00%</td>
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<tr>
<td>Informing citizens of ways they can reduce the damage caused by hazard events</td>
<td>60.00%</td>
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<tr>
<td>Retrofitting/strengthening essential public facilities such as police, fire/emergency</td>
<td>68.00%</td>
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<td>Improving resilience of utilities (electric, communications, water/wastewater facilities)</td>
<td>88.00%</td>
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<td>Purchasing and installing stream gages and water table gages to provide flood warning capabilities.</td>
<td>16.00%</td>
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<td>Continuing participation in the National Flood Insurance Program</td>
<td>36.00%</td>
</tr>
<tr>
<td>Targeting FEMA’s Repetitive Loss Properties and critical facilities located in the floodplain for mitigation Projects</td>
<td>12.00%</td>
</tr>
<tr>
<td>Developing a County-Wide Stormwater Master Plan</td>
<td>40.00%</td>
</tr>
<tr>
<td>Encouraging purchase of earthquake hazard insurance</td>
<td>8.00%</td>
</tr>
<tr>
<td>SurveyMonkey</td>
<td></td>
</tr>
<tr>
<td>--------------</td>
<td>--</td>
</tr>
<tr>
<td>Expanding warning siren coverage into new areas as development and housing expand.</td>
<td>36.00% 9</td>
</tr>
<tr>
<td>Continuing coordination to select locations for tornado safe rooms.</td>
<td>48.00% 12</td>
</tr>
<tr>
<td>Total Respondents: 25</td>
<td></td>
</tr>
</tbody>
</table>
Q7 Are there other mitigation actions Vanderburgh County should consider for reducing future losses caused by natural hazards? Please explain:

Answered: 4   Skipped: 22
Q8 How prepared do you feel for a hazard event?

Answered: 26  Skipped: 0

<table>
<thead>
<tr>
<th></th>
<th>NOT AT ALL PREPARED</th>
<th>SOMEWHAT PREPARED</th>
<th>PREPARED</th>
<th>VERY PREPARED</th>
<th>TOTAL</th>
<th>WEIGHTED AVERAGE</th>
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<td>(no label)</td>
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<td>38.46%</td>
<td>11.54%</td>
<td>26</td>
<td>2.62</td>
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<table>
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<th>0</th>
</tr>
</thead>
<tbody>
<tr>
<td>(no label)</td>
<td>0</td>
</tr>
</tbody>
</table>
Q9 What is the best way for you to receive information about hazard events? Please check all that apply:

Answered: 25  Skipped: 1

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Television News/Advertisements</td>
<td>72.00%</td>
</tr>
<tr>
<td>Radio News/Advertisements</td>
<td>60.00%</td>
</tr>
<tr>
<td>Print Media - newspapers, telephone book, informational brochures</td>
<td>8.00%</td>
</tr>
<tr>
<td>Public Forums/Workshops</td>
<td>16.00%</td>
</tr>
<tr>
<td>Public Library</td>
<td>4.00%</td>
</tr>
<tr>
<td>Evansville - Vanderburgh County Website</td>
<td>32.00%</td>
</tr>
<tr>
<td>Evansville - Vanderburgh County Social Media - Facebook, Twitter</td>
<td>60.00%</td>
</tr>
<tr>
<td>Email Messages</td>
<td>24.00%</td>
</tr>
<tr>
<td>Text Messages</td>
<td>60.00%</td>
</tr>
<tr>
<td>Total Respondents: 25</td>
<td></td>
</tr>
</tbody>
</table>
Q10 If you would like to receive additional information on the hazard mitigation planning process, please provide your contact information:

Answered: 6  Skipped: 20

<table>
<thead>
<tr>
<th>ANSWER CHOICES</th>
<th>RESPONSES</th>
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<tr>
<td>Company</td>
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</tr>
<tr>
<td>Address</td>
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</tr>
<tr>
<td>Address 2</td>
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</tr>
<tr>
<td>City/Town</td>
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<tr>
<td>State/Province</td>
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</tr>
<tr>
<td>ZIP/Postal Code</td>
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</tr>
<tr>
<td>Country</td>
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</tr>
<tr>
<td>Email Address</td>
<td>100.00%</td>
</tr>
<tr>
<td>Phone Number</td>
<td>100.00%</td>
</tr>
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</table>
Multi-Hazard Mitigation Plan Update

Evansville/ Vanderburgh County is beginning the process to update the Multi-Hazard Mitigation Plan to better protect the people and property of Evansville Vanderburgh County from the effects of natural hazard events and to obtain eligibility for mitigation funding from the Federal Emergency Management Agency (FEMA).

What is a Hazard Mitigation Plan?

A hazard mitigation plan is the result of a planning process to determine how to reduce or eliminate the loss of life and property damage resulting from hazards. This plan will address a comprehensive list of natural hazards — ranging from flooding and earthquakes to tornados and severe winter weather. The plan will assess the likely impacts of these hazards to Evansville Vanderburgh County.

This planning process is structured around four phases: Phase 1: Organize Resources, Phase 2: Assess Risks, Phase 3: Develop a Mitigation Plan, and Phase 4: Implement the Plan and Monitor Progress. These phases are further broken down into 10 steps, shown in the box above.
A multi-hazard mitigation plan is the result of a planning process to reduce the risk to life and property damage resulting from hazards. This plan will address a comprehensive list of natural hazards ranging from flooding and earthquakes to tornadoes and severe winter weather. The plan will assess the likely impacts of these hazards to Evansville-Vanderburgh County.

This planning process is structured around four phases: Phase 1: Organize Resources, Phase 2: Assess Risk, Phase 3: Develop a Mitigation Plan and Phase 4: Implement the Plan and Monitor Progress. These four phases are further broken down into 10 steps as shown in the box above.

Why is it Important to Me?
It is important for citizens to become involved in mitigation planning in their community. The planning team needs your input on the types of hazards that are your priority concern. Your opinion on ways to prevent or lessen the impacts of hazards is also valuable input for the planning team.

What Can I do to Participate?
Please visit the County’s website where you will find information on the current Multi-Hazard Mitigation Plan and information about upcoming events and planning meetings:
http://www.evansvillegov.org/index.asp?page=2547

The planning team will use your input on a public survey. This survey captures public opinion on the hazards that are the most significant to you as well as the types of activities that you think will help prevent or reduce losses:
http://www.evansvillegov.org/index.asp?page=2547

Planning Status
The planning team is currently working within Phase 1: Organize Resources. On May 31, 2017, the planning team will participate in a kick-off meeting to organize the planning effort, plan for public involvement opportunities, and initiate coordination with other departments and agencies.

We had a successful kick off meeting on May 31st with approx. 30 local stake holders in attendance. Our next meeting will occur on June 27th from 12:00 - 4:00 at the EMA Office located in the Vanderburgh County Convention Complex and will be the Risk Assessment and Mitigation Strategy.

The next meeting is a Public Meeting to review the Draft Plan and gather public input. The public meeting will be on July 12th at the Evansville Central Library Downtown at 4:30 PM in the Brown Room.

Not able to attend the meeting? Take the survey online today!

Vanderburgh County 2017 Local Multi-Hazard Mitigation Plan Update Survey

Implementation of the Plan is the Ultimate Goal
The ultimate goal of the planning process is implementation of mitigation actions that will prevent or lessen the impacts of hazards to people and property in your community. An example is the elevation of structures that regularly flood, reducing structural damage in the event of future flooding.
Multi-Hazard Mitigation Plan

The draft City of Evansville-Vanderburgh County Multi-Hazard Mitigation Plan is available for review.

Associated Documents

- Full Plan with Appendices
  - PDF
- Full Plan without Appendices
  - PDF
- Cover Page
  - PDF
- Executive Summary and Table of Contents
  - PDF
- Introduction and Planning Process
  - PDF
- Community Profile and Capabilities
  - PDF
- Risk Assessment Part 1
  - PDF
- Risk Assessment Part 2
  - PDF
- Mitigation Strategy
  - PDF
- Plan Maintenance
  - PDF
- Appendix A
  - PDF
- Appendix B
  - PDF
- Appendix C
  - PDF
- Appendix D
  - PDF
- Complete the Online Survey
  - Vanderburgh County 2017 Local Multi-Hazard Mitigation Plan Update Survey
Evansville / Vanderburgh County Emergency Management Agency
July 10

Multi-Hazard Mitigation Plan - Public Meeting
Room: Browning Event Room B - Central, Central Library
Date: Wednesday, July 12, 2017
Time: 4:30 PM to 8:00 PM

If you would like to see, and participate in the final draft of the Vanderburgh County mitigation plan please schedule some time to attend the “Public Meeting” at the Browning Room at the Main Library downtown Wednesday afternoon starting at 4:30 PM.

Evansville-Vanderburgh County is continuing the process to update the Local Multi-Hazard Mitigation Plan in accordance with the Disaster Mitigation Act of 2000. The purpose of this plan is to reduce or eliminate long-term risk to the people and property of Evansville-Vanderburgh County from the effects of hazard events and to provide eligibility for certain pre- and post-disaster funding utilized to protect communities from future disaster damages.

Multi-Hazard Mitigation Plan Public Meeting
Wednesday, July 12th THIS WEEK
Risk Assessment and Mitigation Review Meeting
Tuesday, June 27th COMPLETE
Risk Assessment and Mitigation Kickoff Meeting
Wednesday, May 31st COMPLETE
Input meeting set on local emergency mitigation plan

Evansville Published 12:45 p.m. CT July 5, 2017

The Evansville/Vanderburgh County Emergency Management Agency is updating its multi-hazard mitigation plan and is seeking public input.

The organization hopes to address the potential natural hazards before they occur to be in position to obtain eligibility for mitigation funding from the Federal Emergency Management Agency.

The plan is a cooperative effort among the Vanderburgh County, Evansville and Darmstadt.

There will be a public meeting from 5 to 5 p.m. Wednesday, July 12, in the Browning Room at the EVPL’s Central Library.
RE: Evansville-Vanderburgh County Multi-Hazard Mitigation Plan Update

Dear

Evansville-Vanderburgh County, Indiana, is updating a Multi-Hazard Mitigation Plan to better protect the people and property of Vanderburgh County from the effects of natural and man-made hazard events. The plan will be developed pursuant to the requirements of the Disaster Mitigation Act of 2000 and the implementing regulations set forth in the Federal Register (44 CFR §201.6). These regulations establish the standards for hazard mitigation plans to allow plan owners eligibility to access funds for federal disaster assistance and hazard mitigation, under the Robert T. Stafford Disaster Relief and Emergency Act. In addition, the mitigation planning process will incorporate the 10-steps of Activity 510-Floodplain Management Planning in the National Flood Insurance Program’s (NFIP) Community Rating System (CRS) Program.

The County has contracted Amec Foster Wheeler to facilitate the planning process and the Vanderburgh County Emergency Management Agency will prepare the plan document. On May 31, 2017, a kick-off meeting will be held with the Hazard Mitigation Planning Committee to organize the planning effort, prepare for public involvement in the planning process, and initiate coordination with other agencies and stakeholders.

We are reaching out to other agencies and stakeholders, such as you, to coordinate with those who may bring additional information to the planning process and associated flood/hazard issues within Vanderburgh County. Any information, studies, etc. which may supplement the work of the established Hazard Mitigation Planning Committee would be welcomed. In addition, I invite you to participate in our committee and public meetings throughout the planning process. Future meeting dates will be posted on the County’s website: http://www.evansvillegov.org/index.aspx?page=3823

As the program manager for this project I can be reached at (812) 421-6204; cweaver@vanderburghsheriff.com; or you may send information directly to my attention to the address on this letterhead.

We look forward to hearing from you and/or your participation at future committee and public meetings.

Thank you,

EMA Director
Evansville\Vanderburgh County
Emergency Management Agency
3500 N. Harlan Ave. Suite E228
Evansville, Indiana 47711
## Appendix C
### Mapping of Repetitive Loss Areas

**Repetitive Loss Worksheet Requested Updates** *(Not Mapped)*

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>S Barker Avenue</td>
<td>Roth Road</td>
</tr>
<tr>
<td>Twin Lakes Drive</td>
<td></td>
</tr>
</tbody>
</table>

**Repetitive Loss Structures** *(Not Mapped)*

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Lincoln Park Drive</td>
<td>Kremer Road</td>
</tr>
<tr>
<td>Wedking Avenue</td>
<td></td>
</tr>
<tr>
<td>Forest Avenue</td>
<td></td>
</tr>
<tr>
<td>Stevens Avenue</td>
<td></td>
</tr>
</tbody>
</table>

**Repetitive Loss Areas** *(Mapped)*

<table>
<thead>
<tr>
<th>City</th>
<th>County</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.1 Rheinhardt Avenue</td>
<td>C.9 Union Township</td>
</tr>
<tr>
<td>C.2 East Columbia Street</td>
<td>C.10 Knight Township – Ohio River (A and B)</td>
</tr>
<tr>
<td>C.3 Johnson Lane</td>
<td>C.11 Broadway Avenue</td>
</tr>
<tr>
<td>C.4 North Grand &amp; North Kentucky Avenues</td>
<td>C.12 North St Joseph Avenue</td>
</tr>
<tr>
<td>C.5 Peacock Lane</td>
<td>C.13 Old Boonville Highway (A and B)</td>
</tr>
<tr>
<td>C.6 South Bosse Avenue</td>
<td>C.14 North Green River Road</td>
</tr>
<tr>
<td>C.7 Colonial Garden Road</td>
<td>C.15 Six School Road</td>
</tr>
<tr>
<td>C.8 North First Avenue</td>
<td>C.16 Heckel Road</td>
</tr>
<tr>
<td></td>
<td>C.17 Bergdolt Road</td>
</tr>
<tr>
<td></td>
<td>C.18 Elmridge Drive</td>
</tr>
<tr>
<td></td>
<td>C.19 Voight Road</td>
</tr>
<tr>
<td></td>
<td>C.20 Warrick County Line Road</td>
</tr>
</tbody>
</table>
APPENDIX C

C.1 RHEINHARDT AVENUE
APPENDIX C

C.2 E. COLUMBIA STREET

[Image of a map showing the location of E. Columbia Street in Vanderburgh County, Indiana]
APPENDIX C
C.6 S. BOSSE AVENUE
APPENDIX C

C.7 COLONIAL GARDEN ROAD

Vanderburgh County, Indiana
Multi-Hazard Mitigation Plan
July 2018
APPENDIX C
C.8 N. FIRST AVENUE
APPENDIX C
C.10b KNIGHT TOWNSHIP 2
APPENDIX C

C.11 BROADWAY AVENUE
APPENDIX C
C.16 HECKEL ROAD
APPENDIX C

C.20 WARRICK COUNTY LINE ROAD
APPENDIX D
MITIGATION ALTERNATIVES

The following information was presented to the HMPC as a handout during in Meeting #3 to identify and prioritize mitigation actions.

Categories of Mitigation Actions

FEMA’s publication *Developing the Mitigation Plan* emphasizes the following six categories of mitigation activities and examples:

1. **Prevention:** Administrative or regulatory actions/processes that influence the way land and buildings are developed and built.
   - Building codes and enforcement
   - Floodplain development regulations
   - Open space preservation
   - Stormwater management regulations

2. **Property Protection:** Actions that involve the modification of existing buildings or structures to protect them from a hazard or removal from the hazard area.
   - Acquisition of hazard prone structures
   - Construction of barriers around structures
   - Elevation of structures
   - Relocation out of hazard areas

3. **Public Education and Awareness:** Actions to inform and educate citizens, elected officials, and property owners about the hazards and potential ways to mitigate them.
   - Public education and outreach programs
   - Real estate disclosure
   - Flood insurance
   - Hazard Information Centers

4. **Natural Resource Protection:** Actions that, in addition to minimizing hazard losses, also preserve or restore the functions of natural systems.
   - Best Management Practices (BMPs)
   - Forest and vegetation management
   - Hydrological Monitoring
• Urban forestry and landscape management

5. Emergency Services: Actions that protect people and property during and immediately after a disaster or hazard event. Protection of critical facilities

• Critical facilities protection
• Emergency response services
• Hazard warning systems
• Hazard threat recognition

6. Structural Projects: Actions that involve the construction of structures to reduce the impact of hazard.

• Channel maintenance
• Dam/reservoirs
• Levees/floodwalls
• Safe rooms/shelters

Not all of the mitigation actions presented to and/or discussed by the HMPC at Meeting #3 and the public open house became recommended action items. Action items may not have been considered to be cost-effective or support the community’s goals. Additionally, action items may have lacked political support, constituent support, and funding. Action items not recommended or included in the priority list are presented in Table D.1. In addition, actions items identified in the 2011 Vanderburgh County Multi-Hazard Mitigation Plan that have been completed or were not carried forward are presented in Table D.1.
### Table D.1. Alternative Mitigation Actions

<table>
<thead>
<tr>
<th>Action</th>
<th>Source</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorporate the hazard identification, risk assessment, and mitigation strategies into the 2011 – 2035 Comprehensive Plan for Evansville and Vanderburgh County.</td>
<td>2011 Vanderburgh County Multi-Hazard Mitigation Plan</td>
<td>Completed</td>
</tr>
<tr>
<td>Develop a property acquisition plan and associated policies to acquire prioritized properties in the repetitive loss areas.</td>
<td>2011 Vanderburgh County Multi-Hazard Mitigation Plan</td>
<td>Completed</td>
</tr>
<tr>
<td>Coordinate City of Evansville design requirements for Detention/Retention Ponds with requirements of Vanderburgh County.</td>
<td>2011 Vanderburgh County Multi-Hazard Mitigation Plan</td>
<td>Completed</td>
</tr>
<tr>
<td>Identify electronic notification services for weather information and provide information to public</td>
<td>2011 Vanderburgh County Multi-Hazard Mitigation Plan</td>
<td>Removed, lack of support for development of new service.</td>
</tr>
<tr>
<td>Continue coordination to select locations for tornado safe rooms. Potential sites are located throughout Vanderburgh County, including the City of Evansville, the Town of Darmstadt, and Red Cross, private and public sector</td>
<td>2011 Vanderburgh County Multi-Hazard Mitigation Plan</td>
<td>Completed</td>
</tr>
</tbody>
</table>