MULTI HAZARD MITIGATION PLAN
TIPPECANOE COUNTY, INDIANA

2006

AREA PLAN COMMISSION OF TIPPECANOE COUNTY

IN COOPERATION WITH THE TIPPECANOE COUNTY EMERGENCY MANAGEMENT AGENCY AND CHRISTOPHER B. BURKE ENGINEERING, LTD.

THE AREA PLAN COMMISSION OF TIPPECANOE COUNTY

This plan was prepared for Tippecanoe County, its member jurisdictions and Shadeland by Area Plan Commission of Tippecanoe County staff led by Executive Director Sallie Fahey and Planner Krista Trout-Edwards, CFM, with assistance and cooperation from the Tippecanoe County Emergency Management Agency, the Planning Committee and Christopher B. Burke Engineering Staff: Siavash E. Beik PE, CFM; Sheila McKinley AICP, CFM and Zach Bishton. The Area Plan Commission extends a special thank you to members of the public who participated in the disaster survey and public meeting.

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Unincorporated Tippecanoe County
__ October 2006, Resolution #2006-

City of Lafayette
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City of West Lafayette
__ October 2006, Resolution #2006-

Town of Battle Ground
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Town of Dayton
__ October 2006, Resolution #2006-

Town of Clarks Hill
__ October 2006, Resolution #2006-

Shadeland
__ October 2006, Resolution #2006-

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EXECUTIVE SUMMARY OF THE MULTI- HAZARD MITIGATION PLAN 2006

The Multi-Hazard Mitigation Plan (MHMP) is a requirement of the federal Disaster Mitigation Act of 2000 and has been adopted by the Area Plan Commission and its member jurisdictions as an amendment to the *Comprehensive Plan for Tippecanoe County*. Additionally, the plan includes the Town of Shadeland and was adopted by its town council. This is the first plan of its type for Tippecanoe County. It addresses natural and manmade hazards and provides mitigation goals for each hazard.

METHODOLOGY

The Planning Committee, created to assist the planning process and decision-making, established the methodology used, determined which hazards should be studied, and decided what information would be needed to create long range mitigation goals. In the beginning stages of the process, the committee took a comprehensive look at the community; including population and development growth, road and river systems and past hazardous events. Knowledgeable contributions by Planning Committee members were supplemented by in-depth research and identification of critical facilities. This research helped the committee identify which hazards have the greatest impact on the community and the problems each hazard poses. The Planning Committee also considered and assessed current plans, programs and projects, with special regard to their mitigation value.

The plan development process provided two opportunities for public input. First, in an on-line survey, citizens identified specific disaster events, what effects those events had on their lives and property and how much damage was sustained. Second, Area Plan Commission staff and the Planning Committee held a public meeting to gather information about how these hazards affect individuals, property, and the community. All the information gathered lead to the creation of the mitigation goals and projects outlined in Chapter 5.

THE PLAN

The MHMP begins a new, on-going planning process to identify hazards, at-risk areas and facilities, and to use the information to make better decisions, on both personal and community levels. This plan represents a proactive tool to reduce personal and property damage resulting from natural and manmade events and its implementation will reduce costs to local, state and federal governments. Additionally, the plan's existence ensures a wealth of readily available information to both local government and area citizens.

Each hazard identified as a community threat was thoroughly analyzed to determine appropriate mitigation measures. The Planning Committee and staff discussion of each hazard included at least six factors: previous occurrences; the geographic locations at risk; the hazard's extent; probability of a future event; vulnerability analysis; and an analysis of development trends. The section on flooding contains additional elements based on detailed local data. Another important aspect of this plan is the thorough identification and mapping of critical facilities – facilities likely to need quick emergency response in a disaster event. That information is now easily accessible to all emergency service departments in the county's GIS.

The plan represents a joint effort by the staffs of the Area Plan Commission and the Tippecanoe County Emergency Management Agency, Christopher B. Burke Engineering, and the Planning Committee. The county's GIS department provided significant help and time to the APC staff during the critical facilities mapping phase and when working with the HAZUS program. The Plan has been reviewed by the Area Plan Commission, City of Lafayette, City of West Lafayette, Town of Battle Ground, Town of Clarks Hill, Town of Dayton, Town of Shadeland, representatives of Purdue University, and the public.

IMPLEMENTATION AND FUNDING

Adoption of this plan ensures that the communities involved will be eligible for future federal disaster assistance as well as federal buyout money. It also enables the communities to apply for a variety of grants, such as Hazard Mitigation Grants (HMG), to implement projects to reduce damages. Some projects are easier to implement than others, because the cost can be absorbed in staff time. These include ordinance amendments, database management and public education. Other projects, such as watershed studies, upgrades to the Emergency Operation Center and purchasing additional outdoor warning sirens will likely require grant money.

The Multi-Hazard Mitigation Plan provides a comprehensive assessment of how specific hazards affect the community and proposes solutions to prevent future damage caused by natural and manmade hazards. It will also be used as a tool in future planning to assist community leaders, government departments and citizens to make informed decisions regarding land use, transportation and emergency management. Annual reviews will assess implementation progress and the success of mitigation strategies. Five-year updates will keep the plan current, provide new opportunities for innovative thinking, and allow for inclusion of additional mitigation projects.

1.0 INTRODUCTION

1.1 PROJECT SCOPE AND PURPOSE

The development of a community Multi-Hazard Mitigation Plan (MHMP) is a requirement of the Federal Disaster Mitigation Act of 2000 (DMA 2000). According to DMA 2000, the purpose of mitigation planning is for State, local, and Indian tribal governments to identify the natural hazards that impact them, actions and activities to reduce losses from those hazards and to establish a plan and create a coordinated implementation process for the plan. These goals are accomplished by taking advantage of a wide range of resources.

In order for National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. This planning effort also includes two non-NFIP communities, Clarks Hill and Shadeland. Those two communities should enter the NFIP program as well as adopt established mitigation plans. The Indiana Department of Homeland Security (IDHS) and the Federal Emergency Management Agency (FEMA) Region V offices administer the MHMP program in Indiana. Historically, planning in Tippecanoe County has been accomplished by the Area Plan Commission for its participating jurisdictions; the same is true for this effort.

The Area Plan Commission of Tippecanoe County is leading this multi-jurisdictional planning effort in collaboration with the Tippecanoe County Emergency Management Agency (TEMA). The plan was prepared in partnership with Tippecanoe County, the City of Lafayette, the City of West Lafayette along with the Towns of Battle Ground, Clarks Hill, Dayton and Shadeland. Representatives from these communities attended Planning Committee meetings, provided valuable information about their communities, reviewed and commented on the draft plan and held hearings to adopt the plan. Each community had an equal opportunity for participation and representation in the planning process. The process used to develop the Tippecanoe County MHMP satisfies the requirements of DMA 2000 multi-jurisdictional plan which provides that a plan may be accepted as long as each jurisdiction has participated in the planning process. The town of Otterbein straddles the Benton and Tippecanoe County boundary and falls under the jurisdiction of Benton County and was therefore, not part of this planning process.

Development of this MHMP is the necessary first step of a multi-step process to implement programs, policies, and projects to mitigate adverse effects of hazards in Tippecanoe County. The purpose of this planning effort is to identify hazards and to what extent they affect the residents of this county as well as to determine what type of mitigation strategies or projects may be implemented for mitigating hazards. Although this MHMP process and plan meet the requirements of DMA 2000 and eligibility requirements of the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) Grant, as well as other FEMA programs including the NFIP Community Rating System (CRS), additional detailed studies need to be completed prior to applying for grants and/or programs.

Throughout this Plan, activities that could qualify for CRS points are identified with the NFIP/CRS logo. The CRS is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premium rates are discounted to reflect reduced flood risk resulting from community

actions that meet the three goals of the CRS program: (1) reduce flood losses; (2) facilitate accurate insurance ratings; and (3) promote education and awareness of flood insurance. Savings in flood insurance premiums are proportional to the points assigned to different mitigation efforts. A minimum of 500 points is necessary to enter the CRS program, which would result in a 5% flood insurance premium discount. This Plan could contribute as many as 294 points toward the participation in the CRS program. Currently, no NFIP community in Tippecanoe County participates in this program and two of our communities, Clarks Hill and Shadeland, are not NFIP members.

Funding for this program was provided by the Area Plan Commission of Tippecanoe County (APC). The Tippecanoe County Commissioners signed a contract with Christopher B. Burke Engineering, Ltd., (CBBEL) to assist APC staff by facilitating the planning process and the preparation of the Tippecanoe County MHMP.

1.2 THE PLANNING PROCESS

The planning process to prepare the Tippecanoe County MHMP began in October 2004 when the county staff, including representatives from the APC and County Commissioners' offices and the TEMA Director, began interviewing possible consulting firms to assist in the preparation of the county's Plan. The County Commissioners hired CBBEL in December 2004, to prepare the Plan for all NFIP communities located within the county as well as the non-NFIP towns of Clarks Hill and Shadeland.

In order to submit an application for buyout money within one year of the county's most recent flood event, the Tippecanoe County MHMP was put on an accelerated timeline. In March of 2005, representatives of APC staff, the County Commissioners and TEMA organized a Planning Committee that met during the months of April, May, June, July and August of 2005. In August 2005, a media release regarding the planning process, a community survey for public input and a future opportunity to comment on the draft Plan was released. A story was published in the local paper, aired on the local television station and was broadcast on WBAA, the local public radio station. WBAA broadcast the story several times over a span of a couple of weeks.

From April through August 2005, committee members, APC staff and CBBEL researched and compiled the historic hazard data necessary to prepare the Plan. In February 2006, the draft Tippecanoe County MHMP was distributed to the Planning Committee for its review and comment. Once changes were made to the draft Plan, a public meeting was held on March 2, 2006. The draft Plan was made available at this meeting, on the county's website and by providing the draft version to offices and/or elected officials in participating jurisdictions.

After public review, comments were incorporated into the draft *Plan* which was then forwarded to IDHS and FEMA for their review. Comments obtained from IDHS and FEMA were reviewed by the Planning Committee and incorporated into the *Plan* filed for adoption. Local adoption of the MHMP by Tippecanoe County, the City of Lafayette, the City of West Lafayette, the Town of Battle Ground, the Town of Clarks Hill, the Town of Dayton and the Town of Shadeland was completed in DATE TO BE ADDED (specific adoption dates can be found on the title page).

1.3 PLANNING COMMITTEE

The Tippecanoe County MHMP Planning Committee was created specifically to develop this Plan. Membership on this committee included representatives from various county offices, the City of Lafayette, the City of West Lafayette, the Town of Battle Ground, the Town of Clarks Hill, the Town of Dayton and the Town of Shadeland, all of whom have responsibility for disaster mitigation efforts in their respective jurisdictions. The Planning Committee also included representatives from emergency response agencies, including the TEMA Director and representatives from local fire, police and sheriffs' departments, as well as non-profit groups, Purdue University, public works, zoning and planning, parks and recreation, local businesses and two citizen representatives.

The Planning Committee met on April, May, June, July and August, 2005. The meetings were held at the Community Corrections Building because a handful of the members also served on the Local Emergency Planning Committee (LEPC), which generally met in the same place directly after the Planning Committee meetings.

The meetings were well attended and lasted for approximately 2 hours each. The committee discussed and made decisions on the information presented by CBBEL and committee members at each meeting. During the meetings, the committee successfully identified essential facilities and local hazards; reviewed the State's mitigation plan goals and set local mitigation goals; reviewed hazard data and maps; identified and accessed the effectiveness of existing mitigation measures; established mitigation projects; and reviewed materials for public participation. Each member present signed in at meetings in order to document participation. Meeting agendas and summaries are included in **Appendix A**. Members of the Planning Committee attended the public meeting in November 2005 and assisted with the adoption of the Tippecanoe County MHMP in each of their jurisdictions. **Table 1-1**, at the end of this chapter, is a complete list of all committee members.

Table 1-1: MHMP Planning Committee

Name	Title	Representing
Fahey, Sallie	Executive Director	Area Plan Commission of Tippecanoe County
Trout-Edwards, Krista	Planner, CFM	Area Plan Commission of Tippecanoe County
Kirby, Mark	TEMA Director	TEMA, LEPC
Shedd, Ruth	Commissioner	Tippecanoe County, LEPC
Chapman, Christine	Grant Coordinator	Tippecanoe County Commissioner's Office
Hasan, Khalid	GIS Administrator	Tippecanoe County MITS
Highland, Ron	Building Commissioner	Tippecanoe County Building Commission
Cripe, Ron	Health Department Administrator	Tippecanoe County Health Department
Opal Kuhl	Executive Director	Tippecanoe County Highway Department

Table 1-1: MHMP Planning Committee		
Name	**Title**	**Representing**
Murray, Steve	Surveyor	Tippecanoe County Surveyor's Office
Brown, Tracy	Sheriff's Department	Tippecanoe County Sheriff's Department
Downey, David	Public Works Director	City of West Lafayette
Leroux, Chris	Police Officer	City of West Lafayette
Grenard, Jeromy	Assistant City Engineer	City of West Lafayette
Blann, Michael	Haz-Mat Officer	City of Lafayette
Heide, Joni	Director of Operations	City of Lafayette Parks Department
Danaher, Larry	Safety & Security Coordinator	City of Lafayette Parks Department
Peterson, Frank	Planner / Project Manager	City of Lafayette
Carol Shelby	Senior Dir. Of Environmental Health and Safety	Purdue University, LEPC
Mike Piggot	Director of Community Relations & Visitor Relations	Purdue Community Relations & Chamber of Commerce
Worthington, Butch	Director of Public Works	Town of Battle Ground
Bowman, Robert	Town Council Member	Town of Dayton
Bell, Tracy	Clerk-Treasurer	Town of Clarks Hill
Dowell, Dan	Fire Department and Town Council Member	Shadeland
Axley, Melissa	Emergency Services Director	American Red Cross
Miller, Nathan	Team Leader Security & ER	Eli Lilly
Hill, Abbey	Representative	American Suburban Utilities
Hoovler, Charlie	Volunteer - FP resident	Local Resident
Pettry, Rick	Volunteer – River watcher	Local Resident

1.4 PUBLIC INVOLVEMENT IN THE PLANNING PROCESS

In August 2005, APC staff distributed a media release to the Journal and Courier, the Purdue Exponent, the Lafayette Leader and local radio stations including Shine 99, WBAA, WASK, WAZY, WGLM and WKHY and the local television station (WLFI), entitled, "How do tornadoes, floods, and severe winter storms affect you?". It also identified communities participating in the MHMP effort, requirements of DMA 2000, and included information about the on-line survey to which interested residents could respond. Based on the public response to the survey, residents consider snow storms, tornado/windstorms and flooding as most likely to occur in this area. Educational programs focusing on emergency shelters, information about underline gas lines and proper response to emergency sirens were suggested by the public in the on-line survey. The complete survey results can be found in **Appendix B.** A list of the different media that were contacted can be found in **Appendix C** as can the June 2005 and February 2006 media releases. Also included in Appendix C are two articles from the Journal and Courier newspaper and the local television station's website announcement regarding the public comment phase of this multi-hazard planning process.

The media release announcing the public meeting on March 2, 2006, was distributed to the same local media outlets on February 17th. APC staff also met with the Town

Councils prior to sending the plan to those jurisdictions for adoption.

1.5 INVOLVEMENT OF OTHER INTERESTED PARTIES

Neighboring EMA Directors in Carroll County, White County, Clinton County, Benton County, Warren County, Fountain County and Montgomery County as well as other interested agencies, businesses, academia, and non-profits were invited to review and comment on the draft Tippecanoe County MHMP.

The CRS program credits NFIP communities a maximum of 100 points for organizing a planning committee composed of staff from various departments; involving the public in the planning process; and coordinating with other agencies and departments to resolve common problems relating to flooding and other known natural hazards.

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2.0 COMMUNITY INFORMATION

This section provides an overview and perspective of the history, physical features and development of Tippecanoe County.

2.1 TOPOGRAPHY

The topography and geography of Tippecanoe County has been greatly influenced by glaciation; alluvial action can be found on level glacial till plains eroded by stream valleys. The county covers an area of approximately 502 square miles and the major physiographic feature is the Wabash River. The River runs diagonally through the county from the northeast to the west, exiting near the center of the county's western boundary. There are two main tributaries to the Wabash River: the Tippecanoe River and Wildcat Creek. The Tippecanoe River enters the county from the north and is approximately 5.5 miles in length before its confluence with the Wabash River. There are two hydroelectric upstream dams on the Tippecanoe River in Carroll and White Counties. Wildcat Creek has three branches in all; two of which are State designated scenic rivers. All of the branches merge before empting into the Wabash near the center of the county.

The county slopes gently to the southwest and lies entirely within the drainage basin of the Wabash River. The greatest changes in elevation in this county naturally occur along the river valleys. The uplands lie approximately 700 feet above mean sea level (MSL), while elevations along the Wabash River range from 500' MSL to 510' MSL. The highest elevation is 833' near the southeastern corner of the county and the lowest elevation, 500', can be found where the Wabash River exits the county along the western county line.

2.2 CLIMATE

Based on information from the State Meteorologist's Office, the annual mean temperature in Tippecanoe County is 50 degrees Fahrenheit (F) (for the period between 1971 and 2000). Extreme temperatures in the past have ranged from 111 degrees in 1936 and -33 degrees in 1885. The county experiences an annual average rainfall of 38 inches per year and an annual average snowfall of 22 inches. The driest month is typically February with 1.58 inches of precipitation and the wettest is June with 4.24 inches (measured during the period from 1971 to 2000).

2.3 DEMOGRAPHICS

Tippecanoe County experienced significant growth, in both population and employment, in the 1990s when Subaru International Automotive plant and Wabash National semi-trailer plant located and began operations here. The Area Plan Commission is currently studying population and employment projections based on present conditions. In the past, population projections have been based on new jobs (employment) and new housing starts. However, recent evidence indicates that that process may not generate accurate projections in our current conditions. Based on the most recent data from the US Department of Commerce, Bureau of Economic Analysis, Tippecanoe County lost 4,149 jobs between 2000 and 2003. Some of the lost jobs have been recaptured, but we do not expect employment to return to 2000 levels until late in this decade. Despite the loss of jobs, Tippecanoe County experienced a record number of new housing starts from 2003 to 2004. Trends in the older established neighborhoods indicate a loss of residents and poor home sales. **Table 2-1** represents the 2004 population projection based on the

old formula and will be updated, after the research on current trends has been gathered and analyzed. The only exceptions are the population numbers for Shadeland and Otterbein, the best available information for those towns are the 2000 census numbers.

Table 2-1: 2004 Tippecanoe County Population Data	
NFIP Community	**Population**
Unincorporated Tippecanoe County	56,635
City of Lafayette	54,561
City of West Lafayette	31,390
Town of Battle Ground	1,372
Town of Dayton	1,464
Non-NFIP Community	
Clarks Hill	686
Shadeland	1,682
Otterbein (Tippecanoe Co.)	344

2.4 ECONOMY

In 2003, 76% of the workforce was employed by the sector that includes retail trade, construction, professional/technical services as well as health care and social services among others. The annual per capita personal income in 2003 was $25,982 and the median household income in 2000 was $38,652. The number of individuals commuting into the county for work (10.7%) was significantly more than the number commuting out of the county (2.7%) in 2003. In 2004 the eligible work force was 77,700 individuals, with 74,210 employed; the unemployment rate was 4.5%. Manufacturing represents 14,793 jobs.

2.5 INDUSTRY

According to the Bureau of Economic Analysis: Regional Economic Accounts, the largest employment sectors for Tippecanoe County are: state and local government; manufacturing; retail trade; health care and assistance; and accommodation and food services. Those sectors employ 20,573, 14,793, 11,230, 9,289 and 7,306 individuals, respectively. Other notable areas of employment are miscellaneous jobs (not including public administration) (4,914), construction (4,561), professional/technical services (3,733), and finance/insurance (3,375). Employment sectors showing the most growth between 2000 and 2003 were state and local government, other services (except public administration), and health care and social assistance. Purdue University is the single largest employer in the county.

2.6 LAND USE AND DEVELOPMENT TRENDS

Approximately 69% of land in Tippecanoe County is used agriculturally, another 2.9% is woodland and approximately 28% is residential or mixed urban use. Residential development is concentrated on the south and east sides of Lafayette and north and northwest of West Lafayette. An area for future industrial expansion is reserved on the southeastern side of the City of Lafayette; some of the land is in the unincorporated county, but can be served by sanitary sewer and water services from Lafayette. The Purdue Research Park on West Lafayette's north side has additional room for expansion both north and south of Kalberer Road.

2.7 RIVERS AND WATERSHEDS

According to the Indiana Department of Environmental Management (IDEM), there are 65 waterways in Tippecanoe County. **Table 2-2** lists the waterways identified. All of the county's waterways ultimately drain into the Wabash River.

Table 2-2 : 2003 List of Waterways		
Anderson Ditch	Bee Run	Big Shawnee Creek
Blickenstaff Ditch	Bowers Creek	Box Ditch
Bridge Creek	Brown Ditch	Buck Creek
Buck Creek Ditch	Burnett Creek	Coffee Run Creek
Cole Ditch	Darby Ditch	Dismal Creek
Dry Run	Durkee Creek	E. Branch Big Wea
East Branch Wea Creek	Edward Ditch	Elliott Ditch
Flint Creek	Flint Run	Goose Creek
Harrison Creek	Haywood Ditch	Hentz Ditch
Hoffman Ditch	Hog Run	Ilgenfritz Ditch
Indian Creek	Jordan Creek	Kellerman Lea Ming Ditch
Lauramie Creek	Little Flint Creek	Little Pine Creek
Little Sugar Creek	Little Wea Creek	Lofland Ditch
Lost Creek	Marshall Ditch	McFarland Ditch
McKinney Ditch	Montgomery Ditch	Middle Fork Wildcat Creek
Moots Creek	Moses Baker Ditch	North Fork Wildcat Creek
North Fork Burnett Creek	O'Neall Ditch	South Fork Wildcat Creek
Otterbein Ditch	Philip Dewey Ditch	Platt Ditch
Resser Ditch	Romney Fraley Ditch	Southworth Branch
Stock Farm Ditch	Stoddard Ditch	Sugar Creek
Tippecanoe River	Wabash River	Wallace Ditch
Walters Ditch	Wea Creek	

According to IDEM there are 47 Hydrologic Unit Code (HUC) watersheds in Tippecanoe County. **Table 2-3** lists the identified watersheds.

Table 2-3: List of 14-Digit HUC Watersheds		
14-Digit HUC#	**14-Digit HUC NAME**	**Total Acres**
05120106150050	Tippecanoe River-Main Stem	10754.1
05120106150060	Rayman Ditch/Myers Ditch	13230.7
05120105060010	Wabash River-Bowen Ditch	6854.6
05120106150080	Moots Creek-Tippecanoe River Outlet	12325.5
05120108040070	Big Pine Creek-Brumm Ditch	11022.9
05120108010020	North Fork Burnett Creek-Brown Ditch	11598.2
05120108010010	Burnett Creek-Headwaters	16772.5
05120105060020	Wabash River-Bridge Creek	8218.5
05120108040080	Big Pine Creek-Darby Ditch	11773.2
05120108010030	Burnett Creek-Wabash R Bottoms	6573.8
05120108030020	Indian Creek (Tippecanoe)	18960.6

Table 2-3: List of 14-Digit HUC Watersheds		
14-Digit HUC#	**14-Digit HUC NAME**	**Total Acres**
05120108030060	Little Pine Creek-McFarland/Otterbein Ditches	13175.2
05120105070030	Wabash River-Harrison Creek	5114.6
05120105070010	Sugar Creek-Little Sugar Creek (Tippecanoe)	18360.6
05120105070020	Buck Creek (Tippecanoe)	7495
05120107020100	Wildcat Creek-Pyrmont	14949.1
05120107050010	Wildcat Creek-Dry Run	8994.8
05120108010040	Wabash River-Lafayette	14088.1
05120108030070	Little Pine Creek-Armstrong Creek	13404.4
05120108030010	Wabash River-Jordan Creek	10027.6
05120107030070	Middle Fork Wildcat Creek-Pettit	6768.9
05120107040140	South Fork Wildcat Creek-Cary Camp	4524.4
05120107030060	Middle Fork Wildcat Creek-Hog Run	12877
05120107040130	South Fork Wildcat Creek-Dayton	14307.6
05120108020070	Elliot Ditch	11886.8
05120108030030	Wabash River-Lost Creek	16841.3
05120108020090	Wea Creek-Outlet	3009.3
05120108030050	Wabash River-Flint Creek/Grindstone Creek	15242.6
05120108020080	Little Wea Creek	21379.7
05120108020060	Wea Creek-Kenny Ditch	15193.3
05120107040110	South Fork Wildcat Creek-Mulberry	13323.4
05120108030040	Flint Creek-Flint Run	13964.5
05120107040120	Lauramie Creek	15090.8
05120108070020	Shawnee Creek-Headwaters (Fountain)	23784.8
05120108020050	East Branch Wea Creek-Platt Ditch	7375
05120108020030	Wea Creek-Haywood/Kellerman Leaming Dt	11279
05120108020040	East Branch Wea Creek-Headwaters	10982.5
05120108070030	Shawnee Creek-Kell Dt/Little Shawnee Creek	17382.7
05120108020020	Romney Fraley Ditch	8782
05120110030030	Bowers Creek	11919.6
05120108020010	Lofland Ditch-Phillip Dewey/Stoddard Ditches	14588.3
05120108100020	North Fork Coal Creek-Lower	14704.5
Total		**518902**

2.8 ESSENTIAL AND NON-ESSENTIAL FACILITIES

FEMA provides some guidance for selecting essential and non-essential facilities and describes some approaches to identifying those facilities. FEMA's Public Assistance Guide (FEMA 322) states, "An essential facility is a structure that, if damaged, would present an immediate threat to life, public health and safety. Essential facilities include hospitals, facilities that produce, store or transport toxic materials and emergency operation centers. The related regulation at 44 CFR 206.226, restoration of damaged facilities, states that "Eligible private nonprofit facilities may receive funding under the following conditions: the facililty provides critical services, which include power, water (including water provided by an irrigation organization or facility in accordance with 206.221(e) (3)), sewer services, wastewater treatment, communications, emergency medical care, fire department services, emergency rescue, and nursing homes". Thus, essential facilities appear to fulfill important functions in maintaining community stability and living conditions. The following list suggests some examples of potential essential facilities:

a. Structures or facilities that produce, use or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials;
b. Hospitals, nursing homes and housing likely to have occupants who may not be sufficiently mobile to avoid injury or death during a hazard;
c. Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during and after a hazard; and
d. Utility facilities that are vital to maintaining or restoring normal services to areas before, during and after a hazard.

To begin this identification process the lists of essential facilities included in the HAZUS-MH program were used. In addition, we created lists from facilities listed in the phone book to cross reference the information contained in HAZUS-MH because it was apparent that some facilities were missing. HAZUS-MH databases include information on essential facilities such as hospitals, police and fire stations, emergency operations centers, shelters, and schools; transportation systems; utility lifelines; high potential loss facilities such as potable water, wastewater, oil, natural gas, electric power, and communication systems; and hazardous material facilities. The Planning Committee reviewed all of the information which was provided on county maps and then added additional essential facilities. The additional facilities included hospitals, waterworks, nursing homes and sizable daycare facilities. The Committee further modified the lists by adding schools, public utilities (potable water, wastewater facilities), hazardous materials sites, and communication broadcast facilities.

Two hundred and thirty three (232) essential facilities were identified in Tippecanoe County using the HAZUS-MH database, additional research and input from the MHMP Planning Committee. These facilities include 5 dams, 53 schools (including Purdue University and Ivy Tech State College), 10 public/private airports, 9 police stations (including 1 jail), 1 National Guard Facility*, 23 fire stations, 20 nursing/veteran's/children's homes, 4 hospitals, 17 potable water facilities (including all of the City of Lafayette and the Indiana-American Water Company wells), 8 wastewater facilities, 5 bus/train station, 10 broadcast facilities and 67 hazardous material facilities. **Exhibit 1** Illustrates the location of essential facilities and **Appendix D** lists the essential facilities by NFIP community. Non-essential facilities included in the HAZUS-MH database

represents 38,541 structures in Tippecanoe County, for a total of 38,794 structures in all.

Because this MHMP process focused on essential facilities, non-essential facilities are not mapped or listed. The HAZUS-MH database is conditional because it is based on national data; in this case the omitted facilities were added to the HAZUS-MH database. Future updates of this MHMP will always include an update to the critical facilities list.

* The Army Reserve facility located on South Street in the City of Lafayette is listed on the most recent decommissioning list and has been removed from this plan.

3.0 RISK ASSESMENT

The goal of mitigation is to reduce future impacts of hazards on all areas of civil society, such as public and private property damage, disruption to local and regional economies, the amount of public and private funds spent to assist with recovery, and the displacement of a portion of the population. A community must complete a comprehensive examination of the risks associated with natural and manmade hazards to help establish and realize community mitigation goals. Risk assessment of hazards measures potential loss by assessing the vulnerability of buildings, infrastructures and community residents. It helps to identify characteristics of each hazard as well as potential consequences, such as what portion of the community will be affected and how community assets will be impacted. A typical risk assessment has three components: hazard identification; risk analysis; and vulnerability analysis.

3.1 HAZARD IDENTIFICATION

The MHMP Planning Committee reviewed a list of hazards and discussed the inclusion of two manmade hazards: hazardous material contamination and stand-alone utility failure. The committee also briefly discussed terrorism and pandemic health threats, but decided that those particular hazards were already being addressed in other ways and by other plans. Additionally, the committee discussed droughts and hailstorms, but ultimately decided to focus on more eminent hazards such as flooding and tornadoes. Based on the public survey, the planning committee also discussed the threat of fire to wooded areas in our community and again decided not to include a section on this hazard at this time. Although sections on these three hazards were not included at this juncture, the committee will discuss them for the plan's next five year update. **Table 3-1** illustrates the hazards discussed and those the Planning Committee chose to study in depth. Hazards that were studied are shown in bold and include: dam failure, earthquake, flood, severe winter storm (including ice), tornado, windstorm, hazardous materials (storage and transport) and utility failure (not weather related).

Table 3-1: Hazards Discussed by the Planning Committee

List of Hazards	Hazards with Local Impact	Hazards for Detailed Study
Avalanche	No	
Coastal Erosion	No	
Coastal Storm	No	
Dam Failure	**Yes**	**Yes**
Drought	Yes	No
Earthquake	**Yes**	**Yes**
Expansive Soils	No	
Extreme Heat	Yes	No
Flood	**Yes**	**Yes**
Hailstorm	Yes	No
Hurricane	No	
Land Subsidence	No	
Landslide	No	

Table 3-1: Hazards Discussed by the Planning Committee		
List of Hazards	**Hazards with Local Impact**	**Hazards for Detailed Study**
Severe Winter Storm (ice)	**Yes**	**Yes**
Tornado	**Yes**	**Yes**
Tsunami	No	
Volcano	No	
Wildfire	No	
Windstorm	**Yes**	**Yes**
Hazardous Materials (storage & transport)	**Yes**	**Yes**
Utilities (gas, sewer, water, electricity)	**Yes**	**Yes**

Note: Hazards shown in bold were studied in detail.

After identifying hazards, the Planning Committee helped prioritize them by importance and potential for disruption to the community. A tool for prioritizing hazards is the Calculated Priority Risk Index (CPRI) adopted from MitigationPlan.com. The CPRI evaluates each hazard based on its probability of occurrence, severity, warning time and duration. This tool provides a means of assessing each hazard as compared to other hazards.

To determine the CPRI, a value of 1 through 4 is assigned to each of the following categories:

- probability (unlikely – highly likely);
- magnitude/severity (negligible – catastrophic);
- warning time (more than 24 hours – less than 6 hours); and
- duration of event (less than 6 hours – greater than 1 week).

The following formula calculates the CPRI value:

- CPRI = Probability X 0.45 + Magnitude/Severity X 0.30 + Warning Time X 0.15 + Duration of Event X 0.10

Table 3-2 summarizes the CPRI for all of the studied hazards in this planning effort.

Table 3-2: Calculated Priority Risk Index for Tippecanoe County					
	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • >24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • <1 day • < 1 wk • > 1 wk	**CPRI**
Hazardous Materials	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
Flooding	Highly Likely	Critical	< 6 hrs	> 1 wk	3.7
Tornado/Windstorm	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Severe Winter Storm	Highly Likely	Critical	12-24 hrs	< 1wk	3.3
Earthquake	Highly Likely	Limited	< 6 hrs	< 6 hrs	3.1
Dam Failure	Likely	Critical	< 6 hrs	< 6 hrs	3.0
Utilities	Possible	Negligible	< 6 hrs	< 1 day	2.0

According to the CPRI, historical data and knowledge provided by local planning and emergency professionals, and committee members, the storage transport and spills of

hazardous materials (3.9) ranked as the highest priority hazard for Tippecanoe County, followed by flooding (3.7), tornado/windstorm (3.7), severe winter storms (3.3), earthquakes (3.1), dam failure (3.0) and utility failures (2.0). Section 3.2 includes a profile of individual hazards as well as CPRI values for each community that participated in the planning process.

3.2 HAZARD PROFILE

3.2.1 HAZARDOUS MATERIALS

Storage, transportation and spills associated with hazardous materials are a concern to urban areas that have businesses which use or store chemicals and have major transportation routes, interstates or railways traversing through city and county boundaries. A hazardous material is any element, compound, or combination thereof, which is flammable, corrosive, detonable, toxic, radioactive, an oxidizer, an etiologic agent, or highly reactive, and which, because of handling, storing, processing, or packaging, may have detrimental effects upon operating and emergency personnel, the public, equipment and/or the environment. The Secretary of Transportation is charged with classifying materials that are capable of posing an unreasonable risk to health, safety and property when transported for commerce. Hazardous materials are not necessarily wastes and can include pesticides, cleaning agents, water treatment chemicals and many household products.

A chemical accident is reported in the United States on average twenty-one times a day, one of which results in immediate injury, evacuation or death. The most common of these chemicals: Anhydrous ammonia; chlorine; sulfuric acid; sulfur dioxide; and hydrochloric acid. Many accidents are caused by one of two reasons: human error or failed industrial storage and/or processes.

Previous Occurrences

Historically, oil and/or fuels represent the majority of spills requiring response from local hazmat teams. Other substances spilled include: anit-freeze, freon, propylene, mercury and natural gas. A summary of local hazmat responses provided by the Tippecanoe County Emergency Management Agency can be found in **Appendix E**. The number of responses varies depending on year. In 2000 there were 11 hazmat responses, followed by 50 in 2001, 20 in 2002 and 30 in 2003.

Geographic Location

There are a number major transportation routes in Tippecanoe County including an interstate, several state and US roads, and a fairly extensive railway system. Many of these transportation features both serve and cross populated areas; therefore, a hazardous material spill could easily affect populated areas. The contamination of our surface water, such as the Wabash River, could lead to contamination of areas outside our county boundaries, in addition to a local disaster.

Hazard Extent

There are 269 hazardous waste facilities in Tippecanoe County; 135 of which are active. The active operators are comprised of the following: 19 Large Quantity Generators (LQG) which are also hazardous waste transporters; 19 Small Quantity Generators (SQG) and transporters; and 97 conditionally Exempt Small Quantity

Generators (CESQG), four of which are also transporters. A total of 67 facilities have been mapped and we will continue to update that information as locations are confirmed.

Hazardous material storage, transport and spills potentially affect a wide range of locations because the nature of the event is highly variable. A spill during transport could affect almost any area, including populated centers, depending on the event's location and method of transport. Other variables such as water contamination and airborne chemicals would extend the effects beyond the event area, creating a hazard of greater magnitude. Because there are so many unknowns associated with this particular hazard, it is difficult to judge its impact. The Planning Committee felt that an event could be catastrophic if the right combination of variables occurred simultaneously.

Probability of a Future Event

The probability of a hazardous material spill affecting Tippecanoe County, Shadeland and the cities of Lafayette and West Lafayette is highly likely. An event is likely in the towns of Dayton and Battle Ground because of their proximity to Interstate 65 and because rail lines run through both towns. While Clarks Hill is near SR 28 and US 52, it is relatively far from Interstate 65 and rail lines; therefore, the probability is less likely. Although there is little warning associated with a hazardous material spill, clean up can be difficult and lengthy. **Table 3-3** identifies the CPRI for hazardous material spill for each community.

Table 3-3: Calculated Priority Risk Index (CPRI) for Hazardous Materials

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
West Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
Battle Ground	Likely	Catastrophic	< 6 hrs	< 1 wk	3.45
Dayton	Likely	Catastrophic	< 6 hrs	< 1 wk	3.45
Clarks Hill	Possible	Catastrophic	< 6 hrs	< 1 wk	3.0
Shadeland	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9

According to the CPRI, all of the participating communities have a relatively high level of risk associated with hazardous material spills, with the Town of Clarks Hill having the least threat.

Vulnerability Analysis

Most of the population living in Tippecanoe County is at risk from contamination stemming from a hazardous materials spill. The unknown factors surrounding a hazard such as this make it difficult to quantify potential loss of life and environmental contamination. A serious spill could affect waterways, land, and the air we breathe as well as result in a monumental clean up effort; while smaller spills can be handled in

a more routine manner. Because of this hazard's inherent complexities, it is difficult to pre-determine how essential facilities would be affected.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is growing modestly. Future population is expected to reach approximately 150,000 in 2010. The county has experienced a population flux between the older urban core and newer subdivisions along the interstate and other major arterials. This population flux has caused a decrease in enrollment in the Lafayette School Corporation and an increase in the Tippecanoe School Corporation, requiring additional educational facilities in the unincorporated county. Because a large section of the population lives in the county, many not only travel daily on major roads, but live near them as well. Additionally, the major rail corridor is located in downtown Lafayette, adjacent to the Wabash River.

In 2006 West Lafayette will annex a large area and may need to build an additional fire station. With the exception of additional county school facilities and a fire station, it is unclear whether there will be need for additional essential and non-essential facilities in the near future. However, one can assume that the need for essential facilities would rise with an increase in population. Essential facilities are almost always constructed in areas with good infrastructure near existing businesses; therefore, as additional essential facilities are constructed, they too, would also be at risk for damage from a hazardous waste spill.

3.2.2 FLOODING

Nationwide, flooding is the most common and widespread of all natural disasters—except fire. A home in the floodplain has a 26% chance of flooding during a thirty year mortgage and a 4% chance of catching on fire. Most communities in the United States have experienced some kind of flooding after spring rains, heavy thunderstorms or winter snow thaws.

A flood, as defined by the NFIP, is a general and temporary condition of partial or complete inundation of two or more acres of normally dry land area or of two or more properties from overflow of inland or tidal waters and unusual and rapid accumulation of runoff of surface waters from any source, or a mudflow. Floods can be slow or fast rising but generally develop over a period of days. Mitigation includes any activity that prevents an emergency, reduces the chance of an emergency happening, or lessens the damaging effects of unavoidable emergencies. Investing in mitigation steps now, such as engaging in floodplain management activities, prohibiting construction in the floodplain and encouraging the purchase of flood insurance will help reduce the amount of structural damage to homes and financial loss from building and crop damage should a flood or flash flood occur.

The standard for flooding is a 1% chance of flood water reaching a defined elevation each year; known as the 100-year flood. FEMA uses this benchmark to establish a standard of flood protection in communities throughout the country. Other terms that can be interchanged for the "100-year flood" are the "regulatory" and/or "base" flood. The term 100-year flood is often incorrectly used and can be misleading. It does not mean that only one flood of that size will occur in a 100 year period. It means that there is a 1% chance of a flood of that intensity and elevation happening every year, possibly occurring more than once in a relatively short period.

Previous Occurrences

Flooding is a significant concern for Tippecanoe County. In the last three years we have experienced three very different floods. The first in July 2003 lasted approximately one week and included high water on the Wabash and Tippecanoe Rivers as well as Wildcat Creek. The event was caused by substantial rainfall in the area, northern Indiana and in Howard County (which directly affected Wildcat Creek). The second event was in June of 2004 and was caused by heavy rainfall in a concentrated portion of the county, certain areas experienced flash flooding. This event not only caused flooding along Indian Creek and Hadley Lake, but also caused erosion on steep slopes and road wash-outs. The last major event happened in January 2005 after a period of mixed winter weather. It predominantly affected the Tippecanoe and Wabash Rivers as well as Wildcat and Wea Creeks. Flooding along Wea Creek was relatively quick and destructive, while flooding along the rivers and the Wildcat lasted only a few days and generally resulted in less damage.

Table 3-4 lists the flood events recorded by the National Climatic Data Center (NCDC) and also includes local flood information predating 1994, which is the year the first record appears in the NCDC database. Information regarding the four historic flood events prior to 1994 was obtained from the National Weather Service website (Advanced Hydrologic Prediction Service); however, the amount of damage was not available for these events. The NCDC listed 81 flood events between 1994 and 2005 for Tippecanoe County; those included in the list are the ones that resulted in damage.

Table 3-4: Historic Flood Data

Location	Date	Magnitude	Death/ Injury	Property Damage/ Crop Damage
Tippecanoe County +	05/19/1943	NA	Unknown	Unknown
Tippecanoe County +	01/6/1950	NA	Unknown	Unknown
Tippecanoe County +	06/14/1958	NA	Unknown	Unknown
Tippecanoe County +	02/11/1959	NA	Unknown	Unknown
Tippecanoe County+	04/12/1994	NA	1/0	$500,000 / 0
Tippecanoe County+	01/22/1999	NA	0/0	$23,500,000 / 0
Tippecanoe County +	07/05/2003	NA	0/0	$31,500,000/ 58,000,000
Tippecanoe County +	09/01/2003	NA	0/0	$2,500,000 / 0
Tippecanoe County +	06/11/2004	NA	0/0	$10,000 / $300,000
Tippecanoe County +	06/12/2004	NA	0/0	$450,000 / 0
Tippecanoe County +	12/01/2004	NA	0/0	$160,000 / 0
Tippecanoe County +	01/03/2005	NA	0/0	$9,000,000 / 0
Tippecanoe County +	02/01/2005	NA	0/0	$60,000 / 0
Tippecanoe County +	02/08/2005	NA	0/0	$80,000 / 0
Total			1/0	$67,310,000 / $58,300,000

Note: "County+" denotes that more than Tippecanoe County was affected.

Geographic Location

Tippecanoe County has two rivers, several creeks and several tributaries. The primary sources of flooding in the county are the Wabash River, the Tippecanoe River, Wildcat Creek, Wea Creek, Burnetts Creek and Indian Creek. The county has also experienced flooding associated with Hadley Lake, Celery Bog and overland flooding triggered by poor drainage. The Tippecanoe River enters the county from Carroll County along the northern border and is approximately 5.5 miles in length before its confluence with the Wabash. The Wabash River enters the county at the northeast corner and flows between the downtown areas of the cities of Lafayette and West Lafayette. It exits on the county's western edge near the halfway point of that border. Wildcat Creek flows through the eastern part of the county and empties into the Wabash near the center of the county. **Table 3-5** contains a list of the twelve USGS stream gages located in Tippecanoe County; locations of the stream gages and floodplain areas are shown in **Exhibit 2**.

Table 3-5: USGS Stream Gages in Tippecanoe County

USGS Site Number	Site NAME
3334500	SOUTH FORK WILDCAT CREEK NEAR LAFAYETTE, IND.
3334900	SOUTH FORK WILDCAT CR TRIB NR MONITOR, IND.
3335000	WILDCAT CREEK NEAR LAFAYETTE, IN
3335500	WABASH RIVER AT LAFAYETTE IND
3335660	ILGENFRITZ DITCH NR MONROE, IND.
3335672	ELLIOTT DITCH NR LAFAYETTE, IN
3335674	LITTLE WEA CREEK NEAR LAFAYETTE, IN
3335677	MARSHALL DITCH NEAR MONTMORENCI, IN
3335678	INDIAN CREEK NEAR MONTMORENCI, IN
3335680	WABASH RIVER NEAR WEST POINT, IND.
3335681	FLINT CREEK NR WEST POINT, IN
3335682	INDIAN CREEK NR GREEN HILL, IN

Hazard Extent

Riverine flooding is the most common type of flooding in Tippecanoe County. Parts of the county have also experienced overland flooding, flash flooding, lake flooding (associated with Hadley Lake) and urban flooding. While the primary flooding sources are rivers and creeks, flooding can also occur in urban areas because of increased impervious surfaces and inadequate drainage. Flooding and associated crop damage is most likely to occur during the spring and summer because of heavy rains, sometimes exacerbated by melting snow. However, flooding can happen at any time given the right set of circumstances. Tippecanoe County has experienced three recent flood events; the most destructive occurred during the week of July 4th, 2003 and resulted in $89.5 million in damage throughout north central Indiana.

The West Lafayette wastewater treatment plant could be inundated by flood waters in the future as could the Wea Township Fire Department. Most essential facilities are not directly threatened by flood waters; however, the access road to the Indiana Veteran's Home and the Wabash Valley Hospital could be inundated and subsequently restrict access. In addition to critical facilities, which are covered more thoroughly in the section entitled ***Tippecanoe County Flood Damage***, based

on information from the IDNR, the county also has a handful of Repetitive Loss Structures.

Repetitive Loss Structures

FEMA defines a repetitive loss structure as one covered by a contract of flood insurance issued under the NFIP that has suffered flood damage on two occasions during a ten year period. The ten year period ends on the date of the second loss. Another way FEMA determines if a structure is classified as a repetitive loss is if the cost to repair the flood damage on that structure, on average, equaled or exceeded 25% of the market value of the structure at the time of each loss.

Based on information received from the Indiana Department of Natural Resources (IDNR), Tippecanoe County has 16 repetitive loss structures. The majority of the properties listed were damaged in the 2003 and 2005 riverine flood events; however, some received damage in the eighties and nineties. Lafayette, West Lafayette, Battle Ground, and Dayton have no repetitive loss structures.

Probability of a Future Event

The probability of a flood affecting most communities in Tippecanoe County is highly likely, with the exception of the Town of Dayton. While rivers and streams traverse through most of the county, Dayton does not have any floodplains. Like Dayton, the Town of Clarks Hill does not have any floodplains; however, the town does suffer from overland flooding sparked by poor drainage. The Planning Committee figured the Calculated Priority Risk Index for each community in Tippecanoe County by considering past events and at-risk facilities in each jurisdiction. **Table 3-6** identifies the CPRI for flooding for each community.

Table 3-6: Calculated Priority Risk Index (CPRI) for Flooding

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Highly Likely	Critical	< 6 hrs	>1 wk	3.7
Lafayette	Highly Likely	Critical	> 24 hrs	>1 wk	3.25
West Lafayette	Highly Likely	Catastrophic	> 24 hrs	>1 wk	3.55
Battle Ground	Highly Likely	Limited	< 6 hrs	< 1 wk	3.3
Dayton	Possible	Negligible	12-24 hrs	< 1 wk	1.8
Clarks Hill	Highly Likely	Critical	< 6 hrs	< 1 wk	3.6
Shadeland	Highly Likely	Limited	< 6 hrs	> 1 wk	3.4

According to the CPRI, many communities in Tippecanoe County are highly likely to experience flooding. Those communities include: the unincorporated county, the two cities, and the towns of Battle Ground, Clarks Hill and Shadeland. The Town of Dayton is the only community likely

to experience a negligible affect due to flooding.

Vulnerability Analysis

Many communities in Tippecanoe County are at risk of flood damage and unlike other hazards, floods are generally easier to predict. In many flood events, rivers and streams raise gradually giving notice to owners of property in the floodplain; however, some areas of the county have experienced flash floods, which are characterized by fast rising water and diminished warning time. Past flood events give valuable information regarding the type of damage that can be expected from floods with different crests as well as knowledge about which areas will be inundated.

Because Tippecanoe County has long suffered from flood related damage, the county and member jurisdictions have adopted ordinances regarding the floodplain that are stricter than the current state and federal regulations. A summary of local Flood Plain ordinances, past damage and potential damage is covered in the next two sections.

Local Flood Plain Ordinances

In Tippecanoe County, the six member jurisdictions of the Area Plan Commission (including the unincorporated county, West Lafayette, Lafayette, Dayton, Battle Ground and Clarks Hill) and Shadeland have prohibited the construction of new walled structures in the floodplain since 1965. Although Shadeland is not a participating member of the Area Plan Commission of Tippecanoe County, it has similar regulations. Additionally, jurisdictions participating in this process have adopted a zoning district known as the Flood Plain (FP) zone.

The Unified Zoning Ordinance (UZO) adopted by most of the jurisdictions represented in this planning process, the exception is Shadeland, currently requires a 25' no-building setback from the FP zone boundary and requires the first floor elevation (including basements and crawl spaces) of all structures built within the next 75' to be built at flood protection grade (2' above the regulatory flood elevation).

Because homes are not a permitted use in the FP zone, existing homes below the BFE are considered non-conforming uses and fall under that section in the UZO. That section of the ordinance states that when a non-conforming structure (i.e. home and accessory buildings) in the FP zone is substantially damaged by any means to the extent that repairs would equal or exceed 50% of the market value of the home and/or outbuildings, it will no longer be allowed. The ordinance also limits the amount of permitted repairs. Repairs to a non-conforming home or structure cannot exceed 10% of the market value in any 1 year period and cumulatively may not equal or exceed 50% of the market value of that structure. The "50% rule" is cumulative in nature so that if 20% in repairs are made over time and then the structure is damage by 30%, it could not be repaired and must be removed, because cumulatively it would have been damaged by 50% of its market value. Additionally, structural alterations cannot be made except as required by law.

The Town of Shadeland has its own set of regulations in its *Municipal Code – Town of Shadeland*. It prohibits the construction of buildings within 100' of the floodplain zone boundary and such buildings must comply with the flood protection grade. Additionally, construction of walled structures in the floodplain is prohibited.

Tippecanoe County Flood Damage

Because this county has long restricted construction in the floodplain, most of the homes are older and some were originally cottages that were subsequently converted into homes. Many of the older homes were also elevated over time, most likely without permits. The exception to this would be homes along Elliott Ditch that were constructed in the City of Lafayette. The best available information currently shows them in the floodplain; however, their classification could change when the county updates floodplain information as part of the Cooperative Technical Partners Program (CTPP). The Area Plan Commission is participating in the map modernization program in cooperation with FEMA, IDNR and other county departments to acquire updated, digital Flood Insurance Rate Maps (FIRM).

County personnel at first felt that using HAZUS-MH would be the most accurate way to predict potential flood loss; however, after spending many months working with the program it was decided that the results would not be accurate enough without replacing the national data with local data. While working with the program, county personnel took a small portion of the county's floodplain and investigated the HAZUS-MH data more closely to determine whether or not the fifty homes located in the floodway of the Tippecanoe River were accurately reflected. The placement of the homes was not accurate because the homes from the national database obtained for the computer model were dispersed throughout each census block, rather than being accurately located in the river's floodway.

Tailoring the computer model data to reflect local conditions takes a significant amount of time and it was ultimately decided that while that would be an interesting project for the future, the time delay to input better data would not be beneficial at this point. This *Plan* is already overdue and the consequences of not having an adopted multi-hazard plan are grave. In the end, the most accurate local data available was used to determine the county's flood risk.

Based on recent flood events and the lack of new construction in the floodplain, areas at risk are well known and could be easily mapped using GIS with a digitized FIRM layer. This was completed and the assessed value of each home was extracted. Based on that data, the mean price for homes located in the floodplain is $94,679.72 and the median or average price is $76,000. In all, the county has approximately 224 homes, 1 barn, 5 businesses, 13 potable water wells and a portion of a wastewater treatment plant in the floodplain. **Table 3-7** gives a breakdown of residences and other structures located in the floodplain based on GIS mapping with a digitized FIRM overlay.

Table 3-7: Total Buildings in the Floodplain

Community	Residential Buildings	Other Structures
Tippecanoe County	147	3
Lafayette	61	2
Lafayette	0	1
Battle Ground	10	1
Dayton	0	0
Clarks Hill	0	0
Shadeland	6	1
Total	224	7

Note: Table includes essential and non-essential facilities

One issue associated with flooding that may not be well reflected in Table 3-7 is the problem of access. SR 43, the primary access to the Indiana Veteran's Home and Wabash Valley Hospital, is often obstructed by flood waters. Access can be further complicated by utility failure. **Table 3-8** shows essential facilities located in the floodplain by NFIP community.

Table 3-8: Essential Facilities Located in the Floodplain

Community Name	Essential Facility
West Lafayette	Wastewater Treatment Facility (portion)
Lafayette	Hazardous Materials Facilities, Potable Water Wells (13)
Tippecanoe County	Fire Station
Dayton	NA
Battle Ground	Wastewater Treatment Facility (portion)

HAZUS-MH provided the replacement values shown in **Table 3-9** for structures in the floodplain; however, local data was used for the replacement value for homes. Annualized loss estimations for flood damage were calculated and are listed below. Other assumptions supported by FEMA were used for estimating potential loss from floods. Based on the FEMA model one assumes that 25% of the affected buildings are 100% damaged, 35% are 50% damaged, and 40% are 25% damaged. Although those assumptions were used for non-building structures such as dams, the assumptions were altered slightly to meet our county- specific guidelines for buildings located in a floodplain. Because a building in the floodplain that is damaged by 50% of its market value is considered substantially damaged the standard assumptions were modified. For buildings located in the floodplain, it was assumed that:

- 60% of all structures affected will be 50% damaged or more; and
- 40% of all structures affected will be 25% damaged.

Table 3-9: Estimated Total Replacement Costs

Essential Facilities	Replacement Cost	Non-Essential Facilities	Replacement Cost
Dams	$1,750,000	Residential	$94,680*
Airports	$5,613,500	Commercial	$2,421,670
Broadcast Facilities	$103,000	Industrial	$2,821,102
Potable Water	$34,299,000	Agricultural	$2,609,448
Emergency Operations Center	$88,280	Religious	$2,609,448
Fire Department	$618,000	Governmental	$1,643,286
Hazardous Materials	$67,760	Educational	$515,000
Medical Facilities	$7,210,000		
Police Stations	$1,442,000		
Power Facilities	$1,500,000		
Schools	$515,000		
Wastewater Treatment Plant	$68,598,000		

*With the exception of the replacement cost for residential facilities, the numbers in the table above are national averages used by HAZUS-MH and may not reflect actual structural replacement costs for Tippecanoe County.

Table 3-10 represents a list of critical and non-critical facilities potentially affected by flood waters and their replacement costs. The total replacement costs were generated using the values in Table 3-8 and should be re-evaluated in future revisions of this *Plan* if better local data is compiled. The residential replacement cost was generated using local data and should be adjusted in the future as needed.

Table 3-10: Essential and Non-essential Facilities Affected by Flooding

Essential Facilities	Number Affected	Total Replacement Cost	Non-Essential Facilities	Number Affected	Total Replacement Cost
Dams	5	$11.7 M	Residential	224	$14.8 M
Airports	0	NA	Commercial	3	$5.8 M
Broadcast Facilities	0	NA	Industrial	0	NA
Potable Water	13	$130 B	Agricultural		
Emergency Operations Center	NA	NA	Religious	NA	NA
Fire Department	1	$.6 M	Governmental	1	$1.5 M
Hazardous Materials	1	$.06 M	Educational	NA	NA
Medical Facilities	0	NA			
Police Stations	0	NA			
Power Facilities	0	NA			
Schools	0	NA			
Wastewater Treatment Plant	2	$138 M			
Total	**7**	**$275 B**		**247**	**$64.3 M**

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing moderately. Future population is expected to reach approximately 150,000 in 2010. The Tippecanoe County School Corporation is in need of additional facilities to meet its growing school population and it is likely the 2006 West Lafayette annexation will trigger the need for an additional city fire station. With the exception of those two facilities, it is unclear whether there will be a need for additional essential and non-essential facilities in the near future; however, one can assume that the need for essential facilities would rise with an increase in population.

All of the communities involved in this planning effort prohibit construction in the floodplain; therefore, it is unlikely that new structures would be constructed in areas susceptible to flooding. Risks associated with increased impervious surfaces could lead to more urban area flooding. Continued diligence in floodplain management will be necessary. One mitigation goal of this plan is to have the

communities of Clarks Hill and Shadeland join the National Flood Insurance Program.

3.2.3 TORNADO/WINDSTORM

The Indiana State Climate Office defines tornadoes as violently rotating columns of air extending from thunderstorms to the ground. Funnel clouds are rotating columns of air not in contact with the ground; the violently rotating column of air may reach the ground very quickly and thus, become a tornado. An event that lifts and blows debris around is considered a tornado.

A tornado is generated when conditions in a strong thunderstorm cell produce a mass of cool air that overrides a layer of warm air. The underlying warm air is then forced to rise rapidly while the cool air drops, sparking the swirling action. Tornado damage results from high wind velocity and wind-blown debris. In Indiana, tornado season is generally March through June; however, tornadoes can occur at any time. They tend to occur in the afternoon and evening; over 80% of all tornadoes strike between 3pm and 9pm.

While most tornadoes (69%) have winds of less than 100 miles per hour, they can be much stronger. Although violent tornadoes (winds greater than 205-mph) account for only 2% of all tornadoes, they cause 70% of all tornado deaths. In 1931, a tornado in Minnesota lifted an 83-ton railroad train with 117 passengers and carried it more than 80 feet. In another instance, a tornado in Oklahoma carried a motel sign 30 miles and dropped it in Arkansas. In 1975, a Mississippi tornado carried a home freezer more than a mile.

Windstorms or high winds can result from thunderstorms' inflow and outflow. They can result from strong frontal systems, or gradient winds (high or low pressure systems). High winds have a speed reaching 50-mph or greater, either sustained or gusting. Straight line or downburst winds result from collapsed storm clouds. Straight line winds are responsible for most wind damage associated with thunderstorms and can reach speeds of 100 – 150 mph.

Previous Occurrences

There have been several tornadoes and or windstorms recorded in Tippecanoe County. The Fujita Scale of Tornado Intensity is used to categorize tornado events and is shown in **Table 3-11**. The scale scores an F0 tornado as the weakest tornado event with an F5 being the strongest.

Table 3-11: Fujita Scale of Tornado Intensity

F-Scale	Winds	Character of Damage	Relative Frequency
F0 (weak)	40-72 mph	Light damage	29%
F1 (weak)	73-112 mph	Moderate damage	40%
F2 (strong)	113-157 mph	Considerable damage	24%
F3 (strong)	158-206 mph	Severe damage	6%
F4 (violent)	207-260 mph	Devastating damage	2%
F5 (violent)	261-318 mph	Incredible damage	<1%

(NOAA, 2005)

Table 3-12 contains historical tornado data from the NCDC for the thirty-three tornadoes that have happened in Tippecanoe County between the years of 1953 and 2004. Based on that information, the county has experienced 8-F0, 11-F1, 10-F2, 1-F3 and 3-F4 events in the last fifty one years. The most significant event, an F4, occurred in March of 1976 and resulted in $2.5 billion in damages and six injuries.

Table 3-12: Historical Tornado Damage

Location	Date	Magnitude	Death/Injury	Property Damage/Crop Damage
Tippecanoe County	06/13/1953	F1	0/0	0/0
Tippecanoe County	04/03/1956	F2	0/0	$25,000 / 0
Tippecanoe County	03/06/1961	F1	0/0	0/0
Tippecanoe County	04/22/1963	F2	0/0	$3,000 / 0
Tippecanoe County	06/10/1963	F1	0/0	$3,000 / 0
Tippecanoe County	04/11/1965	F4	0/10	0/0
Tippecanoe County	09/14/1965	F2	0/0	$250,000 / 0
Tippecanoe County	06/24/1967	F2	0/0	$3,000 / 0
Tippecanoe County	05/15/1968	F2	0/0	$3,000 / 0
Tippecanoe County	03/19/1971	F2	0/0	$25,000 / 0
Tippecanoe County	05/29/1973	F0	0/0	0/0
Tippecanoe County	06/12/1973	F1	0/0	$25,000 / 0
Tippecanoe County	06/12/1973	F1	0/0	0/0
Tippecanoe County	04/01/1974	F2	0/0	$25,000 / 0
Tippecanoe County	03/12/1976	F1	0/0	0/0
Tippecanoe County	03/20/1976	F4	0/6	$2,500,000 / 0
Tippecanoe County	04/10/1978	F2	0/0	$25,000 / 0
Tippecanoe County	04/23/1978	F1	0/0	$250,000 / 0
Tippecanoe County	06/25/1978	F0	0/0	0/0
Tippecanoe County	06/25/1978	F3	0/0	0/0
Tippecanoe County	07/02/1978	F1	0/0	$25,000 / 0
Tippecanoe County	06/07/1980	F2	0/0	0/0
Tippecanoe County	06/24/1981	F1	0/0	$250,000 / 0
Tippecanoe County	03/27/1991	F0	0/0	0/0
Tippecanoe County	04/26/1994	F4	3/70	$5,000,000 / 0
Lafayette	01/18/1996	F0	0/0	0/0
West Lafayette	07/04/1998	F1	0/0	$200,000 / 0
Battle Ground	09/28/1999	F1	0/1	$300,000 / 0
Lafayette	06/11/2003	F0	0/0	0/0
West Lafayette	06/11/2003	F0	0/0	0/0
Lafayette	07/21/2003	F0	0/0	0/0
Romney	05/30/2004	F0	0/0	0/0
Dayton	05/30/2004	F2	0/0	$1,000,000 / 0
Total			**3/87**	**$9,911,000 / 0**

(NCDC, 2005) Note: There was a July 2005 tornado event in the Town of Dayton; the numbers were not immediately available.

NCDC lists 108 thunderstorm/wind events since 1959. However, **Table 3-13** includes only those storms that resulted in damage or injury (and all of which coincidentally happened after 1989). The most damaging windstorm occurred in June of 2002 and resulted in $220,000 in damage.

Table 3-13: Historical Wind/Thunderstorm Damage

Location	Date	Magnitude (knots)	Death/Injury	Property Damage/ Crop Damage
Tippecanoe County	05/25/1989	0 knots	0/3	0 /0
Tippecanoe County	05/24/1994	NA	0/0	$1,000 / 0
Tippecanoe County	08/13/1994	NA	0/0	$6,000 / 0
Tippecanoe County+	11/21/1994	0 knots	0/0	$50,000 / 0
Tippecanoe County+	11/27/1994	0 knots	0/0	$120,000 / 0
Tippecanoe County	08/09/1995	NA	0/0	$3,000 / 0
Tippecanoe County+	01/18/1996	60 knots	0/0	$22,000 / 0
Lafayette	06/23/1996	0 knots	0/0	$5,000 / $5,000
Concord	10/29/1996	0 knots	0/0	$1,000 / 0
Romney/Clarks Hill	06/21/1997	0 knots	0/0	$2,000 / 0
Battle Ground	07/18/1997	0 knots	0/0	$1,000 / 0
Battle Ground	06/12/1998	0 knots	0/0	$1,000 / 0
Lafayette	08/24/1998	0 knots	0/0	$1,000 / 0
Tippecanoe County	12/06/1998	66 knots	0/0	$200,000 / 0
Montmorencie	09/28/1999	90 knots	0/0	$10,000 / 0
Clarks Hill	05/09/2000	60 knots	0/0	$20,000 / 0
Cairo	04/09/2001	52 knots	0/0	$50,000 / 0
Lafayette	04/11/2001	52 knots	0/0	$50,000 / 0
Dayton	04/23/2001	52 knots	0/0	$150,000 / 0
Lafayette	07/08/2001	50 knots	0/1	$20,000 / 0
Lafayette	06/04/2002	55 knots	0/0	$220,000 /0
Odell	07/07/2003	55 knots	0/0	$10,000 / 0
West Lafayette	07/06/2004	50 knots	0/0	$1,000 / 0
Total			**0/4**	**$942,000 / $5,000**

(NCDC, 2005) Note: "NA" indicates information was not available. "County+" denotes that more than Tippecanoe County was affected.

Geographic Location

Past tornadoes in this county have generally originated in the southwest and moved in a northeasterly direction. Tornadoes have been recorded in all parts of this county including the cities of Lafayette and West Lafayette, the towns of Battle Ground and Dayton and the unincorporated town of Romney. **Exhibit 3** illustrates the historical tornado activity in Tippecanoe County.

There are seventy-one outdoor warning sirens in Tippecanoe County; the majority of those are located in the cities of Lafayette and West Lafayette as well as around their fringe areas. Smaller towns such as Dayton, Battle Ground, Romney, West Point, Clarks Hill, Montmorenci, Colburn and Colburn also have sirens. There are an additional fifteen sirens covering the rural part of the county.

Hazard Extent

Past tornadoes have been devastating for many communities within Tippecanoe County. According to the NCDC, three tornadoes have caused a million dollars worth of property damage or more. A 1976-F4 tornado caused 2.5 million dollars worth of property damage and resulted in 6 injuries. In 1994 a tornado, also an F4, struck west of West Lafayette and caused five million dollars worth of property damage; it also resulted in three deaths and seventy injuries. In May of 2004 an F2 tornado struck Dayton causing one million dollars worth of property damage; the town was again struck by a tornado in July of 2005. Five tornadoes of varying degrees have caused 200,000 dollars or more damage in the county, West Lafayette and Battle Ground.

Outdoor warning sirens are essential for notifying the public of an approaching tornado or dangerous storm with high winds. The locations of the county's sirens are shown in **Exhibit 4**. When the 2004 tornado struck Dayton, the siren did not work and residents did not receive proper warning. The town raised the money to replace the siren, which proved beneficial when a second tornado struck in the summer of 2005.

The existing 71 tornado sirens provide good coverage for the urban areas and some areas of the county. However, portions of Battle Ground and Clarks Hill are not covered by existing sirens; furthermore the town of Americus does not have any outdoor warning sirens. Additionally there are two schools in Shadeland and a portion of the Purdue University campus (including the airport which is the only public airport in the county) that are not covered by warning sirens.

Probability of Future Event

The probability of a future tornado or windstorm event is highly likely in Tippecanoe County. The warning time is limited at best and can sometimes be just a few minutes; likewise, the duration is also relatively short. Past events have proven that the severity and magnitude of these hazards can be devastating, despite the short time frame. **Table 3-14** identifies the Calculated Priority Risk Index (CPRI) for a tornado and/or windstorm event.

Table 3-14: Calculated Priority Risk Index (CPRI) for Tornado/Windstorm

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
West Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Battle Ground	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Dayton	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7

Clarks Hill	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Shadeland	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7

According to the CPRI, the probability of a tornado or windstorm event is equal for all of the communities within Tippecanoe County.

Vulnerability Analysis

All communities within Tippecanoe County are at risk of a tornado or windstorm event. It is difficult to predict where and when a tornado or strong wind will materialize and estimating potential losses is difficult based on the unpredictable nature of these events. Past events give some indication of the type of damage that can be expected with tornadoes of varying intensity. There have been nine tornados since 2000; resulting in at least $500,000 dollars worth of damage, not including the damage amount from the 2005 tornado in Dayton.

Historically, F1 tornadoes have caused serious property damage in Tippecanoe County; at least four F1 events have individually caused more than $200,000 dollars damage. The most damaging tornadoes have naturally been F4 events; one caused 2.5 million dollars worth of damage in 1976 and 5 million dollars worth of damage resulted from a 1994 event. A direct tornado strike on a populated area could be catastrophic. Because of the nature and complexity of tornados and windstorms, it is impossible at this time to identify the specific number and value of essential facilities that would be adversely affected by this hazard.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing slightly. Future population is expected to reach approximately 150,000 in 2010. The county school system is in need of new facilities for the growing school population and West Lafayette may need an additional fire station to serve the area included in the 2006 annexation. It is unclear whether additional essential and non-essential facilities will be built in the near future; however, a reasonable expectation would be that the need for essential facilities would rise with an increase in population. As additional essential facilities are constructed, they too, will be exposed to potential damage from tornado related losses.

3.2.4 SEVERE WINTER STORM

Winter storms come in different forms, ranging from moderate to heavy snow to blizzards or an ice storm. Each storm can be accompanied by other weather events such as high winds, freezing rain or sleet, blinding wind-driven snow and extremely cold temperatures that can last for several days. The main components of a winter storm are blowing and drifting snow accompanied by cold temperatures. Depending on a storm's size, it could affect several states or a smaller area within a single state or region. A severe winter storm is one that drops 4 inches of snow during a 12-hour period, or 6 or more inches during a 24-hour span. An ice storm occurs when freezing rain falls from clouds and freezes immediately on impact. All winter storms make traveling, either by car or foot, extremely hazardous. The aftermath of a winter storm can affect a community or region for days, weeks, and even months especially if utility outages are caused by the storm.

Severe winter storms can lead to various problems, including stranded motorists and trapped residents who are further burdened by power outages and lack of supplies. Residents, travelers and livestock may become stranded without adequate food, water and fuel supplies. Some winter storms can also cause flooding depending on temperatures and duration of snow melt. Winter storms are considered deceptive killers because they indirectly cause traffic accidents, injury and death resulting from exhaustion/overexertion, hypothermia and frostbite from cold temperature and wind exposure; house fires occur more frequently in the winter because proper safety precautions are not taken. The use of unsafe heating techniques can lead to carbon monoxide poisoning and fire related deaths.

Wind chill is an index that expresses how cold it feels to exposed skin outside when the effects of temperature and wind speed are combined. On November 1, 2001, the National Weather Service (NWS) implemented a replacement Wind Chill Temperature (WCT) index for the 2001/2002 winter season. The reason for the change was to improve upon the current WCT Index, which was based on the 1945 Siple and Passel Index. A winter storm watch indicates that severe winter weather may affect an area. A winter storm warning indicates that severe winter weather conditions are expected. A blizzard warning means that large amounts of falling or blowing snow and sustained winds of at least 35-mph are expected for several hours. Blizzards are characterized by low temperatures (usually 20 degrees or less), sustained wind, and falling or blowing snow that reduces visibility to ¼ mile or less for a duration of three hours or more.

Previous Occurrences

There have been several severe winter storms recorded in Tippecanoe County. A severe storm in January 1978 stopped almost all activity in Indiana for two weeks and a severe ice storm in the early 90s resulted in a disaster declaration. More recently, a January 1999 storm brought heavy snow and ice to north-central, central and south-central Indiana and resulted in a Federal Disaster Declaration. A January 2005 ice storm resulted in $300,000 worth of damage and led to another disaster declaration (the declaration also included a flood event). According to data from the National Climatic Data Center, there have been 17 snow and ice storms reported in Tippecanoe County between 1994 and 2005. The events are listed in **Table 3-15** below.

Table 3-15: Historical Severe Winter Storm Data

Location	Date	Type	Magnitude	Death/ Injury	Property Damage/Crop Damage
Tippecanoe Co. +	02/25/1994	Heavy Snow/Blowing Snow	NA	0/0	0/0
Tippecanoe Co. +	12/08/1995	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	12/18/1995	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	01/02/1996	Winter Storm	NA	0/0	0/0

Table 3-15: Historical Severe Winter Storm Data					
Tippecanoe Co. +	01/06/1996	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	03/19/1996	Heavy Snow	NA	0/0	0/0
Tippecanoe Co. +	01/15/1997	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	01/27/1997	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	01/01/1999	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	03/08/1999	Heavy Snow	NA	0/0	0/0
Tippecanoe Co. +	01/19/2000	Heavy Snow	NA	0/0	0/0
Tippecanoe Co. +	12/13/2000	Heavy Snow	NA	0/0	0/0
Tippecanoe Co. +	03/25/2002	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	12/24/2002	Heavy Snow	NA	0/0	0/0
Tippecanoe Co. +	01/02/2003	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	02/14/2003	Winter Storm	NA	0/0	0/0
Tippecanoe Co. +	01/05/2005	Ice Storm	NA	0/0	$300,000 /0
Total				**0/0**	**$300,000 / 0**

(NCDC, 2005) Note: "County+" denotes that more than Tippecanoe County was affected; NA indicates information was not available.

Geographic Location

Severe winter storms generally affect regions, several counties or States; therefore, all localities in Tippecanoe County are subject to a severe winter storm. Because Interstate 65 cuts through the county, there is an increased number of traveling motorists being stranded in the community. While Tippecanoe County receives less snow than other areas of the state, especially those near Lake Michigan, it is still at risk for severe snow and ice storms.

Hazard Extent

Severe winter storms consisting of freezing rain, sleet, heavy snow, blizzards, icy conditions, extreme low temperatures, and strong winds are not uncommon during winter months in Tippecanoe County. Such conditions can result in personal and property damage, interruption of economic activity in the community, and possibly death.

Probability of Future Event

The probability of a severe winter storm causing disruption to residents and businesses in Tippecanoe County is highly likely. The warning time associated with severe winter storms is generous, typically 12-24 hours, but the duration of the event could be more than a week. **Table 3-16** identifies the Calculated Priority Risk Index (CPRI) for a severe winter storm in this county.

Table 3-16: Calculated Priority Risk Index (CPRI) for Severe Winter Storm

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Lafayette	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
West Lafayette	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Battle Ground	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Dayton	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Clarks Hill	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Shadeland	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3

According to the CPRI, all communities in Tippecanoe County could be equally affected by a severe winter storm.

Vulnerability Analysis

The entire population of Tippecanoe County is at risk during a severe winter storm event. Persons who are critically ill and rely on medication and/or electricity to run medical equipment have a heightened risk when power fails or transportation is restricted. The complexity and nature of a regional hazard event such as this makes it difficult to quantify potential losses to property and infrastructure. Typically, severe winter storms will affect roadways and may cause utility failures that could create a threat to human safety. Potential future problems can be extrapolated from the effects of past events that have disrupted community function in the county. Although the 1978 blizzard shut down the county for more than a week, heavy snow storms typically lead to a few days of disruption.

It is difficult to predict which communities would be affected by loss associated with disruption to all economic activity, infrastructure maintenance, and utility repair and how long the disruption will last. Due to the nature and complexity of severe winter storm events, it is not possible at this time to identify the number and value of specific essential and non-essential facilities that

would be adversely affected by severe winter storms. However, it is well-known that back up generators are essential for some facilities such as hospitals and nursing homes.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing slightly. Future population is expected to reach 150,000 in 2010. The Tippecanoe County School Corporation needs additional facilities to serve the growing school population and West Lafayette may need an additional fire station to serve the area included in the 2006 annexation. It is unclear whether other additional essential and non-essential facilities will be built in the near future; however, a reasonable expectation would be that the need for essential facilities would rise with an increase in population. As additional essential facilities are constructed, they too, will be exposed to potential damage from severe winter storm related losses.

3.2.5 EARTHQUAKE

An earthquake is a sudden, rapid shaking of the earth caused by the breaking and shifting of rock beneath the earth's surface. For hundreds of million of years, the forces of plate tectonics have shaped the earth as the huge plates that form the earth's surface move slowly over, under and past each other. Sometimes the movement is gradual. At other times, the plates are locked together, unable to release the accumulating energy. When the accumulated energy grows strong enough, the plates break free, causing the ground to shake. Although most earthquakes occur at boundaries where the plates meet, some occur in the middle of plates.

Ground shaking from earthquakes can collapse buildings and bridges; disrupt gas, electric and phone service; and sometimes trigger landslides, avalanches, flash floods, fires and huge destructive ocean waves known as tsunamis. Buildings and foundations resting on unconsolidated landfill and other unstable soil, and mobile homes and/or homes not tied to their foundations are at risk because they can move off their mountings during an earthquake. When an earthquake occurs in a populated area, it may cause death, injuries, and extensive property damage. Earthquakes strike suddenly, without warning, and can occur at any time. On a yearly basis, 70 to 75 damaging earthquakes occur throughout the world.

There are 45 states and territories in the United States at moderate to very high risk from earthquakes, and they are located in every region of the country. California experiences the most frequent damaging earthquakes; however, Alaska experiences the greatest number of large earthquakes—mostly in uninhabited areas. The largest earthquakes felt in the United States were along the New Madrid Fault in Missouri, where a three-month long series of quakes from 1811 to 1812 included three quakes thought to have a magnitude of 8 or more on the Richter scale. Those particular quakes occurred over the Eastern United States, with Missouri, Tennessee, Kentucky, Indiana, Illinois, Ohio, Alabama, Arkansas, and Mississippi experiencing the strongest ground shaking.

Previous Occurrences

Based on local data, the most recent earthquakes in Tippecanoe County were in 1968 and 1987; there were no damage reports from either of these events. Future occurrences are possible because this county is located on the northern tip of the

New Madrid Fault. The most recent quake recorded in central Indiana was on September 12, 2004, in Shelbyville, IN, and measured 3.6 on the Richter scale of earthquake intensity. The most serious quakes affecting this part of Indiana were those mentioned above, the 1811-1812 Great New Madrid Earthquakes. The three largest of these earthquakes from that series are believed to have had a magnitude greater than 8.0 on the Richter scale, with hundreds of aftershocks at varying magnitude ranges. The most significant damage was in the New Madrid Seismic Zone in Southern Illinois.

Geographic Location

Tippecanoe County is located on the northern end of the New Madrid Seismic Zone.

Hazard Extent

According to the HAZUS-MH results, property damage, loss of life, and/or injury is not expected in this community. The HAZUS-MH Earthquake Model calculates 8 probabilistic scenarios including the 100, 250, 500, 750, 1000, 1500, 2000, and 2500-year earthquake events. Annualized loss is then calculated as the sum of the product of the loss for a given earthquake frequency and the frequency probability. The resulting value is an estimate of loss that could be incurred in any given year.

$$\text{Annualized Loss} = \sum[(\text{Probability of Earthquakes}) * (\$ \text{ Amount of Loss})]$$

There was conflicting information in the summary report for the annualized loss earthquake event run for Tippecanoe County and it was addressed by the earthquake model developers in order to verify the results for this plan. Additionally GIS data, such as an improved soil layer, should be added to this program in the future to obtain better results.

Since the HAZUS-MH Earthquake Model is still under development, the data generated should be used with some reservation. Estimated losses for an individual building are actually averages for a group of similar buildings and although the buildings are similar, they may experience vastly different damage and losses during an earthquake. The damage estimated for small earthquakes (less than M6.0) centered within an urban region tend to be overestimated. Future releases of the model may address these limitations.

Probability of Future Event

Based on historical earthquake data, local knowledge of previous earthquake events, and the HAZUS-MH results conducted as part of this planning process, it is probable that future earthquakes will occur in Tippecanoe County. The county is located on the northern tip of the New Madrid Seismic Zone and because parts of the county are densely populated, the magnitude or severity of an earthquake event could be significant. If an earthquake were to occur, the warning time and duration of the event would both be relatively short. **Table 3-17** identifies the Calculated Priority Risk Index (CPRI) for an earthquake event in Tippecanoe County.

Table 3-17: Calculated Priority Risk Index (CPRI) for Earthquake					
	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Lafayette	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
West Lafayette	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Battle Ground	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Dayton	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Clarks Hill	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Shadeland	Highly Likely	Limited	< 6hrs	< 6hrs	3.1

According to the CPRI, an earthquake event would be a highly likely event with a limited risk potential for all communities in Tippecanoe County.

Vulnerability Analysis

The entire population of Tippecanoe County is identified as being at risk. The HAZUS-MH Earthquake Model was used to estimate potential losses in Tippecanoe County. The model results indicate that there would be no building damage and/or lifeline related losses. Earthquakes are unpredictable and it is therefore impossible to determine the number and value of essential facilities that could be affected by this hazard.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing slightly. Future population is expected to reach 150,000 in 2010. The county school corporation needs additional facilities to serve its growing population and West Lafayette will likely need an additional fire station to serve the area included in the 2006 annexation. It is unclear whether additional essential and non-essential facilities will be built in the near future; however, a reasonable expectation would be that the need for essential facilities would rise with an increase in population and in turn, new essential facilities would also be exposed to potential damage from an earthquake.

3.2.6 DAM FAILURE

There are approximately 80,000 dams in the United States today; the majority of which are privately owned. Other owners include state and local authorities, public utilities, and federal agencies. Dams can provide many benefits to a region, such as drinking water, navigation, water for irrigation, hydroelectric power, recreation areas and can help reduce the devastation caused by flooding. However, dams can also pose a risk to communities. Dams can fail whether they are built correctly or not

because of different variables such as a lifetime of poor maintenance, flood conditions or an earthquake.

Historically, dam failures have resulted in the loss of life and in many instances the failure happened relatively quickly. Dam failure can be arranged into four classifications:

- overtopping;
- foundation failure;
- structural failure; and
- other unforeseen failures.

Uncontrolled water flowing over, around and adjacent to a dam results in an overtopping failure, which accounts for about 28% of failures. Earthen dams are most susceptible to this type of breech. Foundation and structural failures are generally tied to seepage through the foundation of the main structure of the dam. Deformation of the foundation or settling of the embankment can also result in dam failure. Structural failures account for approximately 28% of failures and foundation problems account for another 25%. Earthquakes or sabotage account for 12% of dam failures, while inadequate design and construction account for the remaining 7% of failures.

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Previous Occurrences

To date, there have been no dam breaks in Tippecanoe County. However, the Oakdale Dam in Carroll County has overflowed as a result of heavy rains. Water released from the two upstream dams, Oakdale and Norway, on the Tippecanoe River can greatly affect flooding in this county.

Geographic Location

There are five dams in Tippecanoe County: one high hazard, two significant hazard and two low hazard dams. Additionally, there is one high hazard dam upstream in Carroll County and a significant hazard dam in White County. A group of approximately 50 homes located on Goldsberry Road (permanent residences for the most part) and Morningside Lane (some of which serve as summer residences) are downstream from the Oakdale dam; there are no essential facilities located in downstream paths.

Hazard Extent

Four assumptions were made to estimate potential losses for dam failure for this planning effort:

- dam failure would occur during dry weather;
- area of inundation was estimated based on judgment;
- only high and significant hazard dams were considered; and
- structures in the path of the dam failure could be substantially damaged.

Approximately seventy-seven buildings could be affected by dam failures. A failure of the Oakdale Dam in Carroll County could affect fifty-two residential and ten agricultural buildings along Goldsberry Road and Morningside Lane, causing an estimated $6.9 and $1.1 million dollars worth of damage respectively. A failure of the Treece Lake Dam could affect fifteen residential buildings and result in $2 million dollars in property damage along Sugar Creek Road. Dry weather dam failures of the Norway (Lake Shafer) Dam in White County and two local dams, the Pretty Prairie Creek Road Dam and Marsh Lake Dam, would not affect any buildings, but could cause road damage to Pretty Prairie Road and CR 900 E respectively.

Probability of Future Event

It is likely that portions of unincorporated Tippecanoe County could be affected by a dam failure in the future. The warning time associated with a dam failure is variable, in many historical dam breaks there was essentially no warning time. In other events, the warning time was significant enough to allow evacuation time prior to the break. Communication between dam operators and downstream residents and emergency personnel is essential. The duration of the event is generally quick, but can produce long lasting societal impacts. **Table 3-18** identifies the Calculated Priority Risk Index (CPRI) for a dam failure in this county.

Table 3-18: Calculated Priority Risk Index (CPRI) for Dam Failure

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Likely	Critical	< 6 hrs	<6 hrs	2.95
Lafayette	Unlikely	Negligible	> 24 hrs	<6 hrs	1
West Lafayette	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Battle Ground	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Dayton	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Clarks Hill	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Shadeland	Unlikely	Negligible	> 24 hrs	<6 hrs	1

According to the CPRI, unincorporated Tippecanoe County is at risk to damage from dam failures. Other communities participating in this plan are unlikely to experience this hazard.

Vulnerability Analysis

A dam failure is most likely to affect the few areas of Tippecanoe County that are located downstream from dams, including the riverfront communities on Goldsberry Road and Morningside Lane. Because there have not been any past events in this county, there is no local historical information on this hazard. Nationally, past events have demonstrated that warning systems and communication are key to evacuation and saving lives. For this planning exercise only dry weather dam breaks were studied, in the future it would be beneficial to study this hazard during flooding conditions. Flooding is generally accompanied by heavy rain and could increase the potential for failure, particularly in light of the fact that the Oakdale Dam has overflowed in the past during heavy rain events.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing slightly. Future population is expected to reach around 150,000 in 2010. The Tippecanoe County School Corporation will need additional facilities to serve its growing school population and West Lafayette will likely need an additional fire station to serve the area included in the 2006 annexation. With those exceptions, it is unclear whether there will be a need for additional essential and non-essential facilities in the near future. The reasonable expectation would be that the need for essential facilities would rise with an increase in population. However, much of the area that is directly at risk of damage from a dam failure lies in the floodplain and Tippecanoe County prohibits construction in that area. Additionally, much of the area is located at the northern portion of the county line and major development of essential facilities is unlikely because there is no sewer or water service in that area.

3.2.7 STAND ALONE UTILITY FAILURE

Massive utility failures can happen without being triggered by a natural disaster event such as a severe storm. In 2003 a massive utility outage in the eastern United States was caused by an energy company's failure to trim trees in Ohio. Strained high-voltage power lines went out of service when they came into contact with overgrown trees. This event was the largest blackout in North American history and affected an estimated ten million people in Ontario, Canada and about forty million people in eight US states. Outage-related financial losses were estimated at six billion dollars. A predecessor to the 2003 blackout was the 1965 northeast blackout, which left twenty-five million people without power for up to twelve hours.

Similar outages have also happened in European countries, including: England, Denmark, Sweden, and Italy. The cause of the 2003 London blackout, which coincidentally took place just two weeks after the eastern US and Canada blackout, was a transformer fault caused by an oil leak. The oil leak had been previously detected, but not repaired. The London blackout ultimately affected far fewer people than the one in eastern US and power was restored much faster.

Previous Occurrences

Based on local newspaper reports, there have only been minor utility failures in Tippecanoe County. In June 2002 a power line snapped causing scattered power outages in downtown Lafayette. Although the broken line sparked a small fire, the overall failure had a negligible effect on residents. There was a minor failure in the Town of Battle Ground on May 3, 2004, which was caused by equipment failure. In June of that same year, thirty Purdue University buildings lost power for more than five hours. The event happened when a cable failed during repairs.

Geographic Location

All areas of this county are subject to utility failures. Urban areas are at a higher risk because they have more infrastructure than rural areas. There are fifteen utility providers in Tippecanoe County.

Hazard Extent

The extent of damage from a stand-alone utility outage depends heavily on the conditions during which the failure happens. Damage associated with a failure could be exacerbated by the time of day, time of year and duration of the event. Loss of power

during the summer triggers a loss of air conditioning and could lead to heat related illnesses for area residents, just as a loss of power during the winter leads to lack of heating and could trigger winter weather threats, such as hypothermia. Essential care facilities such has nursing homes and hospitals as well as police and fire facilities could be greatly affected if back-up generators are not in place and if response plans have not been initiated.

Probability of Future Event

The probability of an utility failure in unincorporated Tippecanoe County and the Town of Shadeland is possible, while a failure in the more urbanized cities and towns is likely. The magnitude or severity of such an event depends on the conditions in which it happens as well as the duration. The severity would be negligible in the unincorporated county and Shadeland and only limited in the three towns. An event could be critical in both Lafayette and West Lafayette, where the majority of essential facilities are located. The duration of an event is typically less than twenty-four hours and the warning time is virtually non-existent. **Table 3-19** identities the Calculated Priority Risk Index (CPRI) for a stand-alone utility failure in Tippecanoe County.

Table 3-19: Calculated Priority Risk Index (CPRI) for Stand-Alone Utility Failure

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe Co.	Possible	Negligible	< 6 hrs	< 1 day	2
Lafayette	Likely	Critical	< 6 hrs	< 1 day	3.05
West Lafayette	Likely	Critical	< 6 hrs	< 1 day	3.05
Battle Ground	Likely	Limited	< 6 hrs	< 1 day	2.75
Dayton	Likely	Limited	< 6 hrs	< 1 day	2.75
Clarks Hill	Likely	Limited	< 6 hrs	< 1 day	2.75
Shadeland	Possible	Negligible	< 6 hrs	< 1 day	2

According to the CPRI, a stand-alone utility failure is likely in the cities of Lafayette and West Lafayette and the towns of Battle Ground, Dayton and Clarks Hill. Such an event is possible, but less likely in the unincorporated portion of the County and Shadeland.

Vulnerability Analysis

All of Tippecanoe County is at risk for stand-alone utility failure; however, failures are more likely to happen in the urban areas. Failures can affect water supplies, transportation, communications and industry. In some cases, they also caused social disobedience such as looting, although no such event has occurred here.

Analysis of Development Trends

The most recent information in Tippecanoe County suggests that the population, if growing, is only growing slightly. Future population is expected to reach 150,000 in 2010. The county school corporation is in need of additional facilities to serve its growing school population and West Lafayette will likely need an additional fire station to serve the area included in the 2006 annexation. It is unknown whether additional essential and non-essential facilities will be built in the near future. However, a reasonable expectation would be that the need for essential facilities would rise with an increase in population. As additional essential facilities are constructed, they too, will be exposed to potential damaged from stand-alone utility failures.

4.0 COMMUNITY CAPABILITY ASSESSMENT

This section provides an inventory of existing mitigation efforts in Tippecanoe County. This capability assessment identifies measures that are currently in place, their success rate, and where gaps exist in efforts to mitigate the physical, social, and economic impacts of hazards.

4.1 NFIP PARTICIPATION

Tippecanoe County, Lafayette, West Lafayette, Dayton and Battle Ground are all members of the National Flood Insurance Program (NFIP). **Table 4-1** lists each participant's NFIP number and the date they joined the program. The only non-NFIP communities in Tippecanoe County are Clarks Hill, Shadeland and Otterbein. Shadeland originally was an NFIP member when they participated in the Area Plan Commission, but that membership ended in the 80s. Otterbein is under jurisdiction of the Benton County Plan Commission.

Table 4-1: NFIP Participation

Community	NFIP Number	Effective Date
Lafayette	180253	November 19, 1980
West Lafayette	180254	January 2, 1981
Battle Ground	180252	January 2, 1981
Tippecanoe County	180428	March 16, 1981
Dayton	180486	February 12, 1982 (NSFHA*)

*NSFHA = No Special Flood Hazard Areas

4.2 FLOOD INSURANCE CLAIMS

There are a total of 186 flood insurance policies in Tippecanoe County. As of 2004 a total of 103 claims have been made and $1,087,929 has been paid out through the NFIP for the entire county. **Table 4-2** is a summary of flood insurance policies and claims paid to each NFIP community.

Table 4-2: Summary of Flood Insurance Policies and Claims

NFIP Community	Number of Policies	Total Payments
Lafayette	31	$89,676
West Lafayette	12	$24,736
Battle Ground	7	$16,761
Tippecanoe County	136	$956,756
Dayton	NA	NA
Total	**186**	**$1,087,929**

(FEMA, 2005)

4.3 REVIEW AND EVALUATION OF EXISTING PLANS, PROGRAMS, AND PROJECTS

The Planning Committee discussed existing mitigation plans, programs, and projects in terms of the six mitigation measures used by FEMA: prevention; property protection; natural resource protection, emergency services, structural control projects; and public information. The following list gives a brief discussion of FEMA's mitigation goals as well as Tippecanoe County's existing plans and programs. This list of local programs is intended to be as comprehensive as possible at this time.

Prevention

FEMA defines prevention as measures that are designed to keep the problem from occurring or getting worse. Member jurisdictions of the Area Plan Commission currently have long range planning, zoning, and subdivision ordinances that guide or restrict development from known hazardous areas. Shadeland has its own municipal code. All communities participating in this plan prohibit construction in the floodplain. Shadeland requires a 100' setback from the floodplain boundary for new construction. All other jurisdictions require a 25' no-building setback from the floodplain boundary and that all structures built within the next 75' to be at flood protection grade. Local jurisdictions have tree trimming programs for street trees so that they do not become safety hazards. There is also a household hazardous waste collection site at the local Solid Waste District. The local subdivision ordinance also requires utility lines to be buried, which prevents damage from different types of storms.

Property Protection

FEMA defines property protection as measures that are used to modify buildings subject to hazard damage rather than to keep a hazard away. The Unified Zoning Ordinance, adopted by all communities except Shadeland, requires all new mobile/manufactured home communities to include a tornado shelter for residents. Requiring an additional setback from the floodplain boundary helps ensure the future safety of buildings built near waterways should the floodplain change. The City of Lafayette has established a well-head protection area for city wells.

Natural Resource Protection

FEMA defines natural resource protection as opportunities to preserve and restore natural areas and their function to reduce the impact of hazards. Tippecanoe County SWCD encourages agricultural landowners to implement filterstrips along drainage ditches and riparian buffers along streams and rivers. The prohibition of the construction of walled structures in the floodplain also helps ensure the area is as natural as possible. Tippecanoe County, Lafayette, West Lafayette, Dayton, Battle Ground, Purdue University and Ivy Tech State College are MS4 communities and have recently adopted a new stormwater ordinance to address sediment and erosion control as well as stormwater management measures. The new stormwater ordinance also includes a no net loss in the floodplain component that requires compensatory storage for fill dirt added to areas in the floodplain. Shadeland was originally designated as an MS4 community, but is seeking an exception. They are responsible for stormwater ordinances within their jurisdiction. Clarks Hill is exempt from the MS4 requirements. The zoning ordinance only permits the storage of hazardous materials in certain zones with a special exception from the Area Board of Zoning Appeals.

Emergency Services

FEMA defines emergency services as measures that protect people during and after a hazard. Tippecanoe County has a county-wide outdoor warning system, but could benefit from additional sirens in certain areas. The TEMA office monitors weather systems in cooperation with IDHS using the National Weather Service and has additional subscriptions for weather monitoring services. The county has mutual aid agreements regarding weather monitoring services with all local jurisdictions as well as District 4, which includes adjoining counties as well as Cass County. There is also a state-wide agreement that allows the

distribution of resources throughout the entire State during disasters. The county also utilizes storm spotters during threatening weather. Local county officials and some area residents monitor water level changes on important streams using USGS gage stations and field observations; water levels are monitored vigilantly in order to prepare for flood conditions. Local television and radio stations also carry weather warnings and advisories. The Red Cross has existing agreements to use areas schools and churches as shelters during emergencies.

Structural Control Projects

FEMA defines structural control projects as physical measures used to prevent hazards from reaching a property. Participating communities have stormwater detention and/or retention sizing requirements for new developments. Tippecanoe County also resizes culverts and bridges as resources allow.

Public Information

FEMA defines public information activities as those that advise property owners, potential property owners, and visitors about the hazards, as well as ways to protect themselves and their properties from hazards. There are several education and training programs throughout the county. MS4 communities, TEMA, SWCD, fire and/or police agencies and programs all have public information and education components. While some programs address hazards and methods of response, other programs focus on water-quality issues.

Tippecanoe County's existing governmental structure ensures strong communication between various governmental agencies; this includes mutual aid agreements within the county and with surrounding counties, training for those interested in participating in emergency response and compatible GIS services for the many emergency response agencies. The existing zoning ordinance includes regulations that require safe rooms in mobile home parks, restricts areas in which hazardous chemicals can be stored and prohibits development in the floodplain. The stormwater ordinance provides further protection to the floodplain by requiring compensatory storage for projects that include the addition of fill dirt to raise land above the regulatory flood elevation.

Although the county's existing mitigation measures have many strong points, there are areas that could be improved. There is little information available to the public regarding earthquakes, dam failures and utility failure. The on-line survey portion of this plan demonstrated that some area residents think the establishment of evacuation routes would be beneficial to the community as well as a more thorough look at fire risk for certain areas of the county. Additionally, a well organized warning system for the upstream dams would also be highly beneficial to those residents living along the Tippecanoe River. Both the text of chapter five and its accompanying table are a comprehensive look at which mitigation measures could be improved and/or implemented by the county.

NFIP/CRS

The CRS program credits NFIP communities a maximum of 30 points for reviewing and evaluating the effectiveness of existing activities as they relate to prevention, property protection, protection of natural resources, emergency services, structural control projects, and public information for flooding and other known natural hazards.

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5.0 MITIGATION GOALS AND PROJECTS

This section identifies the mitigation goals and projects identified by the MHMP Planning Committee for participating jurisdictions.

5.1 MITIGATION GOALS

The Planning Committee discussed existing mitigation plans, programs, and projects in terms of the six mitigation measures used by FEMA: prevention; property protection; natural resource protection, emergency services, structural control projects; and public information. The committee also discussed the State's mitigation goals, which correspond with FEMA's six mitigation measures. Following the discussion, the Planning Committee decided on the following MHMP mitigation goals.

Prevention

- Manage the development of land and construction of buildings to reduce the impact of hazards on people and property; and
- Continue to prohibit construction of homes in known hazard areas, such as the floodplain.

Property Protection

- Prohibit building in known hazard areas;
- Regular inspections during construction to ensure that hazard protection standards are included in local code enforcement.

Natural Resource Protection

- Continue to preserve and maintain the function of existing natural resources to reduce the impact of hazards to people and property.

Emergency Services

- Improve the efficiency, timing and effectiveness of warning, response and recovery efforts before, during, and immediately after a hazard;
- Create an emergency warning system for residents living downstream from dams;
- Train persons involved in emergency response in the National Incident Management System;
- Gather more information regarding earthquakes; and
- Use new technology to help with hazard response and communication between different agencies.

Structural Control Projects

- Prohibit structural control projects and remove existing structures in the floodplain so that it can function as naturally as possible.

Public Information

- Educate and inform the public about the risks of hazards and ways to protect themselves and their property before and during a disaster; and
- Use non-traditional or alternative communication networks during a disaster if traditional networks are inoperable.

5.2 MITIGATION PROJECTS

The Planning Committee reviewed FEMA's list of mitigation ideas for each hazard studied during this planning effort and identified which of those best meet the community's needs. All mitigation projects were evaluated according to selected social, technical, administrative, political, and legal criteria.

The following list includes the key consideration for each evaluation criteria:

- Social – mitigation projects will have community acceptance, they are compatible with present and future community values, and do not adversely affect or neglect any segment of the population;
- Technical – the mitigation projects will be technically feasible, reduce losses in the long-term, and will not create more problems than they solve;
- Administrative – the mitigation projects may require additional staff time, alternative sources of funding, and have some maintenance requirements;
- Political – the mitigation projects will have political and public support;
- Legal – the mitigation projects will be implemented through the laws, ordinances, and resolutions that are either in place or will be created to implement the goals of this plan.

Although a detailed economic and social analysis of each proposed project was beyond the scope and intent of this MHMP planning effort, the Planning Committee did weigh potential benefits and costs associated with each project based on their personal and professional experience. In the future, a detailed benefit-cost analysis will be required during the pre-application phase of any grant request. The committee identified each mitigation project as having a high, medium or low cost ratio based on their experience and professional judgment.

The following description of mitigation projects for Tippecanoe County, NFIP and non-NFIP communities are categorized by the six mitigation measures used by FEMA. The following proposed mitigation measures are general in nature; specific details on project location for each project are identified in **Table 5-1**.

5.2.1 PREVENTION

Mitigation projects for prevention include land use planning and zoning, special projects and studies, floodplain management, geographic information services, safe rooms and community shelters, community ratings system, safety procedures for hazardous materials, tree maintenance, and utilities.

<u>P1 – Land Use Planning and Zoning</u>

P1.a) Incorporate hazard mitigation goals into the adopted Comprehensive Plan for Tippecanoe County. The Comprehensive Plan is a powerful planning tool for mitigation because it defines how and where the community should grow. Goals and objectives identified in the Comprehensive Plan are the foundation for all development ordinances in the community.

P1.b) Continue restriction of activities in the floodplain, prohibition on construction and compensatory storage requirements.

P1.c) Update floodplain ordinance to include the no adverse impact language that was recently adopted as a part of the county's stormwater ordinance as well as additional no adverse impact concepts.

P1.d) Encourage innovative planning tools and ideas such as updating The Park, Recreation and Open Space element of the adopted Comprehensive Plan, cluster development, the development of greenways, alternative pavement products and conservation easements to limit and/or modify development in known hazard areas.

P2 – Watershed-based Projects and Studies

P2.a) Conduct special projects and studies such as hydrology and hydraulic modeling and watershed management planning in known hazard areas to better understand conditions and identify solutions. Part of this goal would be accomplished by continued cooperation and participation in the Cooperative Technical Partners Program (CTPP). The CTPP will result new, digital FIRMs and floodplain zoning maps for the county and participating jurisdictions.

P3 – Floodplain Management

P3.a) Continue the prohibition on the construction of walled structures in the floodplain, current requirements for no adverse impact in the floodplain, and participation in the Indiana Association of Floodplain and Stormwater Managers.

P3.b) Continue participation in the CTPP to acquire new, digital FIRMs for the county and participating jurisdictions. This will result in one floodplain map for jurisdictions in Tippecanoe County, instead of the three (zoning map, FIRM and the Floodway –Flood Boundary and Floodway Map) that are currently used.

P3.c) Continue to seek grants to buy out homes located in the floodplain to help reduce risk to life and property damage for local residents.

P3.d) Encourage the towns of Clarks Hill and Shadeland to join the NFIP.

P4 – Geographic Information Services

P4.a) Incorporate local data into the HAZUS-MH database to replace the national data set so that model predictions will be more accurate and specific to Tippecanoe County. Local data should include a local soil layer, hydrologic features, floodplain information, local replacement costs as well as the location and attributes of essential and non-essential facilities.

P4.b) Ensure that local GIS data include classifications compatible with HAZUS-MH including type of essential facilities, building type by occupancy, construction materials, transportation systems, and lifeline systems.

P4.c) Update HAZUS-MH with local data at the parcel level rather than based on averaged Census Tract (Earthquake Model) or Census Block (Flood Model)

P4.d) Additional training in HAZUS-MH for APC staff to quantitatively estimate losses in “what-if scenarios”. Such scenarios could aid planning efforts as well as determine the benefit-cost ratios necessary for mitigation planning grant applications. Although HAZUS is recommended by FEMA, it is not a substitute for detailed engineering studies and is only intended to serve as a planning tool for communities interested in assessing their risk from flooding and earthquakes.

P4.e) Create GIS zoning maps with the most accurate floodplain information created in the CTPP.

P5 – Safe Rooms and Community Shelters

P5.a) Establish safe rooms or community shelters in vulnerable locations. The warning time associated with many hazards, such as dam failure, earthquake, tornado, windstorm, utility failure, and hazardous materials is minimal.

P5.b) Require safe rooms in all new public facilities, which are generally centrally located and are occupied by a large number of people. Safe rooms may also be required in multi-family structures without a safe location such as a basement.

P5.c) Clearly advertise the location of safe rooms and community shelters for both county residents and visitors.

P6 – Community Ratings System (CRS)

P6.a) Encourage NFIP communities in Tippecanoe County to participate in the CRS program. The CRS program is a voluntary incentive program that recognizes and encourages community floodplain activities that exceed the minimum NFIP requirements. As a result, flood insurance premiums rates are discounted to reflect the reduced flood risk.

P7 – Tree Maintenance

P7.a) Maintain trees in good condition in road rights-of-way, utility corridors, and public property. Regular maintenance of trees improves the health and longevity of public trees as well as reduces the potential for dead or dying limbs from falling and injuring people, damaging property, and utility lines during a tornado, windstorm, or sever winter storm.

5.2.2 PROPERTY PROTECTION

Mitigation projects for property protection include techniques for protecting buildings as well as property insurance.

PP1 – Building Protection

PP1.a) Continue to prohibit the construction of all buildings and essential facilities, in known hazard areas. Access to and from medical care, police, fire, emergency operation centers, power substations, potable water, and wastewater treatment facilities must be maintained during, and following, a hazard event. Other types of essential facilities such as schools and government building are occupied by a large number of people who could become trapped if built in a hazard area.

PP1.b) Actively pursue buyout money for properties located in the floodplain. This money could be used for acquisition and relocation, and would help reduce the high costs of response and recovery associated with flood events.

PP2 – Property Insurance

PP2.a) Encourage property owners in known hazard areas to purchase property and multi-hazard insurance (such as flood insurance) to protect their investment. Although insurance should not be considered an alternative to mitigating damages for any type of hazard, it does protect property owners from financial devastation if damage does occur.

PP3 – Building Codes

PP3.a) Review construction standards and building codes to ensure that hazard protection standards, especially for essential facilities and structures (such as mobile homes) which are anchored by “tie downs”, are incorporated into local building codes and inspections and to ensure that those codes are sufficient. Continue enforcement of adopted building codes in all jurisdictions. Building codes are an important mitigation measure for flooding, earthquake, tornado, windstorm, and severe winter storms. This may include sprinkler systems, structural bracing, anchor bolts, and secured exterior materials such as roofing shingles and shutters.

5.2.3 NATURAL RESOURCE PROTECTION

Mitigation projects for natural resource protection include land use planning and stormwater management.

NR1 – Natural Resource Planning

NR1.a) Continue to restrict development in the floodplain and encourage "No-Adverse Impact" (NAI) techniques, promoted by the Association of State Floodplain Managers (ASFPM).

NR1.b) Protect natural wetlands from encroaching development and agricultural activities. Wetlands serve as natural collection basins for floodwaters. Acting like sponges, wetlands collect water, filter it, and release it slowly into rivers and streams. Protecting and preserving wetlands can help prevent flooding.

NR2 – Stormwater Management

NR2.a) Implement the Best Management Practices (BMPs) identified in the recently completely Stormwater Quality Management Program (SWQMP) that address construction and post-construction site stormwater runoff control.

5.2.4 EMERGENCY SERVICES

Mitigation projects for emergency services include mutual aid agreements, emergency warning systems, and power back up systems.

ES1 – Mutual Aid Agreements

ES1.a) Utilize the mutual aid agreements between neighboring communities and counties to ensure a quick response in the event of a hazard. Mutual aid agreements can be expanded to include utility and communication services in addition to fire and police. Tippecanoe County participates in the state-wide mutual aid agreement order.

ES1.b) Conduct a Mutual Aid Capability Verification to assess the availability of resources and response time for emergencies in Tippecanoe County.

ES2 – Emergency Warning Systems

ES2.a) Utilize outdoor warning systems and extend their coverage to alert the residents of a potential tornado or severe weather event. Advance warnings such as sirens, in conjunction with Emergency Alert System broadcast, are an effective mitigation measure to reduce loss of life and property.

ES2.b) Utilize stream gages as well the USGS website for flood warning. NOAA Weather Radio and the EAS broadcast can be incorporated into the community's flood warning system.

ES2.c) Work with dam operators and owners to create an early warning system for dam facilities and excessive water release.

ES2.d) Encourage residents and businesses located in known hazard areas to stay abreast of current weather conditions with NOAA Weather Radio. Provide NOAA weather radios to all essential facilities and train personnel on use of radio.

ES2.e) Maintain a redundancy of communication systems to ensure clear communication with emergency personnel before, during, and after a hazard. There are several cellular or radio "dead-zones" in the county.

ES3 – Power Back-Up Generators

ES3.a) Require emergency back-up generators at all essential facilities in known hazard areas because back-up power is vital. Ham radio operators should also be included in this

because this group could be vital during emergencies if traditional communication lines are no longer available.

ES4 – Upgrades to Emergency Operations Center

ES4.a) Upgrade the physical facilities and communication network at the permanent Emergency Operations Center to improve communications and accommodate the needs of emergency personnel following a disaster. This would include updating the meeting area with an adequate number of table and chairs so that a large group of decision makers could be accommodated.

ES5 – Hazard Database

ES5.a) Collect and report accurate and community specific information on hazard events, including extent, magnitude, and costs to each community. Keeping a detailed, up-to-date, and consistent record of hazards in a central location will help keep the future planning process efficient and relevant.

ES6 – Local Emergency (LEPC) Projects & Coordination

ES6.a) Seek additional funding for local Community Emergency Response Team (CERT) projects and team coordination as well as help facilitate the development of the Purdue University CERT program. The CERT program helps train people to be better prepared to respond to emergencies in their communities. When emergencies happen, CERT members can give critical support to first responders, provide immediate assistance to victims, and organize spontaneous volunteers at a disaster site. CERT members can also help with non-emergency projects that help improve community safety.

5.2.5 STRUCTURAL CONTROL PROJECTS

Mitigation projects for structural control projects include requirements for high hazard dams and drainage systems.

SC1 – Stormwater Drainage Improvements

SC1.a) Flood mitigation can be improved by installing, re-routing, or increasing the capacity of a storm drainage system that can involve detention and retention ponds, or drainage easements along streams and creeks.

SC1.b) Maintain waterways traversing through public lands on a regular basis to prevent localized flooding by removing debris such as large log jams. The risk of flooding increases when drainage systems are not properly maintained.

SC1.c) Regional detention solutions for appropriate waterways, the waterways are typically county-regulated drains in urban areas.

5.2.6 PUBLIC INFORMATION

Mitigation projects for public information include education and outreach projects.

PI1 – Public Education and Outreach Projects

PI1.a) Participate in community events, such as local neighborhood meetings and area school activities, throughout the year to share information on the different types of hazards, methods for preventing damages resulting from hazardous conditions, locations of safe shelters and how to respond when a hazard threatens.

PI1.b) Maintain literature regarding hazards in public facilities, such as libraries, government office buildings, police and fire stations as well as on government websites. FEMA publishes information on different aspects of hazards, including methods to prevent

damage and response techniques.

PI1.c) Create new literature for hazards or events specific to Tippecanoe County that are not covered by existing FEMA publications or where local regulations differ from national ones (for instance, floodplain management and logjam removal).

PI1.d) Implement the Best Management Practices (BMPS) identified in the recently completed stormwater ordinance that addresses public education, outreach, participation, and involvement.

5.3 SUMMARY OF MITIGATION PROJECTS

Table 5-1 lists the mitigation projects, local status, local priority, benefit-cost ratio, project location, responsible entity, funding source, and hazard addressed as identified by the MHMP Planning Committee. The local status portion of the table is categorized as "ongoing" and "proposed" and projects identified as such are expected to be completed within the 5-year term of this MHMP. Depending on the availability of funding, some proposed mitigation projects may take longer to implement. The proposed projects have been organized in terms of the six mitigation measures used by FEMA: prevention; property protection; natural resource protection; emergency services; structural control projects; and public information.

The development of this MHMP is the necessary first step in a multi-step process to implement programs, policies, and projects to mitigate the effects of hazards in Tippecanoe County. This planning effort had multiple intents:

- Identify the hazards which threaten this community;
- Identify to what extent they affect Tippecanoe County; and
- Identify mitigation strategies or projects that can be undertaken to mitigate the effects of the identified hazards.

Although this MHMP meets the requirements of DMA 2000 and eligibility requirements for the Hazard Mitigation Grant program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation (PDM) Grant, the Community Ratings System (CRS) as well as other FEMA programs, additional detailed studies will need to be completed prior to applying for grants or programs.

NFIP/CRS

The CRS program credits NFIP communities a maximum of 72 points for setting goals to reduce the impact of flooding and other known hazards; identifying mitigation projects that include activities for prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

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Table 5-1: Mitigation Projects

Project Category and Number	STATUS	Local Priority	Benefit-Cost Ratio	Project Location	Responsible Entity	Funding Source	Hazards Addressed
Land Use Planning and Zoning P1.a P1.b P1.c P1.d	Proposed and on-going	High	High	Tippecanoe County and all NFIP communities. Tippecanoe County Area Plan Commission (APC) provides planning for all jurisdictions except Shadeland.	APC Shadeland	Existing budget	Dam Failure Flooding Tornado & Windstorm Hazardous Material
Watershed-based Projects & Studies P2.a	On-going	High	High	Tippecanoe County and NFIP communities with floodplains and flooding problems	APC County Surveyor Engineering for: Lafayette West Lafayette Shadeland	Existing budgets and grants	Dam Failure Flooding
Floodplain Management P3.a P3.b P3.c P3.d	On-going	High	High	Tippecanoe County and communities with floodplains and flooding problems	APC County Surveyor Engineering for: Lafayette West Lafayette Shadeland	Existing budget and grants	Dam Failure Flooding
Geographic Information Services P4.a P4.b P4.c P4.d P4.e	Proposed & on-going	High – local use for planning Medium – HAZUS	High	Tippecanoe County, APC for member jurisdictions and communities with GIS mapping capabilities	Management Information Technology Services City of Lafayette APC	Existing budget and grants (PDM)	Dam Failure Earthquake Flooding Hazardous Materials Tornado & Windstorm Utility Failure
Safe Rooms and Community Shelters P5.a P5.b P5.c	Proposed & on-going	High	High	Public buildings, multi-family buildings, and public parks/soccer fields	APC Engineering for: Lafayette & West Lafayette Co. Building Commissioner Shadeland	Existing budget for construction and operation	Dam Failure Earthquake Flooding Hazardous Material Severe Winter Storm Tornado & Windstorm Utility Failure

Table 5-1: Mitigation Projects

Project Category and Number	STATUS	Local Priority	Benefit-Cost Ratio	Project Location	Responsible Entity	Funding Source	Hazards Addressed
Community Ratings System P6.a	On-going	High	High	All NFIP communities	APC	Existing budget	Flooding
Tree Maintenance P7.a	On-going	Low	High	All public property, utility corridors, and ROW throughout Tippecanoe County	Tipmont REMC Cinergy Parks, Streets & Highways for: Tippecanoe County, Lafayette, West Lafayette, Battle Ground, Dayton, Clarks Hill and Shadeland	Utility rate or existing budget	Severe Winter Storm Tornado & Windstorm Utility Failure Flooding
Building Protection PP1.a PP1.b	On-going	High-Restricted building areas Medium - acquisition	High	All residential and non-residential structures in the floodplain and those in the regulatory floodway.	APC Tippecanoe County Grant Coordinator	Existing budget, property owners and grants (PDM, FMA, HMGP)	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Property Insurance PP2.a	On-going	High	High	All buildings in known hazard paths, especially floodplains.	APC Engineering for: Lafayette West Lafayette Planning for Shadeland	Property owners Existing budget (promotion)	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Building Codes PP3.a	On-going	High	High	All buildings in the county, especially those in known hazards areas.	APC County Building Commission Engineering for: Lafayette and West Lafayette Shadeland	Existing budget	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Natural Resource Protection (floodplain) NR1.a	On-going	High	High	Tippecanoe County and communities with floodplains	APC Engineering for: Lafayette and West Lafayette Shadeland	Existing budget	Flooding

Table 5-1: Mitigation Projects

Project Category and Number	STATUS	Local Priority	Benefit-Cost Ratio	Project Location	Responsible Entity	Funding Source	Hazards Addressed
Natural Resource Protection (wetland) NR1.b	On-going	Medium	High	All NFIP communities with wetlands	APC Engineering for: Lafayette and West Lafayette Shadeland	Existing budget	Flooding
Natural Resource Protection (stormwater) NR2.a	On-going	High	High	All MS4 communities	MS4 coordinator for: Tippecanoe County Lafayette West Lafayette Battle Ground Dayton Purdue Ivy Tech	Existing budgets	Flooding
Mutual Aid Agreements ES1.a ES1.b	On-going	High	High	TEMA and all police, and fire departments in Tippecanoe County and where needed in neighboring counties.	TEMA Red Cross	Existing budgets	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Emergency Warning Systems (sirens) ES2.a	Proposed & On-going	High	High	Additional outdoor sirens are needed in Clarks Hill, Americus and near some of the county schools.	TEMA	Existing budgets	Tornado/ Windstorm
Emergency Warning Systems (stream gages) ES2.b	On-going	Medium	High	Additional stream gages are needed in Tippecanoe County on Wea, Indian and Burnetts Creeks.	USGS TEMA County Surveyor	Existing budgets	Flooding
Emergency Warning Systems (dams) ES2.c	Proposed	High	High	Implement a system for homes located downstream from dams.	TEMA IDNR	Existing budgets	Dam Failure Flooding Hazardous Materials
Emergency Warning Systems (NOAA radio) ES2.d	Proposed & on-going	High	High	All essential facilities in Tippecanoe County and NFIP communities	TEMA	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure

Table 5-1: Mitigation Projects

Project Category and Number	STATUS	Local Priority	Benefit-Cost Ratio	Project Location	Responsible Entity	Funding Source	Hazards Addressed
Emergency Warning Systems (communications) ES2.e	Proposed	High	High	All emergency response facilities, personnel, and vehicles.	TEMA	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Power Back-Up Generators ES3.a	Proposed	High: essential facilities Low: traffic signals	High	All essential facilities. Major intersections.	Property owner of each essential facility. TEMA Parks, Streets & Highways for: Tippecanoe County, Lafayette, West Lafayette, Battle Ground, Dayton, Clarks Hill and Shadeland	Construction cost and operation for building owners.	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Upgrades to EOC ES4.a	Proposed	High	High	Permanent EOC facility	TEMA	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Hazard Database ES5.a	Proposed	Medium	High	County-wide documentation of physical, social, economical impact of all hazards for grants and updating this *Plan*.	TEMA APC (Floods)	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
CERT Projects and Coordination ES6.a	On-going	High	High	Tippecanoe County and Purdue University	TEMA and Purdue University	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure

Table 5-1: Mitigation Projects

Project Category and Number	STATUS	Local Priority	Benefit-Cost Ratio	Project Location	Responsible Entity	Funding Source	Hazards Addressed
Stormwater Drainage Improvements SC1.a SC1.b SC1.c	Proposed	Medium	High	All new developments required to comply with new stormwater ordinance.	County Surveyor Engineering for: Lafayette and West Lafayette	Existing budgets Grants	Flooding
Public Education (community events) PI1.a	Ongoing	High	High	All schools and community events.	TEMA, Red Cross, Police and Fire for: Tippecanoe County, Lafayette, West Lafayette, Dayton, Battle Ground, Clarks Hill Shadeland	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Public Education (literature) PI1.b P11.c	Ongoing	High	High	All public buildings, TEMA office, public safety facilities.	TEMA, Red Cross, Parks, Police and Fire for: Tippecanoe County, Lafayette, West Lafayette, Dayton, Battle Ground, Clarks Hill Shadeland	Existing budgets Grants	Dam Failure Earthquake Flooding Hazardous Materials Severe Winter Storm Tornado & Windstorm Utility Failure
Public Education (MS4s, BMPs) PI1.d	Proposed & ongoing	High	High	MS4 communities throughout the county as identified by IDEM.	MS4 coordinator for: Tippecanoe County Lafayette West Lafayette Battle Ground Dayton Purdue University Ivy Tech Soil & Water Conservation Dist.	Existing budgets Grants	Flooding

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6.0 PLAN MAINTENANCE PROCEDURES

6.1 MAINTENANCE PROCESS

Area Plan Commission staff and the Executive Director of TEMA will reconvene the MHMP Planning Committee annually during the five year planning cycle of this document. In preparation for the annual meeting, the appropriate APC staff member and TEMA's Executive Director will meet to review the mitigation strategies and to prepare a list of items accomplished as well as those that are in progress or have yet to be started. These individuals will then prepare a report of upcoming work items to present to the Planning Committee. At each annual meeting, the Committee will monitor, evaluate, and update the *Plan* as needed. Members of the Committee can meet to discuss the *Plan* between meetings when necessary.

Monitoring the plan, this will be accomplished in several different ways. A table for the mitigation processes outlined will be created and maintained so that the information needed to update the plan will be readily available. This will allow the Committee to keep track of the status of each project and will assist in providing direction for future initiatives. Depending on financial resources and grant opportunities, mitigation projects may be implemented by individual communities or through multi-jurisdictional partnerships; the record for each project will be kept accordingly. Additionally, a hazard database will be created; this database will be updated when necessary so that new information regarding disaster events can easily be added to the plan. The database will enable the committee (as well as individual communities) to keep track of financial losses resulting from several events to assist future planning. This database will be monitored by both the APC and TEMA offices, with APC staff making the updates. Zoning ordinance updates benefiting all six member jurisdictions will also be added as needed and records of the changes will be kept by the APC staff member.

The mitigation process table, the hazard database and changes to local ordinances as well as public input will help the Committee evaluate the plan in terms of its effectiveness. At the annual meetings, the Committee may determine the this plan needs to be changed or updated to increase effectiveness. APC staff will make all changes and updates to the plan. Prior to submitting the plan to the IDHS and FEMA, members of the planning committee will review the final document. At the end of the five year period, the updated plan will be resubmitted to the state and federal agencies by APC staff.

This is the first MHMP prepared by Tippecanoe County and NFIP communities; data used was the best information readily available during the planning process. There could be limitations based on current data and updates with new, more accurate data is expected and planned for. During the annual committee meetings, updates to the risk assessment and vulnerability analysis will be made as appropriate based on newer data.

6.2 INCORPORATION INTO EXISTING PLANS

Several of the proposed mitigation projects are currently on-going, but are in need of enhancements. Existing planning documents adopted by the jurisdictions represented in this plan will be amended to reflect necessary changes.

GIS data needed for hazard analysis, including data needed for HAZUS-MH, will be updated throughout the five year planning cycle by the County GIS Department as time allows.

6.3 CONTINUED PUBLIC INVOLVEMENT

Continued public involvement is encouraged and necessary to the successful implementation of this plan. Comments from the public will be received by the APC and the TEMA director and forwarded to the Planning Committee for discussion and review. Education efforts for hazard mitigation will be a focus of the annual Severe Weather Awareness Week as well as incorporated into existing stormwater planning, land use planning, and special projects and studies.

The adopted plan will be posted on the Tippecanoe County website and available to the public at the APC and TEMA offices.

Updates or modifications to the Tippecanoe County MHMP during the five year planning process will require public notice and/or meetings prior to submitting revisions to the individual jurisdictions for approval.

The CRS program credits NFIP communities a maximum of 37 points for adopting the plan; establishing a procedure for implementation, review, and updating the plan; and submitting an annual evaluation report.

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Appendix A

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10am-12pm Friday, April 15, 2005
Community Corrections Building
2800 N. 9th Street Road

AGENDA

1. Overview of the Multi-Hazard Mitigation Plan (MHMP) Requirements
2. Overview of the MHMP Planning Process and Project Timeline
3. Identify Critical Facilities
4. Identify Local Hazards
5. Schedule Next Planning Committee Meeting

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10am-12pm Friday, April 15, 2005
Community Corrections Building
2800 N. 9th Street Road

MEETING SUMMARY

Planning Committee Members Present:
Melissa Axley, Red Cross Emergency Services Director
Tracey Bell, Clarks Hill Clerk Treasurer
Michael Blann, Lafayette Haz-Mat Officer
Robert Bowman, Dayton Town Council Representative
Tracy Brown, Major - Tippecanoe County Sheriff's Department
Christine Chapman, Tippecanoe County Grant Coordinator
Ron Cripe, Tippecanoe County Health Department
Larry Danaher, Lafayette Parks Safety & Section Coordinator
David Downey, West Lafayette Public Works Director
Sallie Fahey, Tippecanoe County APC Executive Director
Khalid Hasan, Tippecanoe County GIS Coordinator
Joni Heide, Lafayette Parks Director of Operations
Ron Highland, Tippecanoe County Building Commissioner
Abbey Hill, American Suburban Utilities
Charlie Hoover, Floodplain Resident
Mark Kirby, TEMA Director
Nathan Miller, Eli Lilly
Frank Peterson, Lafayette Planning Department
Ruth Shedd, Tippecanoe County Commissioner
Carol Shelby, Purdue University Environmental Health and Safety Senior Director
Krista Trout-Edwards- Tippecanoe County APC Planner
Butch Worthington, Battleground Public Works Director
Chris Leroux, West Lafayette Police Department Deputy Chief

Others Present:
Siavash Beik, Christopher Burke Engineering, Ltd. (CBBEL)
Zach Bishton, Christopher Burke Engineering, Ltd. (CBBEL)
Sheila McKinley, Christopher Burke Engineering, Ltd. (CBBEL)

1. Overview of the Multi-Hazard Mitigation Plan (MHMP) Requirement
The Disaster Mitigation Act of 2000 (DMA 2000) requires both the state and local communities to prepare for disasters through pre and post disaster planning. This process reinforces the importance of mitigation planning and the need for communities to plan for a disaster before it occurs in order to reduce the physical, social, and economical impact.

In order for National Flood Insurance Program (NFIP) communities to be eligible for future mitigation funds, they must adopt either their own MHMP or participate in the development of a multi-jurisdictional MHMP. The DMA 2000 originally required MHMPs to be approved by FEMA before November 1, 2004 however; according to the Indiana Department of Homeland Security

(IN-DHS), this is only a "drop dead deadline" for the state. If Tippecanoe County or the City of Lafayette, or any other participating community were to experience a disaster before their MHMP is adopted they will qualify for future project grant funds as long as their MHMP is approved and adopted within the 18 month application period (12 months plus two 90 day extensions).

The development of a MHMP is the necessary first step of a multi-step process to implement programs, policies, and projects to mitigate the effect of hazards in Tippecanoe County. The intent of this planning effort is to identify the hazards, the extent of damage, and to determine what type of mitigation strategies or projects may be undertaken to mitigate for these hazards. The MHMP prepared by Tippecanoe County with CBBEL's assistance will meet the requirements of DMA 2000 and eligibility requirements of the Hazard Mitigation Grant Program (HMGP), Flood Mitigation Assistance (FMA), Pre-Disaster Mitigation Competitive (PDMC) Grant, as well as other FEMA programs including the NFIP's Community Ratings System (CRS), however, additional detailed studies will need to be completed prior to applying for these grants or programs.

The MHMP is often confused with the Comprehensive Emergency Management Plan (CEMP). Although the CEMP provides some hazard and vulnerability analysis, it does not identify historical community-based mitigation projects, risk assessment, cost of disasters or costs avoided through use of mitigation, and detailed mitigation measures required in the MHMP.

According to FEMA, there are 4 key sections to the MHMP including:

1. Organize Resources – establish a Planning Committee; coordinate among the various agencies and department involved with hazard preparedness and/or response; coordinate among neighboring communities and the public; and review and incorporate existing plans, studies, and reports into the MHMP.
2. Assess Risk – identify all hazards; determine which to study in detail; profile hazard events using HAZUS GIS software; assess vulnerability of community; and estimate potential losses.
3. Develop Mitigation Strategies – establish hazard mitigation goals and identify and prioritize mitigation actions.
4. Implement and Monitor Progress – monitor, evaluate, and update the MHMP; incorporate mitigation projects into existing plans, projects, and policies; and continue public involvement.

2. Overview of the MHMP Planning Process

The Planning Committee is composed of a diverse group of local leaders and decision-makers. Members of the Planning Committee are knowledgeable about various hazards and/or have tools necessary to reduce the impact of the hazards. These members include representation from:

- Planning/Community Development
- Engineering
- Emergency Management
- Public Information/Community Relations
- Public Safety/Police/Fire
- Public Works/Streets/Highway
- Building/Zoning/Code Enforcement
- Parks/Recreation
- Residents/Business Owners/Industry Representatives/Stakeholders

- Purdue University
- NFIP Communities:
    - Tippecanoe County
    - Lafayette
    - West Lafayette
    - Dayton
    - Battle Ground

A 12 month project timeline was distributed to the Planning Committee. This includes 6 months to prepare a draft MHMP, 4 months for IN-DHS and FEMA to review and comment, and 2 month for local adoption. The participation of the Planning Committee will be predominantly from April through September 2005.

MHMP PLANNING PROJECT TIMELINE

April 2005

- Assemble Planning Committee
- Community Capability Assessment
- Promulgation Authority Information
- Planning Committee meeting (#1)
    - Overview of DMA 2000 and MHMP requirements
    - Identify local hazards and which to study in detail
    - Review Critical/Essential Facilities

May 2005

- Update Critical/Essential Facilities
- Gather local hazard information
- Review of existing plans
- Develop Plan:
    - Section 1 – Public Planning Process
    - Section 2 – Jurisdiction Participation Information
    - Section 3 – Jurisdiction Information
- Planning Committee meeting (#2)
    - Review Critical/Essential Facilities
    - Review initial hazard data research
    - Discuss existing mitigation efforts
    - Discuss public participation

June 2005

- Continue to gather local hazard information
- Map hazards and estimate damage
- Public Participation (newspaper article with survey)
- Planning Committee meeting (#3)
    - Review hazard maps and estimated damage
    - Compare with local damage reports
    - Calculate Priority Risk Index for each hazard studied

July 2005

- Continue to gather local hazard information
- Map hazards and estimate damage
- Public Participation (newspaper article with survey)
- Develop Plan:
    - Section 4 – Risk Assessment
- Planning Committee meeting (#4)
    - Review State goals and set local goals

    - Discuss mitigation projects
    - Discuss maintenance and evaluation of plan

September 2005

- Develop Plan:
    - Section 5 – Mitigation Strategies
    - Section 6 – Plan Maintenance
- DRAFT Plan to Planning Committee for review

October 2005

- Public Participation
- Submit DRAFT Plan to IN-DHS & FEMA for review

February 2006

- Edits to Plan based on IN-DHS & FEMA comments
- Review by Planning Committee

March 2006

- Local adoption of Plan
- Submit adopted version of Plan to IN-DHS & FEMA

3. Identify Essential Facilities

FEMA defines critical facilities as:

a. Structures or facilities that produce, use or store highly volatile, flammable, explosive, toxic, and/or water-reactive materials;
b. Hospitals, nursing homes and housing likely to have occupants who may not be sufficiently mobile to avoid injury or death during a hazard;
c. Police stations, fire stations, vehicle and equipment storage facilities, and emergency operations centers that are needed for flood response activities before, during and after a hazard; and
d. Public and private utility facilities vital to maintaining or restoring normal services to areas before, during and after a hazard.

A PowerPoint Presentation by Krista Trout-Edwards furthered clarified the definition of critical/ essential facilities and also identified numerous known essential facilities within the County and participating communities. Large County maps were distributed and Planning Committee members identified the location of essential facilities on each map. Essential facilities identified at the meeting will be digitized into GIS prior to the next Planning Committee meeting.

4. Discussion of Local Hazards and Determine which to Study in Detail

The Planning Committee reviewed the list of hazards identified by FEMA and determined which hazards affect Tippecanoe County and which hazards they would like to study in detail as part of this MHMP effort. Additional hazards were added to FEMA's list and considered for detailed study. The Planning Committee agreed to study dam failure, earthquake, flood, severe winter storm, tornado, windstorm, hazardous materials (storage and transport), utilities and natural gas pipelines.

List of Hazards	Hazards with Local Impact	Hazards for Detailed Study
Avalanche	No	
Coastal Erosion	No	
Coastal Storm	No	
Dam Failure	**Yes**	**Yes**
Drought	Yes	No

Earthquake	**Yes**	**Yes**
Expansive Soils	No	
Extreme Heat	Yes	No
Flood	**Yes**	**Yes**
Hailstorm	Yes	No
Hurricane	No	
Land Subsidence	No	
Landslide	No	
Severe Winter Storm (ice)	**Yes**	**Yes**
Tornado	**Yes**	**Yes**
Tsunami	No	
Volcano	No	
Wildfire	No	
Windstorm	**Yes**	**Yes**
Hazardous Materials *(storage & transport)*	***Yes***	***Yes***
Utilities *(gas, sewer, water, electricity)*	***Yes***	***Yes***

Note: Hazards shown in bold will be studied in detail. Hazards shown in italics were added by the Planning Committee

5. Schedule Next Meeting

The next Planning Committee meeting will be held from 10:30am – 12:30pm on Friday May 20, 2005 at the classroom in the Community Corrections Building located at 2800 N. 9th Street.

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:30am-12:30pm Friday, May 20, 2005
Community Corrections Building
2800 N. 9th Street Road

AGENDA

1. Review Hazards and Highlights from Initial Research
2. Discuss Existing Mitigation Efforts
3. Set Mitigation Goals
4. Discuss Public Participation
5. Schedule Next Planning Committee Meeting

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:30am-12:30pm Friday, May 20, 2005
Community Corrections Building
2800 N. 9th Street Road

MEETING SUMMARY

Planning Committee Members Present:
Smokey Anderson, Tippecanoe County Sheriff
Melissa Axley, Red Cross Emergency Services Director
Robert Bowman, Dayton Town Council Representative
Michael Blann, Lafayette Haz-Mat Officer
David Downey, West Lafayette Public Works Director
Sallie Fahey, Tippecanoe County APC Executive Director
Jeromy Frenard, West Lafayette Assistant City Engineer
Khalid Hasan, Tippecanoe County GIS Coordinator
Abbey Hill, American Suburban Utilities
Charlie Hoovler, Floodplain Resident
Mark Kirby, TEMA Director
Opal Kuhl, Tippecanoe County Highway Department
Larry Melton, Wastewater Treatment Plant Manager
Mike Piggot, Community Relations Director Purdue
Carol Shelby, Purdue University Environmental Health and Safety Senior Director
Krista Trout-Edwards- Tippecanoe County APC Planner
Butch Worthington, Battleground Public Works Director
Dan Dowell, Shadeland Town Council/ Fire Department

Others Present:
Zach Bishton, Christopher Burke Engineering, Ltd. (CBBEL)
Sheila McKinley, Christopher Burke Engineering, Ltd. (CBBEL)

1. Review Hazards and Highlights from Initial Research
The Planning Committee reviewed the list of hazards to study in detail as part of this planning process. These include: dam failure, earthquake, flood, severe winter storm, tornado, windstorm, hazardous materials, and utilities.

Information was also provided regarding initial research conducted on each of the hazards to be studied in detail.

Dam Failure
Five dams have been identified in Tippecanoe County to date. Of those five, one is considered a high hazard dam, two are considered significant hazard dams, and two are considered to low hazard dams. In addition, there are two dams located upstream of Tippecanoe County in Carroll and White Counties that could potentially impact Tippecanoe County in the event of a dam failure.

Earthquakes
There have been 40 known earthquakes affecting Indiana and Illinois since 1874. No data on earthquakes specific to Tippecanoe County has been identified. According to the USGS the probability of an earthquake with a magnitude greater than 4.75 occurring in Tippecanoe County in the next 100 years is between 1% and 2%, while the probability of earthquake with a magnitude greater than 4.75 occurring in Tippecanoe County in the next 1000 years is between 10% and 20%.

Flooding
There have been 77 recorded flood events impacting Tippecanoe County between April of 1994 and December of 2004. Of those 77 events, only 17 were limited to Tippecanoe County. The remaining 60 events were regional in nature. Total combined damage estimates associated with these events total more than $115 Million.

Severe Winter Storms
Winter storms are typically regional in nature and their impacts are rarely limited to a single county. Between February 1994 and February of 2003, 14 winters storms effecting Tippecanoe County have been recorded.

Tornadoes
Between June 1953 and May 2004, 33 tornadoes have been recorded in Tippecanoe County. Of these 33 events, 8 were classified as FO, 11 were classified as F1, 10 were classified as F2, 1 was classified as F3, and 3 were classified as F4 events. These events have resulted in 3 deaths, 86 injuries, and more than $9 M in property damages. An F4 tornado in April 1994 accounted for all the deaths, 70 of the injuries and more than $5 million of the property damages associate with these events.

Wind Storms
192 wind storms have been recorded between October 1959 and July 2004. These events have resulted in 1 death, 7 injuries, and $947 thousand in damages. Win speeds associated with these events average between 60 - 70 MPH and maximum speeds often top 90 MPH.

Hazardous Materials
The Indiana Department of Environmental Management's (IDEM) hazardous Materials notifiers list identifies 269 facilities in Tippecanoe County. IDEM's underground Storage Tank (UST) and Leaking Underground Storage Tank (LUST) data bases identify 178 LUSTs and 79 USTs in Tippecanoe County. Additionally, Interstate 65, U.S. 52, and the County's rail corridors pose a substantial threat for chemical spills.

2. Discuss Existing Mitigation Efforts

Prior to recommending new hazard mitigation measures it is necessary to identify and understand the existing mitigation measures currently in place in all jurisdictions participating in the planning process. To facilitate discussions mitigation measures were discussed in the context of FEMA's six mitigation measures – prevention, property protection, natural resource protection, emergency services, structural control projects, and public information.

Prevention
Prevention measures are designed to keep the problem from occurring or getting worse. These include government administrative or regulatory actions or processes that influence that

way land and buildings are developed and built to ensure that future development does not increase hazard damage. Examples include:

- Planning and zoning
- Capital Improvement Programs
- Open space preservation
- Stormwater management regulations-

All communities have existing Comprehensive Plans and Zoning and Subdivision Control Ordinances or some variation there of. All communities are utilizing the International Building Code. All communities have floodplain regulations prohibiting construction in the flood plain.

Building Protection

Property protection measures are used to modify or remove existing buildings or structures to protect them from hazard damage. These measures may be relatively inexpensive to the community since they are implemented through a cost-share with the property owner. Many of the measures do not affect the building's appearance or use, making them particularly appropriate for historical sites and landmarks.

Examples include:

- Acquisition
- Elevation
- Relocation
- Structural retrofits
- Storm shutters
- Floodproofing

In 2004, the County was denied buyouts of properties in the floodplain. In total there have been approximately 20 buyouts since 1965. Retrofitting of structures in the floodplain is generally prohibited. All buildings in the floodplain are considered non-conforming and nonconforming uses cannot be expanded.

Natural Resource Protection

Natural resource protection measures can minimize hazard losses by preserving or restoring natural areas and the natural functions of floodplain and watershed areas. Examples include:

- Erosion and sediment control
- Stream corridor restoration
- Watershed management
- Wetland protection
- Best Management Practices (BMPs) for stormwater runoff.

Tippecanoe County, Lafayette, West Lafayette, Dayton and Battleground recently adopted new stormwater ordinances, which require new developments greater than or equal to one acre in size to implement erosion and sediment control measures and measures to reduce pollution associated with Post-Construction Stormwater Runoff. The Stormwater Ordinance also requires compensatory storage in the floodplain.

Emergency Services

Emergency services measures protect people and property during and immediately after a hazard. Most counties and many cities have emergency management offices to coordinate warning, response and recovery during a disaster. Examples include:

- Warning system
- Emergency response services

- Protection of critical/essential facilities

All communities in Tippecanoe County have mutual aid agreements with surrounding communities and counties. Numerous outdoor warning systems are in place throughout the County. Most critical facilities are equipped with NOAA weather radios and back up generators. The County also has a reverse 911 system for critical facilities

Structural Projects
Structural project measures involve the construction of structures to reduce the impact of a hazard or to prevent a hazard from reaching a property. Examples include:

- Reservoirs
- Dams
- Levees
- Floodwalls
- Seawalls
- Retaining walls
- Safe rooms

Safe rooms are not currently required for trailer parks; however some developers are incorporating them into site plans. Wastewater Treatment Plants operated by the City of Lafayette and West Lafayette have partial levy protection, and the Lafayette Parks Department has some flood wall protection. Lafayette and West Lafayette have incorporated sewer separation projects into their CSO Long Term Control Plans. The County Highway Department conducts log jam maintenance at bridges, and the County Surveyor's Office is responsible for maintenance of regulated drains.

Public Information
Public information measures inform and educate citizens, elected officials, and property owners about the hazards and ways to protect themselves and their property. Examples include:

- Map information
- Outreach projects
- Education programs
- Real estate disclosures
- Technical assistance

There is a variety of existing education in the County relating to hazards or hazard recovery including but not limited to the following:

- The local Red Cross has a variety of educational brochures related to disasters and hazards.
- TEMA is developing flipchart brochure detailing local hazards and hazard response.
- Purdue Extension has a variety of educational materials relating to Rural Emergency Planning.
- The County recently was awarded a Homeland Security Citizen Corp Grant which provides the County with funding to train citizens to provide assistance with disaster recovery.

3. Set Mitigation Goals

The Planning Committee reviewed and discussed the States MHMP Mitigation Goals, which are shown below.

1. Develop an effective public awareness program for the natural hazards that Indiana is most likely to experience

2. Promote economic development consistent with floodplain management, earthquake, and tornado guidelines

3. Use Pre-Disaster Mitigation program to promote recognition of the value of hazard mitigation to public safety and the welfare of the population.

4. Encourage scientific study of natural hazards and the development of data to support mitigation strategies for those hazards that are a threat to Indiana.

5. Develop a program to identify need for warning or monitoring systems (dam structures, river levels, weather conditions) and provide a plan of action to protect communities or individuals from hazards.

6. Maintain an effective State Hazard Mitigation Council that will facilitate implementation of the Indiana Hazard Mitigation Plan, and recommend modifications to the GAR and Governor.

7. Identify mitigation opportunities for long-range planning considerations.

8. Develop a workshop for local mitigation planning.

9. Establish building and zoning codes that support floodplain management, earthquake, and tornado objectives in all counties of Indiana.

10. Identify critical and governmental facilities. Determine methods of protection in hazard prone areas, including relocation, flood proofing, earthquake/wind retrofit, back-up systems.

11. Develop a state-wide hazard mitigation training program for local government officials (i.e. building inspectors, community planners and public works, state agencies, and construction professionals (contractors, architects, designers).

After review of the State's goals, the Planning Committee decided on the following draft MHMP Mitigation goals, which correspond to FEMA's six mitigation measures.

1. <u>Prevention</u>
   The multi-hazard goal for prevention is to continue to manage the development of land and buildings to reduce the impact of hazards on people and property.

2. <u>Property Protection</u>
   The multi-hazard goal for property protection is to continue to modify the buildings subject to hazard damage to protect people and property from the impacts of hazards.

3. <u>Natural Resource Protection</u>
   The multi-hazard goal for natural resource protection is to continue to preserve and maintain the function of existing natural resources to reduce the impact of hazards to people and property.

4. Emergency Services
   The multi-hazard goal for emergency services is to continue to improve the efficiency, timing and effectiveness of warning, response and recovery efforts before, during, and immediately after a hazard.

5. Structural Projects
   The multi-hazard goal for structural projects is to continue to use structures, where feasible, to minimize the potentially damaging effects of hazards on people and property.

6. Public Education
   The multi-hazard goal for public information is to continue to educate and inform the public about the risks of hazards and ways to protect themselves and their property.

4. Discuss Public Participation

CBBEL explained that public participation is important to the development of this MHMP. There will be three public outreach efforts during this planning process – a newspaper article with short survey mid-project, a public meeting to present the draft MHMP, and a presentation during the public hearing for local adoption the MHMP

5. Schedule Next Planning Committee Meeting

The next Planning Committee meeting will be held from 10:00am – 12:00pm on Friday June 24, 2005.

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:00am-12:00pm Friday, June 24, 2005
Community Corrections Building
2800 N. 9th Street Road

AGENDA

1. Review Hazard and Estimated Damage Data
2. Calculate Priority Risk Index for Each Hazard
3. Review Media Release
4. Schedule Next Planning Committee Meeting

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:00am-12:00pm Friday, July 15, 2005
Community Corrections Building
2800 N. 9th Street Road

AGENDA

1. Continue to Review Hazard and Estimated Damage Data
2. Continue to Calculate Priority Risk Index for Each Hazard
3. Review Media Release
4. Schedule Next Planning Committee Meeting

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:00am -12:00pm Friday, June 24, 2005
10:00am - 12:00pm Friday, July 15, 2005
Community Corrections Building
2800 N. 9th Street Road

MEETING SUMMARY

Planning Committee Members Present:

Melissa Axley, Red Cross Emergency Services Director
Michael Blann, Lafayette Haz-Mat Officer
Tracy Brown, Major - Tippecanoe County Sheriff's Department
Christine Chapman, Tippecanoe County Grant Coordinator
Ron Cripe, Tippecanoe County Health Department
Sallie Fahey, Tippecanoe County APC Executive Director
Jeromy Grenard, West Lafayette Assistant City Engineer
Khalid Hasan, Tippecanoe County GIS Coordinator
Ron Highland, Tippecanoe County Building Commissioner
Mark Kirby, TEMA Director
Frank Peterson, Lafayette Planning Department
Nathan Miller, Eli Lilly
Frank Peterson, Planner/Project Manager
Rick Pettry, Citizen
Carol Shelby, Purdue University Environmental Health and Safety Senior Director
Chris Leroux, West Lafayette Police Department Deputy Chief
Butch Worthington, Battleground Public Works Director
Krista Trout-Edwards- Tippecanoe County APC Planner

Others Present:

Zach Bishton, CBBEL
Sheila McKinley, CBBEL

1. Review Hazard and Estimated Damage Data

CBBEL and APC staff provided summary information for dam failure, earthquakes, flooding, hazardous materials, severe winter storm, tornado/windstorm, and utility failures. The summary gave an overview based of each hazard on previous occurrences, inventory of assets, and estimate of potential loss.

The following comments were made during the hazard discussion:

- Contact Purdue University Meteorological Department regarding hazardous weather events. It is believed that they may have data that could supplement gaps with National Climatic Data Center (NCDC) information.
- The APC agreed to Reevaluate the drainage area for the Hoon Lake Dam.
- Risks associated with hazardous materials would be easier to quantify if they were broken down by participating community. CBBEL agreed to geo-code facilities for further discussion at the next meeting.
- Additional local information on hazard events should continue to be collected.

2. Calculate Priority Risk Index for Each Hazard

In an effort to mathematically determine which hazard is the greatest importance to Tippecanoe County, the Planning Committee developed a Calculated Priority Risk Index (CPRI) for all of the hazards studied as part of this planning effort. CBBEL staff explained that in order to determine the CPRI, a value of 1 through 4 is assigned to the categories for probability (unlikely – highly likely), magnitude/severity (negligible – catastrophic), warning time (more than 24 hrs – less than 6 hours), and duration of event (less than 6 hours – greater than 1 week). The following formula, adopted from MitigationPlan.com, calculates the CPRI value: CPRI = Probability X 0.45 + Magnitude/Severity X 0.30 + Warning Time X 0.15 + Duration of Event X 0.10.

Based on the CPRI, Tippecanoe County is at greatest risk from Hazardous Materials (3.9), Flooding (3.7), Tornado & Windstorms (3.7), Severe Winter Storms (3.22), and Earthquakes (3.1). The tables below show the individual CPRI scores for each hazard and participating community.

Calculated Priority Risk Index (CPRI) for Dam Failure

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Likely	Critical	< 6 hrs	<6 hrs	2.95
City of Lafayette	Unlikely	Negligible	> 24 hrs	<6 hrs	1
City of West Lafayette	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Town of Battle Ground	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Town of Dayton	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Town of Clarks Hill	Unlikely	Negligible	> 24 hrs	<6 hrs	1
Town of Shadeland	Unlikely	Negligible	> 24 hrs	<6 hrs	1

Calculated Priority Risk Index (CPRI) for Earthquake

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Critical • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Highly Likely	Limited	< 6hrs	< 6hrs	3.1

City of Lafayette	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
City of West Lafayette	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Town of Battle Ground	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Town of Dayton	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Town of Clarks Hill	Highly Likely	Limited	< 6hrs	< 6hrs	3.1
Town of Shadeland	Highly Likely	Limited	< 6hrs	< 6hrs	3.1

Calculated Priority Risk Index (CPRI) for Flooding

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Highly Likely	Critical	< 6 hrs	>1 wk	3.7
City of Lafayette	Highly Likely	Critical	> 24 hrs	>1 wk	3.25
City of West Lafayette	Highly Likely	Catastrophic	> 24 hrs	>1 wk	3.55
Town of Battle Ground	Highly Likely	Limited	< 6 hrs	< 1 wk	3.3
Town of Dayton	Possible	Negligible	12-24 hrs	< 1 wk	1.8
Town of Clarks Hill	Highly Likely	Critical	< 6 hrs	< 1 wk	3.6
Town of Shadeland	Highly Likely	Limited	< 6 hrs	> 1 wk	3.4

Calculated Priority Risk Index (CPRI) for Hazardous Materials

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9

City of Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
City of West Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9
Town of Battle Ground	Likely	Catastrophic	< 6 hrs	< 1 wk	3.45
Town of Dayton	Likely	Catastrophic	< 6 hrs	< 1 wk	3.45
Town of Clarks Hill	Possible	Catastrophic	< 6 hrs	< 1 wk	3
Town of Shadeland	Highly Likely	Catastrophic	< 6 hrs	< 1 wk	3.9

Calculated Priority Risk Index (CPRI) for Severe Winter Storm

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
City of Lafayette	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
City of West Lafayette	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Town of Battle Ground	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Town of Dayton	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Town of Clarks Hill	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3
Town of Shadeland	Highly Likely	Critical	12-24 hrs	< 1 wk	3.3

Calculated Priority Risk Index (CPRI) for Tornado & Windstorm

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
City of Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
City of West Lafayette	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Town of Battle Ground	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Town of Dayton	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Town of Clarks Hill	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7
Town of Shadeland	Highly Likely	Catastrophic	< 6 hrs	< 6 hrs	3.7

Calculated Priority Risk Index (CPRI) for Utility Failure

	Probability • Unlikely • Possible • Likely • Highly likely	**Magnitude/ Severity** • Negligible • Limited • Essential • Catastrophic	**Warning Time** • > 24 hrs • 12-24 hrs • 6-12 hrs • < 6 hrs	**Duration of Event** • < 6 hrs • < 1 day • < 1 wk • > 1 wk	**CPRI**
Tippecanoe County	Possible	Negligible	< 6 hrs	< 1 day	2
City of Lafayette	Likely	Critical	< 6 hrs	< 1 day	3.05
City of West Lafayette	Likely	Critical	< 6 hrs	< 1 day	3.05
Town of Battle Ground	Likely	Limited	< 6 hrs	< 1 day	2.75
Town of Dayton	Likely	Limited	< 6 hrs	< 1 day	2.75
Town of Clarks Hill	Likely	Limited	< 6 hrs	< 1 day	2.75
Town of Shadeland	Possible	Negligible	< 6 hrs	< 1 day	2

3. Review Media Release

APC staff distributed an updated press release, which identified the communities participating in the MHMP effort and the requirements of DMA 2000. The press release was slightly amended since the last meeting. Direct quotes from Krista Trout-Edwards of the APC were added to give the media release a more "story ready" feel.

In addition, APC staff distributed a draft version of the MHMP web-site survey that is currently being developed. The web-site provides Tippecanoe County residents with an opportunity to report all experiences they have had with local disasters and allows residents to rank disasters in the order in which they are most likely to occur in Tippecanoe County. Finally, the web-site allows County residents to select those disasters that are most likely to impact their property and provides them with an opportunity to add any additional information regarding disasters that would be beneficial to the County's planning process.

4. Schedule Next Planning Committee Meeting

The next Plan Commission Meeting is scheduled for Friday August 19, 2005, at 10:00 am in the Community Corrections Building located at 2800 N. 9th Street Road.

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:00am-12:00pm Friday, August 19, 2005
Community Corrections Building
2800 N. 9th Street Road

AGENDA

1. Discuss Newspaper Article, Web-site, and Survey Responses
2. Discuss Mitigation Projects
3. Discuss Maintenance and Evaluation of the Plan
4. Discuss Options for Public Meeting

Tippecanoe County Multi-Hazard Mitigation Plan
Planning Committee Meeting

10:00am-12:00pm Friday, August 19, 2005
Community Corrections Building
2800 N. 9th Street Road

MEETING SUMMARY

Planning Committee Members Present:
Melissa Axley, Red Cross Emergency Services Director
Michael Blann, Lafayette Haz-Mat Officer
Christine Chapman, Tippecanoe County Grant Coordinator
Jeromy Grenard, West Lafayette Assistant City Engineer
Joni Heide, Lafayette Parks Director of Operations
Khalid Hasan, Tippecanoe County GIS Coordinator
Mark Kirby, TEMA Director
Opal Kuhl, County Highway Engineer
Steve Murray, County Surveyor
Krista Trout-Edwards- Tippecanoe County APC Planner

Others Present:
Zach Bishton, CBBEL
Sheila McKinley, CBBEL

1. **Discuss Newspaper Article, Web-site, and Survey Responses**
Krista Trout-Edwards provided an update on the status of the Press Release and Hazard Survey developed by the Planning Committee. The Tippecanoe Journal and Courier ran a story on the Multi-Hazard Mitigation Planning Process and the importance of public input. NPR and local television stations have also done stories on the planning process. To date, 24 citizens have completed the Hazard Survey. In an effort to increase citizen participation, it was suggested that the survey be posted on the Red Cross' webpage and that the survey be distributed to local scout troops and high school students.

2. **Discuss Mitigation Projects**
The Planning Committee participated in an extensive exercise to identify mitigation projects suitable for all-hazards, dam failure, drought, earthquake, flooding, hazardous materials, severe winter storm, tornado and windstorm, and utility failure. Many of the mitigation project identified are on-going and would benefit from continued support or additional resources. Each mitigation project was discussed and evaluated based on priority, cost benefit ratio, project location, responsible entity, and funding source. The charts on the following pages summarize the discussion.

3. **Discuss Maintenance and Evaluation of the Plan**
It was determined that long term maintenance of the plan should be conducted through a joint APC and TEMA effort.

4. **Discuss Options for Public Meeting**
As part of this planning process, Tippecanoe County and participating NFIP communities need to hold a public meeting. At this meeting, the draft MHMP will be presented in an effort to share the

goals and mitigation projects as well as obtain additional suggestions from the general public. The meeting will be held in October of 2006.

Proposed Mitigation Projects

MITIGATION PROJECT	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Emergency Operations Center	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	On-going	Medium	High	County-wide	*EMA*	Existing budget and grants (HMGP)
Emergency Warning Systems	☒ Dam Failure ☐ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	Proposed & On-going	High (especially for public education and signage)	High	Essential Facilities 13 USGS Gauges. Upstream need on Tippecanoe and Wabash. Major Roads	*EMA & Surveyor*	Existing budget and grants (HMGP, PDM)
Mutual Aid Agreements	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒Utility Failure	On-going	High	High	County-wide and Regional	*EMA, Police, Fire, & Red Cross for:* County Lafayette West Lafayette Battleground Clarks Hill Dayton Shadeland	Existing budget
Safety Procedures for Hazardous Material	☐ Dam Failure ☐ Earthquake ☐ Flooding ☒ Hazardous Material ☐ Severe Winter Storm ☐ Tornado & Windstorm ☐ Utility Failure	On-going	High	High	County-wide	*Facility owner & transporter* *EMA & LEPC*	Existing budget

MITIGATION PROJECT	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Land Use Planning & Zoning	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☐ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	Proposed and on-going	Medium	High	County-wide	*APC* *Planning for:* Shadeland	Existing budget
Floodplain Management and Watershed Studies	☒ Dam Failure ☐ Earthquake ☒ Flooding ☐ Hazardous Material ☐ Severe Winter Storm ☐ Tornado & Windstorm ☐ Utility Failure	On-going	High	High	County-wide	*APC* *Surveyor* *Engineering for:* Lafayette & West Lafayette *Planning for:* Shadeland	Existing budget and grants (IDEM, FMA, EPA)
Stormwater Drainage System Improvements	☐ Dam Failure ☐ Earthquake ☒ Flooding ☐ Hazardous Material ☐ Severe Winter Storm ☐ Tornado & Windstorm ☐Utility Failure	Proposed & on-going	High	High	Urbanized/ MS4 Area Regional	*APC* *Surveyor* *Engineering for:* Lafayette & West Lafayette *Planning for:* Shadeland *MS4 Coordinators for:* County Co-Permittees	Existing budget, grants (FEMA) for design and/or construction, landowner or special assessment

MITIGATION PROJECT	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Maintenance & Management of High Hazard Dams	☒ Dam Failure ☐ Earthquake ☒ Flooding ☐ Hazardous Material ☐ Severe Winter Storm ☐ Tornado & Windstorm ☐ Utility Failure	Proposed	Low	High	Dams Two High Hazard Dams (Treece Lake Dam and Oakdale Dam)	*Dam owners* *IDNR*	Cost of operation and/or HOA fees
Building Insurance Protection & Building Codes	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	On-going	High	High – Building Codes High – promoting property insurance Medium - Acquisition	County-wide	*APC* *Building Commission for:* Lafayette West Lafayette *Planning for:* Shadeland	Existing budget property owners and grants (PDM, FMA, HMGP)
Power Back-Up Generators	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	Proposed and on-going	High - essential facilities. Low - traffic signals	High	Essential Facilities Major Intersections	Building owner (private & public) *EMA*	Cost of construction & operation and grants (PDM)
Safe Rooms & Community Shelters	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	On-going	High	High	County-wide	*APC* *EMA* *Red Cross*	Existing budget for construction & operation

MITIGATION PROJECT	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Tree Maintenance	☐ Dam Failure ☐ Earthquake ☐ Flooding ☐ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒Utility Failure	On-going	Medium	High	Utility Corridors Road Right-of-Ways	*Utility Provider* APC (Zoning) *Street & Highway Department for:* County Lafayette West Lafayette Battleground Clarks Hill Dayton	Utility rate or existing budget
Use & Location of Utilities	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	On-going	Medium	High - locating outside known hazard areas and participation in digging hotlines Low - retrofit existing utility lines.	County-wide	*Utility Provider* *APC*	Utility rate or existing budget
Geographic Information Systems	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☐ Severe Winter Storm ☒ Tornado & Windstorm ☒Utility Failure	On-going	High - use for local planning Medium – HAZUS	High	County-wide	*Management Information Technology Services*	Existing budget and grants (PDM)
Hazard Database	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒Utility Failure	Proposed	High	High	County-wide	*EMA*	Existing budget and grants. (PDM)

MITIGATION PROJECT	HAZARD ADDRESSED	STATUS	PRIORITY	BENEFIT-COST RATIO	LOCATION	RESPONSIBLE ENTITY	FUNDING SOURCE
Public Education & Outreach Efforts	☒ Dam Failure ☒ Earthquake ☒ Flooding ☒ Hazardous Material ☒ Severe Winter Storm ☒ Tornado & Windstorm ☒ Utility Failure	On-going	High	High	County-wide	*MS4 Coordinator for:* County Co-Permittees *APC, EMA, Red Cross*	Existing budget and grants. (PDM)

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Appendix B

Results for Question 1 – Public Survey

Disasters experienced by survey respondents and the amount of damage associated with that disaster.

Lafayette:

Ice Storm: 1 response - $0 - $499 in damage
Windstorm: 6 responses - $0 - $499 (2 responses)
$500 - $999 (2)
$3000 - $4999 (1)
$5000 - $9999 (1)
Utility Failure: 1 response - $0 - $499

West Lafayette:

Snow Storm: 1 response - $0 - $499
Ice Storm: 1 response - $500 - $999
Tornado: 1 response - $10,000 or more

Dayton:

Tornado: 4 responses - $0 - $499 (2)
$500 - $999 (1)
$5000 - $9999 (1)

Tippecanoe County:

Snow Storm: 3 responses - $0 - $499 in damage (1)
$1000 - $2999 (2)
Ice Storm: 5 responses - $0 - $499 (2)
$1000 - $2999 (2)
$10,000 or more (1)
Tornado: 3 responses - $0 - $499 (2)
$1000 - $2999 (1)
Windstorm: 4 responses - $0 - $499 (3)
1 response - $500 - $999 (1)
Flooding: 3 responses - $1000 - $2999 (1)
$5000 - $9999 (1)
$10,000 or more (1)
Utility Failure: 3 responses - $0 - $499 (3)

Results for Question 2a – Public Survey

Rank of disaster in the order that survey respondents felt they were most likely to occur overall.

Weighted Mean Average Value from Public Survey Results

Snow Storm:
(8/45 X 9) + (8/45 X 8) + (10/45 X 7) + (7/45 X 6) + (8/45 X 5) + (1/45 X 4) + (1/45 X 1)=
1.5999 + 1.4224 + 1.5555 + .9333 + .8888 + .0888 + .0222 = **6.5109**

Windstorm:
(11/45 X 9) + (6/45 X 8) + (7/45 X 7) + (6/45 X 6) + (5/45 X 5) + (5/45 X 4) + (1/45 X 3) + (1/45 X 2) =
2.1999 + 1.0666 + 1.0888 +.7999 + .5555 + .4444 + .0666 + .0444 = **6.2661**

Tornado:
(6/45 X 9) + (7/45 X 8) + (9/45 X 7) + (10/45 X 6) + (4/45 X 5) + (5/45 X 4) + (2/45 X 3)=
1.1999 + 1.2444 + 1.4 + 1.3333 + .4444 + .4444 + .1333 = **6.1994**

Flooding:
(9/45 X 9) + (10/45 X 8) + (5/45 X 7) + (5/45 X 7) +(5/45 X 6) + (6/45 X 5) + (2/45 X 4) + (3/45 X 3) =
1.8 + 1.7777 + .7777 + .6666 + .6666 + .1777 + .1999 = **6.0662**

Ice Storm:
(1/45 X 9) + (6/45 X 8) + (7/45 X 7) + (11/45 X 6) + (12/45 X 5) + (4/45 X 4) + (1/45 X2) =
.1999 + 1.0666 + 1.0888 + 1.4666 + 1.3333 + .3555 + .0444 = **5.5551**

Utility Failure:
(7/45 X 9) + (5/45 X 8) + (1/45 X 7) + (2/45 X 6) + (4/45 X 5) + (10/45 X 4) + (7/45 X 3) + (5/45 X 2) =
1.3999 + .8888 + .1555 + .2666 + .4444 + .8888 + .4666 + .2222 = **4.7328**

Hazardous Materials Spills and Storage:
(1/45 X 9) + (1/45 X 8) + (4/45 X 7) + (2/45 X 6) + (2/45 X 5) + (11/45 X 4) + (14/45 X 3) + (3/45 X 2) + (1/45 X 1) =
.1999 + .1777 + .6222 + .2666 + .2222 + .9777 + .9333 + .1333 + .0222 = **3.5551**

Earthquake:
(6/45 X 4) + (9/45 X 3) + (16/45 X 2) + (12/45 X 1) =
.5333 + .6 + .7111 + .2666 = **2.111**

Dam Failure:
(7/43 X 5) + (10/45 X 2) + (23/45 X 1) =
.4666 + .4444 + .5111 = **1.4221**

Results for Question 2b – Public Survey

The disaster that survey respondents felt was most likely to affect them and their property.

Lafayette:

Tornado – 18 (this disaster was selected 18 times by Lafayette residents)
Windstorm – 16
Ice Storm – 16
Snow Storm – 15
Utility Failure – 10
Hazardous Materials – 5
Flooding – 3
Dam Failure – 1

West Lafayette:

Snow Storm – 4
Ice Storm – 4
Tornado – 3
Windstorm – 2
Utility Failure –2

Dayton:

Tornado – 3
Windstorm – 2
Ice Storm – 2
Snow Storm – 2
Flooding – 1

Tippecanoe County:

Ice Storm – 17
Windstorm – 16
Tornado – 16
Snow Storm – 16
Utility Failure – 14
Flooding – 8
Hazardous Materials – 8
Dam Failure – 1

Results for Question 3 – Public Survey

Additional information provided by survey respondents to help our planning efforts.

Education/Miscellaneous Ideas

1. Evacuation routes, establishment of emergency headquarters, establishment of shelters with alternative sites in advance of disasters

2. Information about underline gas lines education and warning siren education. The education about warning sirens could focus on how the public should respond so that people know how to respond to the sirens (i.e. whether or not to run in or out of the building).

3. Maintain a list of disabled/elderly residents and coordinating a system to check on them during inclement or hazardous weather.

Flooding

1. Removal of trees from waterways to reduce flooding impacts

2. Create restrictions on housing developments to reduce the damage from flooding along rivers and streams. Reduce farmland conversion and urban sprawl, lack of careful planning imposes externalities on other residents that results in property damage from flooding that would be less likely to occur if the land remains agricultural.

Utility Failure

Prairie Oaks Subdivision – Replacement of current infrastructure to reduce power outages, which are fairly regular during storms. This has been a problem for multiple years.

Snow Storms

Yearly ice and snow storms, make budgeting for snow removal vital as is maintaining communications through the media. Local school systems often have school when conditions are hazardous, putting children at risk.

Other Hazards that should be looked at:

Inclusion of Fire Hazard – near Happy Hollow Park

Appendix C

In August 2005 and February 2006, APC staff distributed media releases to following local media outlets:

Radio Stations

Shine 99
WBAA
WASK
WAZY
WGLM
WKHY

Television Station

WLFI

Newspapers

Journal and Courier
Purdue Exponent
Lafayette Leader

MEDIA RELEASE

For Immediate Release
Media Release Date: June 30, 2005
Contact: Krista Trout-Edwards, Area Plan Commission of Tippecanoe County (765) 423-9242

How do tornadoes, floods, and severe winter storms affect you?

Lafayette, IN (June 30, 2005) – The Area Plan Commission, in cooperation with Tippecanoe County, the City of Lafayette, City of West Lafayette, Town of Battle Ground, Town of Dayton, Town of Shadeland, and Town of Clarks Hill is preparing a Multi-Hazard Mitigation Plan. Citizen input is a key element of the planning process.

The Disaster Mitigation Act of 2000 (DMA 2000) requires communities to prepare a Multi-Hazard Mitigation Plan in order to be eligible for any future mitigation funding through the State and Federal Emergency Management Agencies. Krista Trout-Edwards, APC Planner stated, "The intent of this planning process is to prepare for a disaster before it occurs in order to reduce the physical, social and economic impact of that disaster."

Tippecanoe County has experienced numerous natural and man-made disasters. Floods, tornadoes, and ice storms, have caused millions of dollars of damage to properties in Tippecanoe County in recent years. The Multi-Hazard Mitigation Planning Committee would like citizen input regarding natural and man-made hazards in Tippecanoe County. "Information based on personal experiences with dam failures, earthquakes, flooding, severe snowstorms, tornadoes, ice storms, hazardous material spills, and utility failures would be particularly helpful", says Trout-Edwards.

The Tippecanoe County webpage at http://www.tippecanoe.in.gov/apc provides more information about the development of the Tippecanoe County Multi-Hazard Mitigation Plan and how to participate in the first of two opportunities for public input. At that website, citizens may fill out an online survey designed to gather information from area residents regarding different aspects of various hazards.

The second opportunity for public input will follow a presentation of the draft-version of the Tippecanoe County Multi-Hazard Mitigation Plan at a public meeting this coming October. The meeting date and time have not been determined but will be widely published in the near future.

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MEDIA RELEASE

For Immediate Release
Media Release Date: February 17, 2006
Contact: Krista Trout-Edwards, Area Plan Commission of Tippecanoe County (765) 423-9242 ktrout-edwards@tippecanoe.in.gov

Lafayette, IN (February 17, 2006) – The Federal Disaster Mitigation Act of 2000 (DMA 2000) requires communities to prepare a Multi-Hazard Mitigation Plan in order to be eligible for future mitigation funding through the Indiana Department of Homeland Security and the Federal Emergency Management Agency. The intent of the planning process is to prepare for a disaster before it occurs to reduce the physical, social and economic impact of that disaster. The disasters most likely to occur in this community, including natural and manmade, were analyzed for severity, duration, warning time, extent and potential damage.

To ensure the future flow of money to our community, the Area Plan Commission, in cooperation with the Tippecanoe County Emergency Management Agency and on behalf of Tippecanoe County, Lafayette, West Lafayette, Battle Ground, Clarks Hill, Dayton, and Shadeland has prepared a draft Multi-Hazard Mitigation Plan. The plan identifies ways to lessen the impact of disasters on our community and ways to reduce lose of life and property when a disaster does strike.

Citizen input is a key element of the planning process and the resulting outcomes. "Additional information or ideas based on personal experiences with dam failures, earthquakes, flooding, severe snowstorms, tornadoes, ice storms, hazardous material spills, and utility failures would be particularly helpful", says Krista Trout-Edwards of the APC staff because, "some of the best lessons come from experience".

Local governments have some existing mitigation tools in place; the plan calls for the preservation or expansion of existing measures while adopting new initiatives. Examples of existing mitigation tools: 1. The Area Plan Commission and its member jurisdictions have prohibited construction in the floodplain since 1965; the Town of Shadeland also prohibits construction in the floodplain. 2. In 1998, the Unified Zoning Ordinance began requiring under ground tornado shelters for new manufactured home communities. This concept could be expanded for places of public assembly, apartment complexes or manufacturing plants. 3. Use of NOAA weather radios at critical facilities, such as hospitals, and by residents in known hazard areas would reduce risk to citizens and property by providing additional time to seek shelter and secure belongings.

The first opportunity for public comment was an online survey conducted in 2005. The Planning Committee is now inviting the public to comment on the draft version of the MHMP, which is available online at the Tippecanoe County website homepage at http://www.tippecanoe.in.gov and in the Area Plan Office. A public meeting to discuss the draft plan will be held on March 2, 2006, at 7:00 pm in the Tippecanoe Room of the Tippecanoe County Office Building located at 20 N. 3rd Street. Public comment will be received until March 17, 2006 and can be mailed to the Area Plan Commission, 20 N. 3rd Street, Lafayette 47901 or emailed to Krista Trout-Edwards at ktrout-edwards@tippecanoe.in.gov.
----END----

ByzCity

This was reprinted from http://www.wlfi.com ON March 2, 2006

APC To Take Public Comments on Plan To Mitigate Hazards
February 27, 2006

The Tippecanoe County Area Plan Commission will take public comment this week on a federally-mandated plan to mitigate hazards.

APC planner Krista Trout-Edwards says the draft plan deals with issues like flooding, snowstorms and tornadoes. She says the public hearing is designed give planners a wider range of input on the issue.

"Basically we're looking for anything that can make a better plan for our community. If there are any ideas out there that we maybe haven't thought of, or any facts that we didn't get right in our plan, or maybe didn't know about, that kind of thing.

"There's a lot of knowledge out there, maybe with past floods or snowstorms or ice storms. And maybe someone thought of a way that we could do something better next time, and that's the kind of information that we need for our plan so that it actually is a community plan," said Trout-Edwards.

The public hearing will be held at 7 p.m. Thursday, March 2, in the Tippecanoe Room at the County Office Building, at Third and Columbia streets in downtown Lafayette.

JOURNAL & COURIER 3-1-06

Hazard meeting set for Thursday

A plan designed to help government respond to natural disasters will be discussed at 7 p.m. Thursday at the county office building, 20 N. Third St.

The meeting will focus on the Multi-Hazard Mitigation Plan. Using data collected on previous floods, tornadoes and ice storms that have struck the county, the plan outlines how emergency workers can best prepare for and respond to such disasters.

The county must adopt a Multi-Hazard Mitigation Plan to receive certain types of federal funding.

Disaster mitigation plan introduced

Staff reports

Members of the Tippecanoe County Area Plan Commission presented Thursday the draft of a plan to minimize loss of property and life due to disasters in the county.

The Multi Hazard Mitigation Plan describes how the county can better prepare to deal with hazardous material spills, floods, tornadoes, ice and snow storms, earthquakes and the failure of dams and of utilities. The federal Disaster Mitigation Act of 2000 requires that local governments adopt such a plan in order to receive funding for projects aimed at minimizing the harm from disasters.

The Indiana Department of Homeland Security and the Federal Emergency Management Agency will soon receive a copy of the local mitigation plan for review, said Krista Trout-Edwards, of the plan commission. After that, the plan will come before the area plan commission for approval.

The final step toward adoption will be plan's review by the Tippecanoe County commissioners, the city councils of Lafayette and West Lafayette, and the town boards of Dayton, Battle Ground, Clarks Hill and Shadeland. Sallie Fahey, executive director of the plan commission, said the process will take about six months.

Comments about the plan can be e-mailed to ktrout-edwards@tippecanoe.in.gov.

On the Net

To view the plan online, visit www.tippecanoe.in.gov/egov/docs/1139242029550.htm and click on Draft Multi Hazard Mitigation Plan.

Appendix D

NFIP Communities	Schools	Fire Station	Police Stations/Jails	Waste Water Facilities	Potable Water Facilities	Military Installations	Hospitals	Public/Private Airports	Hazardous Materials	Specialized Homes*	Dams	Broadcast Facilities	Bus/Train Station	Total Essential Facilities by Community
Tippecanoe County	13	9	1	4	0	1	1	9 (private)	24	4	5	5	0	**76**
Lafayette	28**	8	2	1	14	0	3	0	36	10	0	5	5	**112**
West Lafayette	7	2	2	1	1	0	0	1 (public)	6	6	0	0	0	**26**
Battle Ground	2	1	1	1	1	0	0	0	0	0	0	0	0	**6**
Dayton	1	1	1	0	0	0	0	0	0	0	0	0	0	**3**
Non-NFIP Communities														
Clarks Hill	0	1	1	1	1	0	0	0	0	0	0	0	0	**4**
Shadeland	2	1	1	0	0	0	0	0	1	0	0	0	0	**5**
Total Essential Facilities	**53**	**23**	**9**	**8**	**17**	**1**	**4**	**10**	**67**	**20**	**5**	**10**	**5**	**232**

Note: Information for critical/essential facilities was gathered by the Planning Committee and the HAZUS database.
* Specialized Homes classification includes nursing homes as well as the Indiana Veteran's Home and the Cary Home (for children)
** Washington and Durgan Elementary Schools are no longer operating as public schools, but they operating as different learning institutions and have been kept on the list.

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Appendix E

TEMA HAZ-MAT RESPONSES 2000 - 2003

2001 RESPONSES					
Substance Spilled	*Number*	*Cause*	*Number*	*Location*	*Number*
Fuel Spill	22	Auto Accident	24	State Highway	11
Used Oil	3	Drainage Ditch	4	County Road	14
Hydrlic Oil	1	Leak Unknown	17	City Street	25
Anti-Freeze	1	Underground Tank	1		
Nothing Found	5	Leaking A/G Tank	1		
Corn Starch	1	Car Fire	2		
Freon	1	Decon	1		
Propylene	1				
Mercury	1				
Unknown Substance	12				
Fat	1				
Chlorine	1				
TOTAL ACCIDENTS	**50**		**50**		**50**
2002 RESPONSES					
Substance Spilled	*Number*	*Cause*	*Number*	*Location*	*Number*
Fuel Spill	13	Auto Accident	11	State Highway	4
Used Oil	1	Drainage Ditch	1	County Road	6
Unknown Substance	1	Leak Unknown	5	City Street	10
Chlorine	1	Underground Tank			
Potassium	1	Leaking A/G Tank			
Natural Gas	1	Car Fire			
Halothane	1	Decon	1		
Syrencos	1	Construction Accident	2		
TOTAL ACCIDENTS	**20**		**20**		**20**
2003 RESPONSES					
Substance Spilled	*Number*	*Cause*	*Number*	*Location*	*Number*

Fuel Spill	13	Auto Accident	14	State Highway	10
Used Oil	2	Drainage Ditch	1	County Road	3
Anti-Freeze	1	Leak Unknown	12	City Street	17
Unknown Substance	9	Underground Tank			
Fat	1	Leaking A/G Tank	1		
Chlorine		Car Fire			
Latex Paint	1	Decon			
Potash	1	Construction Accident	2		
Natural Gas	1				
Bromine	1				
TOTAL ACCIDENTS	**30**		**30**		**30**

Note: The Hazardous Materials Response Team responds to requests from local police and fire departments. After a briefing by the site's commander, the team performs an assessment and advises the steps it will take to render the scene safe.