ITEM RES 00-05274

VILLAGE OF DOWNERS GROVE
REPORT FOR THE VILLAGE COUNCIL MEETING
JULY 9, 2013 AGENDA

SUBJECT:	TYPE:	SUBMITTED BY:
Adoption of the 2012 DuPage County Natural Hazard Mitigation Plan	✓ Resolution Ordinance Motion Discussion Only	Nan Newlon, P.E. Director of Public Works

SYNOPSIS
A resolution has been prepared for adoption of the 2012 DuPage County Natural Hazard Mitigation Plan.

STRATEGIC PLAN ALIGNMENT
The goals for 2011-2018 identified *Exceptional Municipal Services*

FISCAL IMPACT
N/A

RECOMMENDATION
Approval on the July 9, 2013 consent agenda.

BACKGROUND
To receive Federal Emergency Management Agency (FEMA) and Illinois Emergency Management Funding (IEMA) for natural disaster mitigation, the Village is required to adopt a natural hazard mitigation plan. The plan, which is coordinated in a county-wide effort by the DuPage County Office of Homeland Security, indentifies ways through which the county, municipalities and townships can reduce the impact of natural disasters on residents, public facilities and businesses. The plan is the same for each municipality. The previous plan was developed in October 2007.

Village staff participated in the plan update meetings. Each municipality has until July 12, 2013 to pass a local ordinance or resolution to adopt the county's plan.

ATTACHMENTS
Resolution
2012 DuPage County Natural Hazard Mitigation Plan

Resolution No. ___
DuPage County Natural Hazards Mitigation Plan

Whereas the Village of Downers Grove (the Village) is subject to natural hazards, such as, floods, severe summer and winter storms, tornadoes, and extreme heat events; and

Whereas natural hazards can damage property, close businesses, disrupt traffic, threaten lives, and present public health and safety hazards; and

Whereas the DuPage County Natural Hazards Mitigation Workgroup has prepared a recommended *DuPage County Natural Hazards Mitigation Plan* that reviews the Village's options to protect people and reduce damage from the hazards; and

Whereas the Village has participated in the development of the *DuPage County Natural Hazards Mitigation Plan*; and

Whereas the recommended *DuPage County Natural Hazards Mitigation Plan* has been presented for review by residents and federal, state and regional agencies;

Now therefore, be it resolved that:

1. The 2012 *DuPage County Natural Hazards Mitigation Plan* is hereby adopted as an official plan of the Village of Downers Grove.

2. The *DuPage County Natural Hazards Mitigation Plan* identifies a series of action items. The following action items are hereby assigned to the noted person or department of the Village. The designated person or department shall be responsible for the implementation of the action item, provided that resources are available, by the deadline listed in the Plan.

A. Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
B. Urban Forestry - Participation in Tree City USA
C. Community Rating System Participation
D. Community Rating System Information Workshop
E. Property Protection Checklist
F. Property Protection Projects
G. Continued Watershed Management
H. Structural Flood Control Projects
I. Stream Maintenance Programs
J. Participation in StormReady
K. Identification of Floodplain Structures
L. Review of Critical Facilities
M. Development of Flood Stage Maps
N. Seek Mitigation Grant Funding for Additional Mitigation Planning Cost Beneficial Projects
O. Development of a Public Information Strategy
P. Property Protection References

3. The Village's Stormwater Administrator is hereby appointed as the Village's representative on the DuPage County Natural Hazards Mitigation Workgroup. The offices charged with implementation of action items in Section 2 shall keep the representative advised of their progress and recommendations.

ADOPTED this the _____ day of _____, 2013

_____
Martin T. Tully
Mayor

(SEAL)

APPROVED this the _____ day of _____, 2013

_____
April Holden
Clerk

DUPAGE COUNTY

DuPage County Natural Hazard Mitigation Workgroup

2012

DuPage County, Illinois

Natural Hazards Mitigation Plan

Including:

Village of Addison
Village of Bartlett
Village of Bensenville
Village of Bloomingdale
Village of Burr Ridge
Village of Carol Stream
Village of Clarendon Hills
City of Darien
Village of Downers Grove
City of Elmhurst
Village of Glendale Heights
Village of Glen Ellyn
Village of Hanover Park
Village of Hinsdale
Village of Itasca
Village of Lisle
Village of Lombard
City of Naperville
Village of Oak Brook
City of Oakbrook Terrace
Village of Roselle
Village of Villa Park
City of Warrenville
Village of Wayne
City of West Chicago
Village of Westmont
City of Wheaton
Village of Willowbrook
Village of Winfield
City of Wood Dale
Village of Woodridge

DuPage County Hazard Mitigation Workgroup

November 2012

DuPage County
Natural Hazards Mitigation Plan

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Chapter 1 – Introduction

1.1 Overview

DuPage County, Illinois, is subject to natural hazards that threaten life and health, and have caused extensive property damage. Major floods struck in 1972, 1974, 1976, 1987, 1996, 2008, and 2010. The County has taken significant steps to mitigate against future flood damage since the 1987 flood; however, more remains to be done. Tornadoes caused damage in 1967, 1976 and 1996. Blizzards and snowstorms impacted the County in 1979, 1999, 2001, and 2011. To address the potential impact and mitigation opportunities of these and other natural hazards DuPage County and the participating municipalities, agencies and institutions have developed this *Natural Hazards Mitigation Plan in 2007, and have updated the plan in 2012. This plan expands and builds off of the foundation created in 2007.*

> *"Hazard mitigation is defined as any sustained action taken to reduce or eliminate long-term risk to life and property from a hazard event."*
>
> Source: Federal Emergency Management Agency

"Hazard mitigation" does not mean that all hazards are stopped or prevented. It does not suggest complete elimination of the damage or disruption caused by such incidents. Natural forces are powerful and most natural hazards are well beyond our ability to control. Natural hazards can be compounded manmade hazards and vice versa. Hazard mitigation does not mean quick fixes. Hazard mitigation means a long-term, permanent approach to reduce hazard vulnerability. Hazard mitigation also means a comprehensive approach to minimizing the impact of hazards.

Purpose of Planning: Every community must address natural hazards. Every community has different resources and interests relating to natural hazards. There are many ways to deal with hazards, there are many agencies that can help, and there are many solutions for managing or mitigating hazards.

Planning is one of the best ways to assess hazards and resources in order to produce a long-term sustainable program of activities that will best mitigate the impact of hazards and, often times, meet other needs. A well-prepared plan will ensure that all possible activities are reviewed and implemented so that the problem is addressed by the most appropriate and efficient solutions. It can also ensure that activities are coordinated with each other and with other goals and activities, preventing conflicts and reducing the costs of implementing each individual activity.

Mitigation activities need funding. A mitigation plan is now a requirement for Federal mitigation funds. Section 104 of the Disaster Mitigation Act of 2000 (42 USC 5165) states that after November 1, 2003, local governments applying for *pre*-disaster mitigation funds must have an approved local mitigation plan. Also, since November 1, 2004, a plan is needed for *post*-disaster mitigation funds under the Hazard Mitigation Grant Program. These requirements are contained in 44 CFR (Code of Federal Regulations) Part 201.

Therefore, a mitigation plan will both guide the best use of mitigation funding and meet the prerequisite for obtaining such funds from the Federal Emergency Management Agency (FEMA). FEMA also recognizes plans through its Community Rating System, a program that reduces flood insurance premiums in participating communities.

Purpose of this *Plan*: This *Plan* identifies activities that can be undertaken by both the public and the private sectors to reduce safety hazards, health hazards, and property damage caused by natural hazards. The *Plan* focuses on the six major natural hazards facing DuPage County: floods, winter storms, tornadoes, severe summer storms, earthquakes, and extreme heat. The *Plan* also attempts to address a major secondary effect of these natural hazards: power outages.

This *Plan* fulfills the federal mitigation planning requirements for mitigation funding, and it provides the County, municipalities, agencies, and institutions with a blueprint for reducing the impacts of these natural and manmade hazards on people and property.

1.2 Planning Approach

This *Plan* reviews mitigation alternatives and selects those that will work best for DuPage County and participating municipalities, agencies, and institutions. It provides carefully considered directions to the County government and to the participating municipalities by studying the overall damage potential and ensuring that public funds are well spent.

Mitigation Workgroup: This *Natural Hazards Mitigation Plan* was developed under the guidance of a Hazard Mitigation Workgroup, created by a resolution of the DuPage County Board on August 8, 2006. The municipalities and colleges within DuPage County were invited to participate. Interested municipalities passed a resolution stating their commitment to the plan development. The Workgroup's members include representatives of County offices, interested municipalities, fire protection districts and the College of DuPage.

Most members of the Workgroup are municipal representatives to the stormwater ordinance administrator's workgroup, coordinated by the DuPage County Stormwater Management Division, and/or the Local Emergency Managers Coordination (LEMC) group, sponsored by the DuPage County Office of Homeland Security and Emergency Management. The member organizations and primary representatives who attended Mitigation Workgroup meetings are shown in Table 1-1. All participants are listed in Appendix A. In 2010, the DuPage County Office of Homeland Security and Emergency Management took over coordination of the Hazard Mitigation Workgroup.

The Workgroup met nine times during the eleven month period from May 2006 through April 2007. It reviewed the hazards and their effects on people and property, considered a variety of ways to reduce and prevent damage, and recommended the most appropriate and feasible measures for implementation. Annually since 2007, the Workgroup has met to discuss and document the required Annual Reports.

Technical support for the planning effort was provided by the DuPage County Stormwater Management Division and Molly O'Toole & Associates, Ltd., a hazard mitigation planning consulting firm.

Table 1-1 – 2012 Natural Hazard Mitigation Workgroup Members

DuPage County Natural Hazards Mitigation Workgroup	
DuPage County Departments	
Agency	**Representative**
Homeland Security and Emergency Management	David Bunge Safia Rabah
Stormwater Management	Sarah Ruthko Mary Mitros Jamie Geils
Public Works	Greg Phillips
Economic Development	Jen Boyer Jim Stran Clayton Heffter
Forest Preserve	Brock Lovelace
Municipalities	
Village of Addison	Bob Nissen Rick Federighi Kai Liu
Village of Bartlett	Mike McGuigan Brian Goralski Steven Bosco
Village of Bensenville	Don Schultz
Village of Bloomingdale	Michael Marchi
Village of Burr Ridge	Tim Vaclav
Village of Carol Stream	Jim Knudsen
Village of Clarendon Hills	Dan Underleider
City of Darien	Gerry Piccoli
Village of Downers Grove	Karen Daulton Lange Nathaniel Hawk
City of Elmhurst	Don Novak
Village of Glendale Heights	John Hanson Steve Ewoldt Roy Charvat
Village of Glen Ellyn	Bob Minix Dave Buckley
Village of Hanover Park	Tom Cortese Howard Killian
Village of Hinsdale	Kevin Votava Dan Deeter
Village of Itasca	Scott Heher
Village of Lisle	Jason Elias

	Mary Lou Kalsted Randall Johnson
Village of Lombard	Doug Cail Jana Bryant
City of Naperville	Dan Nelson
Village of Oak Brook	Michael Hullihan Blaine Wing Michelle Ruska
City of Oakbrook Terrace	Todd Kupsak Wayne Holakovsky
Village of Roselle	Robert Tinucci
Village of Villa Park	John Beckwith Vydas Juskelis
City of Warrenville	Jim Burke Phil Kuchler
Village of Wayne	Tom Read
City of West Chicago	Chris Woodill
Village of Westmont	David Lincoln Noriel Noriega
City of Wheaton	Vince Laoang
Village of Willowbrook	Garrett Hummel Tim Halik Peter Krumins
Village of Winfield	Chuck Martschinke, Peter Krumins
City of Wood Dale	John Forrest
Village of Woodridge	Bill Hoogland Chris Bethel
Argonne National Laboratories	Joseph Kirts Tonya Petty

Planning Process: The Hazard Mitigation Workgroup followed a 10-step process, based on FEMA guidance and requirements. Step 1 of the planning process was to organize, which the Hazard Mitigation Workgroup did in May and June 2006. The Workgroup has continued to meet annually since then. In 2012, the Workgroup met on 10/26 to begin the 5-year plan update process. All DuPage County municipalities were also encouraged to participate in two separate online surveys to provide opportunities for input. A final webinar meeting was held for municipalities on 12/21 to solicit input and review changes to the updated plan.

Public Involvement: Step 2 of the planning process was to obtain input from the public, particularly residents and businesses that have been affected by natural hazards. The public was invited to participate through several concurrent means, including:

– Contact with Workgroup members and their organizations

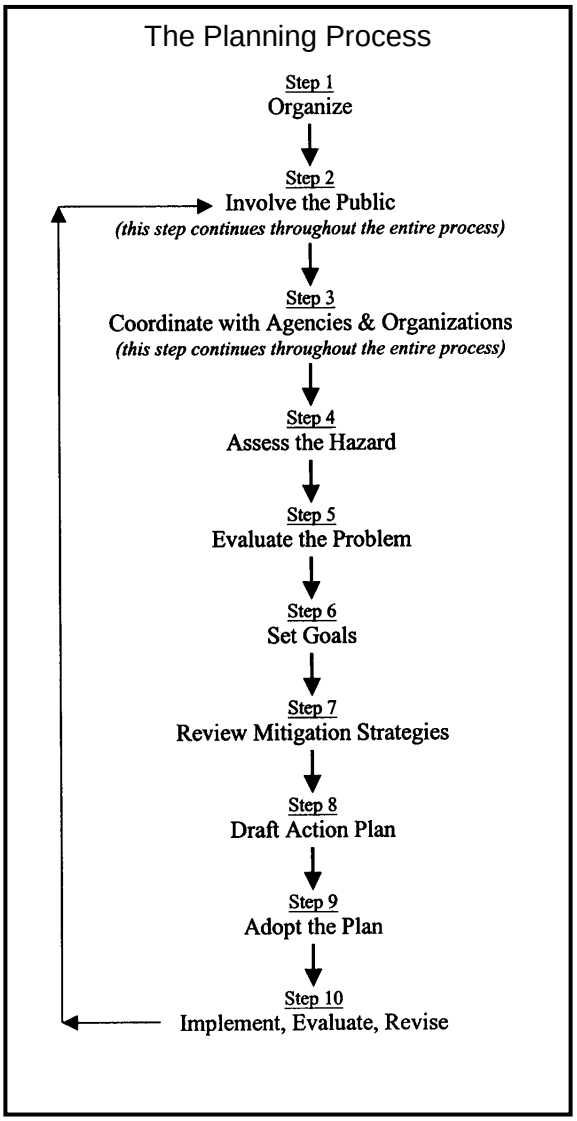
– Workgroup meetings open to the public

– Press releases and mitigation information provided to DuPage County local newspapers and reporters

– A public meeting was held on September 26, 2007 at the DuPage County Complex to receive comments on the draft plan

- Another public meeting was held on November 19, 2012 at the DuPage County Complex to receive comments on the 5-year plan update

Examples of public involvement efforts are provided in Appendix B.



Coordination: Existing plans and programs were reviewed during the planning process. It should be underscored that this *Plan* does not replace other county or municipal planning efforts, such as the County's stormwater management plan, comprehensive plans, or local emergency management plans. This *Plan* is intended to complements those efforts.

During the planning process, contacts were made with regional, state, and federal agencies and organizations to determine how their programs affect or could support the County's mitigation efforts.

- U.S. State Geological Survey (USGS)

- U.S. Army Corps of Engineers (USACE)
- National Weather Service (NWS)
- Federal Emergency Management Agency (FEMA)
- Illinois Emergency Management Agency (IEMA)
- Illinois Department of Natural Resources (IDNR)
- Illinois State Water Survey

In most cases, these agencies did not provide any information or comments in response to this effort. Direct discussions with several of them did prove helpful. These agencies were given the opportunity to comment on the draft *Plan*.

The DuPage County Transportation Division, Public Works, Health Department, and GIS department were also included in coordination efforts.

Hazard Assessment and Problem Evaluation: The Workgroup undertook steps 4 and 5 of the planning process from June to October 2006. In addition, the hazard assessment and problem evaluation were reviewed in February 2007. The potential hazards reviewed were based on the natural hazards identified by the County. Each hazard was scored for its likelihood of occurring or frequency, its potential impact or consequences, and the vulnerability of the County to them. Five natural hazards had an overall score of "high" or "medium": floods, severe summer storms, severe winter storms, tornadoes, and extreme heat.

DuPage County Hazard Mitigation Workgroup Meeting

The hazard data and the Workgroup's findings and conclusions are covered in Chapter 2 of this *Plan*. Chapter 2 examines the hazards, including a hazard assessment – what causes the hazard and the likelihood of occurrence, and a vulnerability assessment – and the impact of the hazard on life, health, and property.

Goals: Mitigation planning goals were developed by the Hazard Mitigation Workgroup. A goal-setting exercise was conducted at the September 2006 meeting. The goals were reviewed and revised at the October 2006 meeting. The goals are presented and discussed in Chapter 3 of this *Plan*. Objectives or guidelines to go with the goals were developed as the Workgroup examined the mitigation strategies. The guidelines are presented in Chapter 9 with the Action Plan.

During the plan update process in 2012, DuPage County representatives met to re-evaluate and score the hazards listed in the 2007 plan. All hazards remained the same as listed in the 2007. An additional hazard – power outage was added. Although not a natural disaster, loss of power has been a regular side effect of natural disasters since 2007, and it was determined that steps should be taken to mitigate these effects.

Mitigation Strategies: The Hazard Mitigation Workgroup considered a range of hazard mitigation alternatives. The Workgroup examined current mitigation efforts and then considered a variety of measures that could affect the impact of the hazards. The mitigation strategies have been organized under six categories and all measures were reviewed in relationship to the developed mitigation goals. The mitigation strategies are the subject of Chapters 4 – 8 in this *Plan*.

- Property protection – such as, relocation out of harm's way, retrofitting buildings, insurance.
- Preventive – such as, zoning, building codes, other development regulations, wetlands protection, urban forestry programs.
- Structural projects – such as, levees, reservoirs, channel improvements.
- Emergency services – such as, warning, sandbagging, evacuation.
- Public information – such as, outreach projects, technical assistance to property owners.

Action Plan: After the review of mitigation alternatives, the Workgroup drafted an "Action Plan" that specifies recommended efforts and projects. The Action Plan describes who is responsible for implementing the mitigation measure, when the measures are to be done, and an estimate of cost and potential funding sources. The Action Plan was developed with the consideration of the continuation of the Mitigation Workgroup, but also the consideration of the countywide coordination that takes place through the stormwater administrator's group and the LEMC. The Action Plan is included in Chapter 9 of this *Natural Hazards Mitigation Plan*.

It should be noted that this *Plan* serves only to recommend mitigation measures. Implementation of these recommendations depends on adoption of this *Plan* by the DuPage County Board and the city council or board of trustees of each participating municipality. It also depends on the cooperation and support of the offices designated as responsible for each action item.

1.3 DuPage County

DuPage County is located 20 miles west of Chicago in northeastern Illinois. The County Seat is Wheaton, Illinois. DuPage County is approximately 334 square miles. DuPage County is bordered by Cook County to the east, Lake and McHenry Counties to the north, Kane County to the west, and Will County to the south.

DuPage County includes nine townships (Exhibit 1-1) and contains portions of 39 municipalities (Exhibit 1-2). A list of municipalities with general information, including the community

number for FEMA's National Flood Insurance Program (NFIP) and participation in the NFIP's Community Rating System (CRS), are shown in Table 1-2. The NFIP and CRS programs are discussed in Chapter 4. The College of DuPage is located in Glen Ellyn, Illinois.

Watersheds, Topography and Soils: DuPage County has six major watershed areas: Salt Creek, the East Branch of the DuPage River, the West Branch of the DuPage River, Sawmill Creek, the Des Plaines River Tributaries, and the Fox River Tributaries. The northeastern part of the County is drained by Salt Creek, which flows to the south-southeast. The central part of the County is drained by the West and East Branches of the

Table 1-2 – DuPage Community Information

DuPage County Community Information				
Community	**Incorporation Date**	**Home Rule**	**NFIP Number**	**CRS Community**
Addison, Village of	1884	Yes	170198	Yes
Aurora, City of	1857	Yes	170320	
Bartlett, Village of	1891	Yes	170059	Yes
Batavia, Village of	1891	No	170321	
Bensenville, Village of	1884	No	170200	
Bloomingdale, Village of	1889	Yes	170201	
Bolingbrook, Village of	1965	Yes	170812	
Burr Ridge, Village of	1956	No	170071	
Carol Stream, Village of	1958	Yes	170202	
Chicago, City of	1833	Yes	170074	
Clarendon Hills, Village of	1924	No	170203	
Darien, City of	1969	No	170750	
Downers Grove, Village of	1873	Yes	170204	Yes
Elk Grove Village, Village of	1956	Yes	170088	
Elmhurst, City of	1881	Yes	170205	
Glendale Heights, Village of	1959	Yes	170206	Yes
Glen Ellyn, Village of	1892	Yes	170207	
Hanover Park, Village of	1958	Yes	170099	
Hinsdale, Village of	1873	No	170105	
Itasca, Village of	1890	No	170210	
Lemont, Village of	1873	No	170117	
Lisle, Village of	1956	No	170211	Yes
Lombard, Village of	1869	No	170212	
Naperville, City of	1857	Yes	170213	Yes
Oak Brook, Village of	1958	No	170214	Yes
Oakbrook Terrace, City of	1958	No	170215	
Roselle, Village of	1922	No	170216	
St. Charles, City of	1834	Yes	170158	Yes
Schaumburg, Village of	1914	Yes	170330	
Villa Park, Village of	1915	No	170217	
Warrenville, City of	1967	Yes	170218	
Wayne, Village of	1958	Yes	170865	
West Chicago, City of	1873	No	170219	
Westmont, Village of	1922	No	170220	
Wheaton, City of	1859	Yes	170221	
Willowbrook, Village of	1960	No	170222	Yes
Winfield, Village of	1921	No	170223	
Wood Dale, City of	1928	No	170224	Yes
Woodridge, Village of	1958	Yes	170737	
Unincorporated DuPage Co.			170197	
College of DuPage		n/a	n/a	

Exhibit 1-1

Map of DuPage County Townships

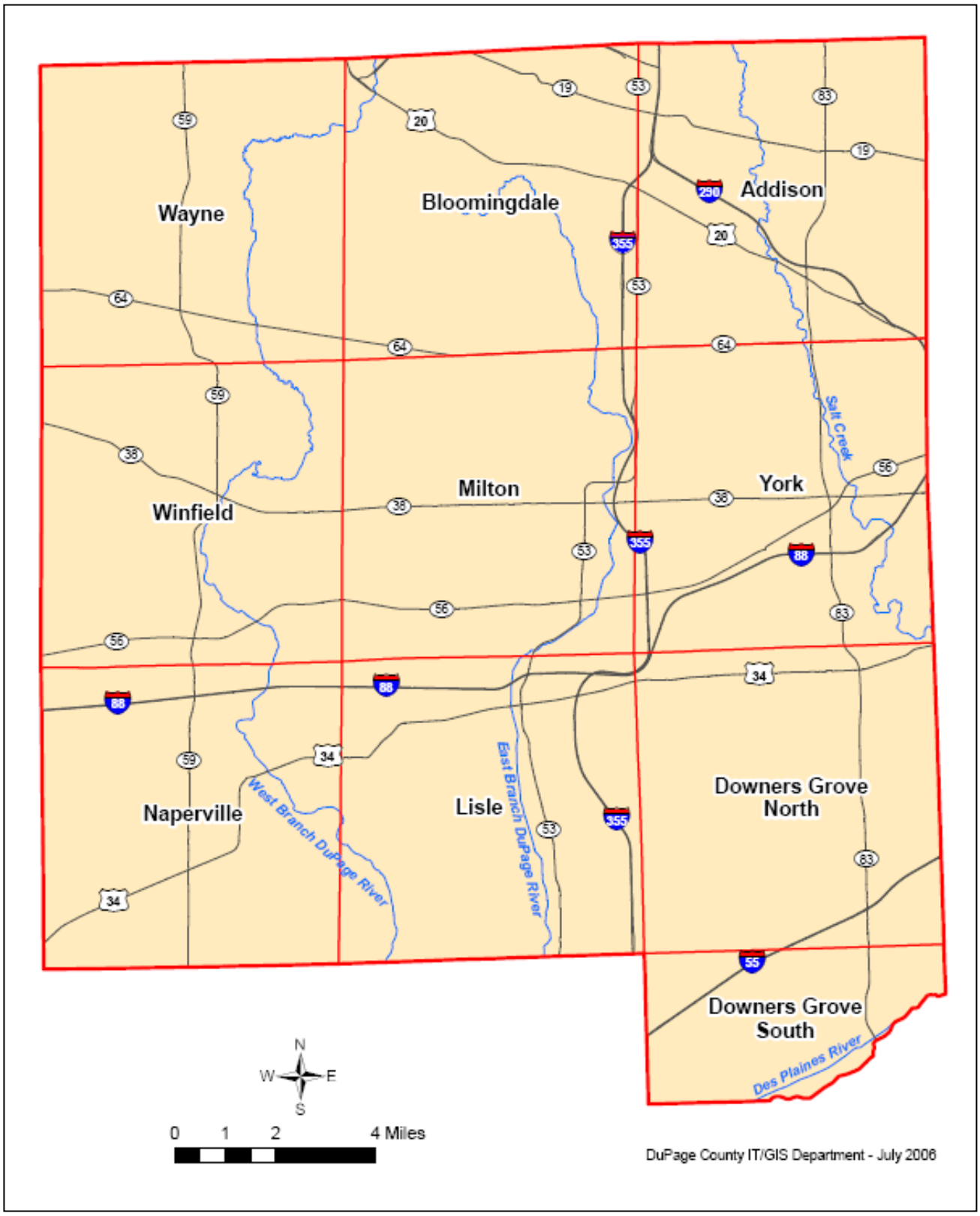
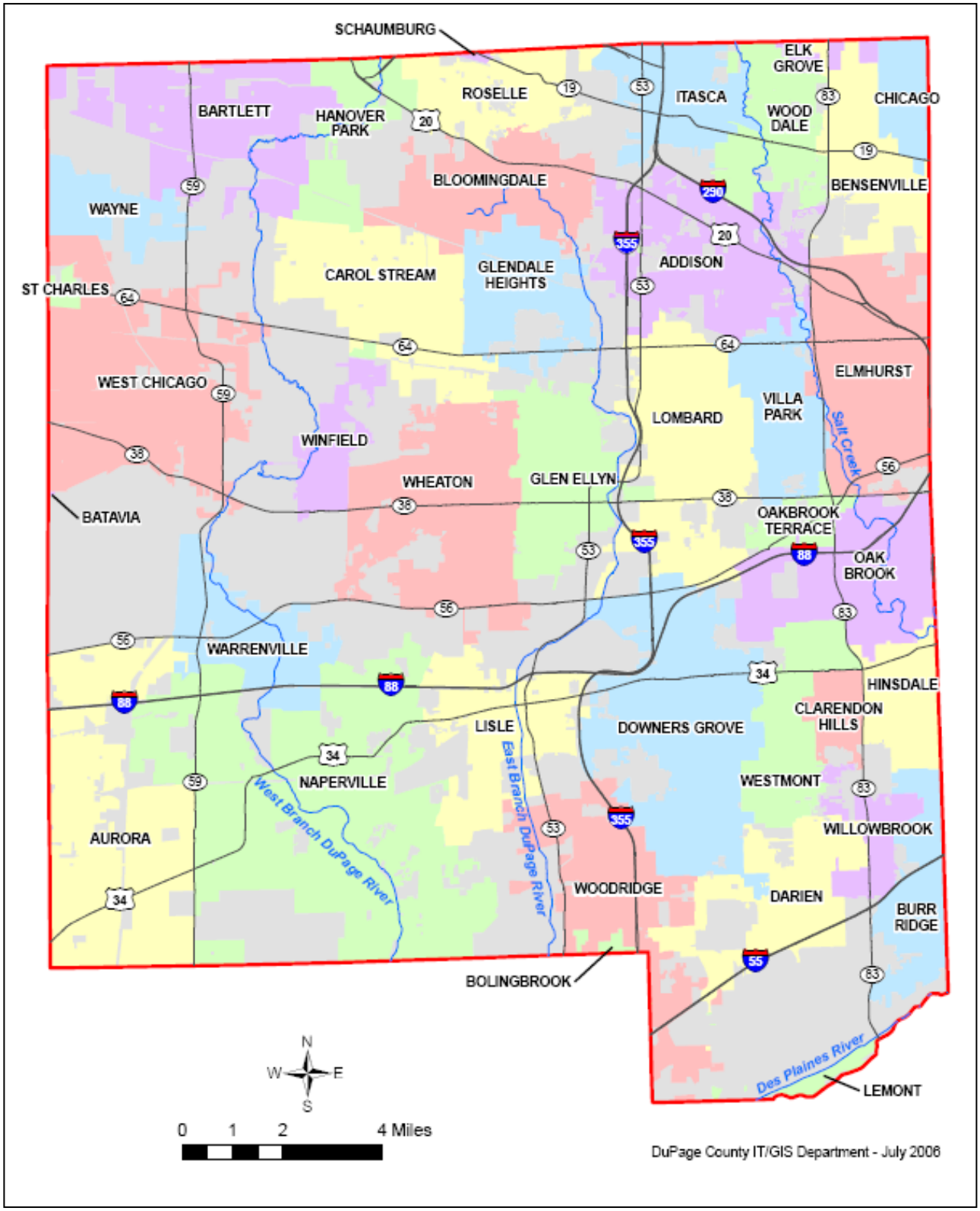


Exhibit 1-2
Map of DuPage County Municipalities



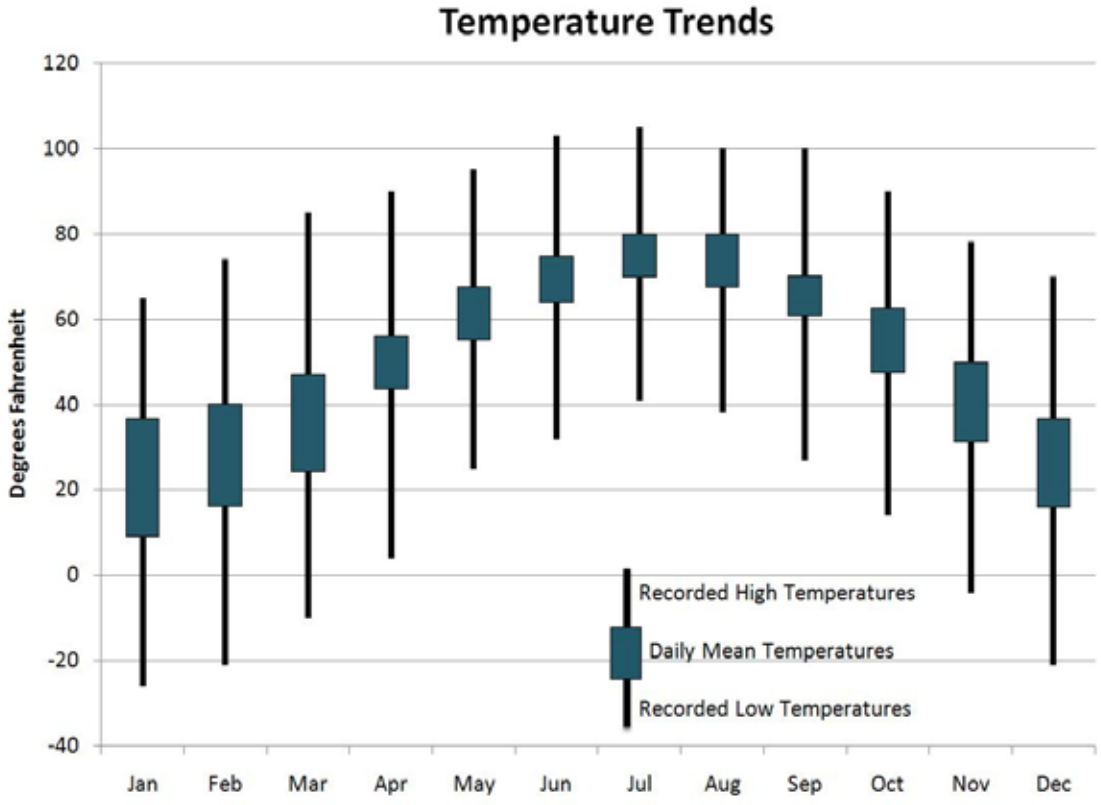
DuPage River, which generally flow south. The southeast corner of the County is drained by the Des Plaines Rivers, which flows to the southwest. The northwest and southwest corners of the County are drained by tributaries that flow to the Fox River. Exhibit 1-3 shows the County's major streams and watersheds.

The land surface elevation is highest in the northwestern part of the County. The land surface gradually slopes to the southeast. Most of the County is relatively flat. The highest natural elevation in the County is about 855 feet above sea level at Mt. Hoy. The lowest elevation is about 585 feet above sea level in the Des Plaines River Valley at the southeast part of the County.

DuPage County soils are predominately silt loams and silty clay loams. Portions of DuPage County are underlain by sand and gravel. Groundwater is available from one shallow and one deep aquifer system. The bedrock of DuPage County consists primarily of dolomites.

Climate:

The weather statistics shown below were taken from data collected at the Wheaton weather observation station dating back to 1895 through 2006 courtesy of the Illinois State Water Survey.



The highest temperature ever recorded was 105 °F on July 14, 1995; the lowest temperature recorded was -26 °F on January 20, 1985. The area experiences on average 37.94 inches of precipitation annually where most of this precipitation occurs as spring and summer thunderstorms when moisture from the Gulf of Mexico meets cooler air.

Table 1-3 DuPage County Average Monthly Precipitation Totals

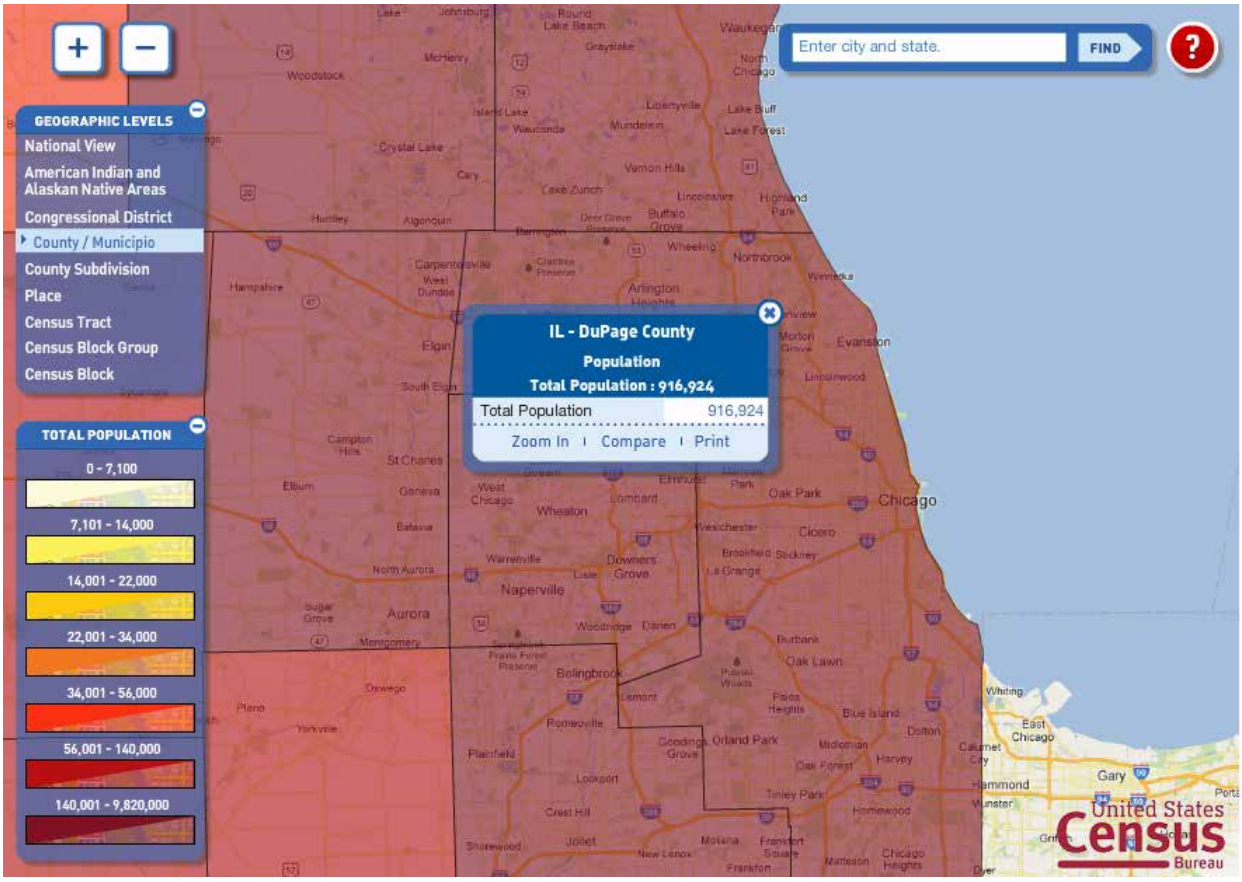
Month	Monthly Total (in)			1-Day Record (in)	Date Occurred
	Highest	Average	Lowest		
Jan	6.61	1.85	0.12	2.89	1/12/1960
Feb	5.58	1.56	0.00	2.85	2/21/1997
Mar	7.28	2.62	0.38	3.39	3/19/1948
Apr	9.42	3.80	0.41	5.20	4/05/1947
May	8.34	3.94	0.04	3.79	5/10/1990
June	10.65	3.91	0.56	4.05	6/21/1939
July	11.95	3.97	0.11	9.24	7/18/1996
Aug	15.53	4.60	0.55	6.01	8/14/1987
Sept	11.23	3.38	0.00	3.35	9/07/1998
Oct	10.87	2.66	0.16	5.60	10/10/1954
Nov	7.20	3.20	0.40	2.98	11/11/1995
Dec	6.14	2.45	0.00	3.04	12/03/1982

The average seasonal snowfall is 36 inches. The greatest snow depth at one time recorded between 1961 and 1990 was 29 inches on January 25, 1979. The average relative humidity in midafternoon is about 60 percent

Some of the precipitations during the winter months were converted to liquid-equivalent of inches from snow depth. DuPage County receives 33.5" of snowfall annually mostly from December to February. The list below consists of the 10 biggest snowstorms as recorded at O'Hare International Airport courtesy of the National Weather Service:

1. 23.0 inches on Jan 26-27, 1967
2. 21.6 inches on Jan 1-3, 1999
3. 20.2 inches on Feb 1-2, 2011
4. 19.2 inches on Mar 25-26, 1930
5. 18.8 inches on Jan 13-14, 1979
6. 16.2 inches on Mar 7-8, 1931
7. 15.0 inches on Dec 17-20, 1929
8. 14.9 inches on Jan 6-7, 1918
9. 14.9 inches on Jan 30, 1939
10. 14.3 inches on Mar 25-26, 1970

Population:



According to the 2010 U.S. Census data, DuPage County had a total population of 916,924. Approximately 88 percent of the County's population resides within the County's 39 municipalities. The average density of people in 2010 is estimated to be 2,799 persons per square mile. The greatest density of people is in the central and eastern portions of the County. A Municipal Population Table shows the municipal population and size of DuPage County communities. The greatest density of people is in the central and eastern portions of the County. Exhibit 1-4 shows the population density in the County by U.S. Census tract. Table 1-3 shows the municipal population and size of DuPage County communities. In 2000, the enrollment at the College of DuPage was almost 29,000. Current enrollment exceeds 30,000 and is expected to grow.

In 2011, the total housing units was estimated at 355,617 units (248,762 owned and occupied; 76,839 rental units; 10,020 vacant housing units) with an average family size of 3.27. The density of people is approximately 2,799 people to every square mile. The labor force is about 521,189 people.

Another important estimate for the County is the estimated travel time for people to get to work. People commute to work location both inside and outside DuPage County. It is estimated that 44 percent of the DuPage population travels 30 minutes or more to work.

Like many suburban areas around the United States, DuPage County is experiencing a significant population change. Although the County will continue to experience modest population growth, the new residents are increasingly likely to be members of minority groups, particularly Latinos, or international immigrants. Further, many more low income persons are and will be living in DuPage County.

Population growth is the basic indicator. While surrounding counties are experiencing suburban sprawl and farmlands are being rezoned into residential developments, DuPage County has mostly exhausted all of its farmland with developments. The future of the County as its population exceeds one-million people will see DuPage not just as a suburb of Chicago, but as a growing economic power in the region that draws top technological employers. As urbanization occurs, emergency management must evolve to support the larger population and the new challenges that come with a larger population density.

DuPage County continues to be the second most populated county in Illinois. In 2007, DuPage County had an estimated population of 929,192. This is a 2.2% increase in five years, where the population was 909,476 in 2002.

Table 1-4 DuPage County Population

Census Year	Population (Estimates)
2002	909,476
2003	909,856
2004	913,386
2005	913,781
2006	932,670
2007	929,192
2010	916, 924
2011	923, 222

Exhibit 1-3
Map of DuPage County Watersheds

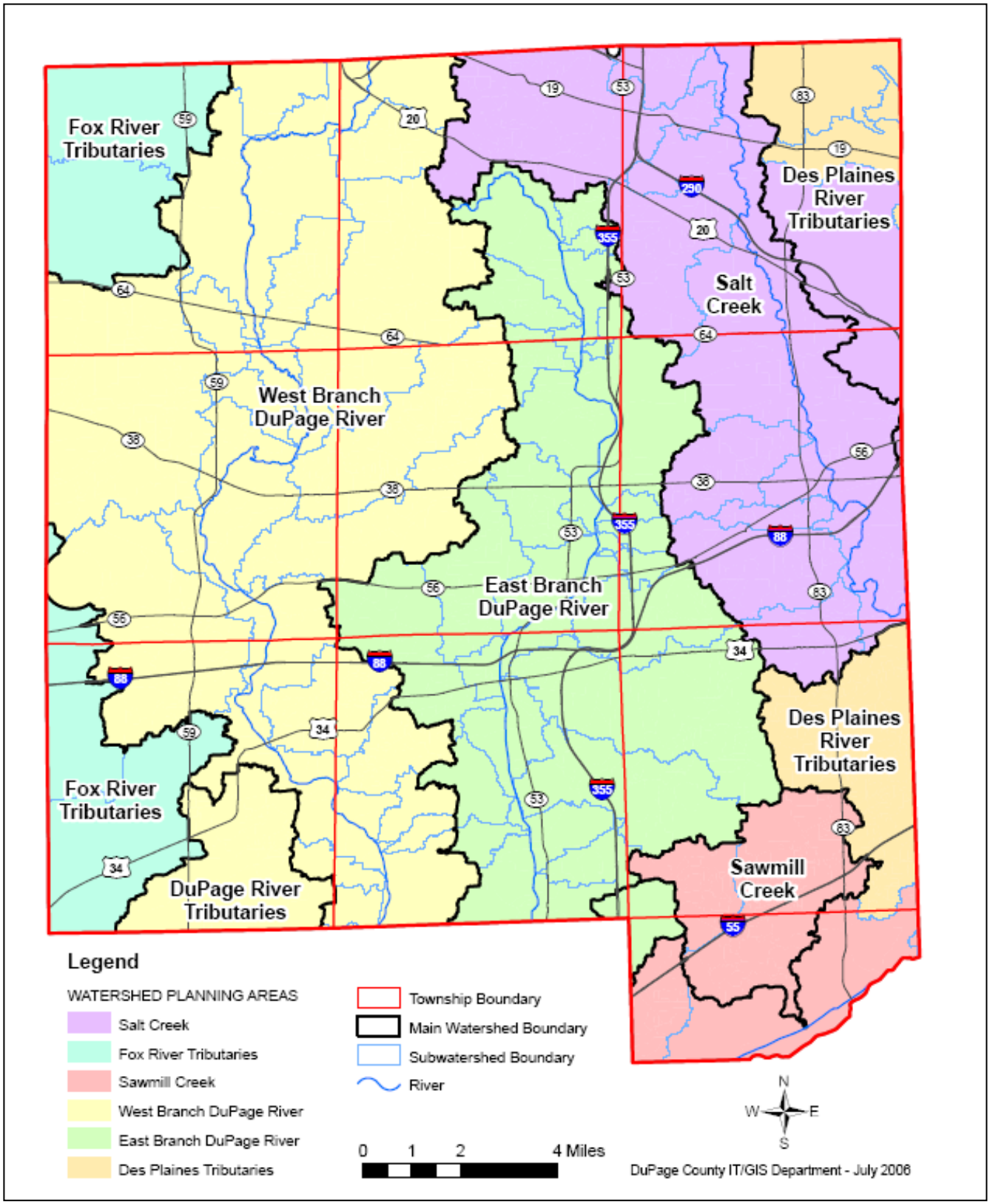


Exhibit 1-4
DuPage County Population Density by U.S Census Tract (2000)
Source: U.S. Census Bureau

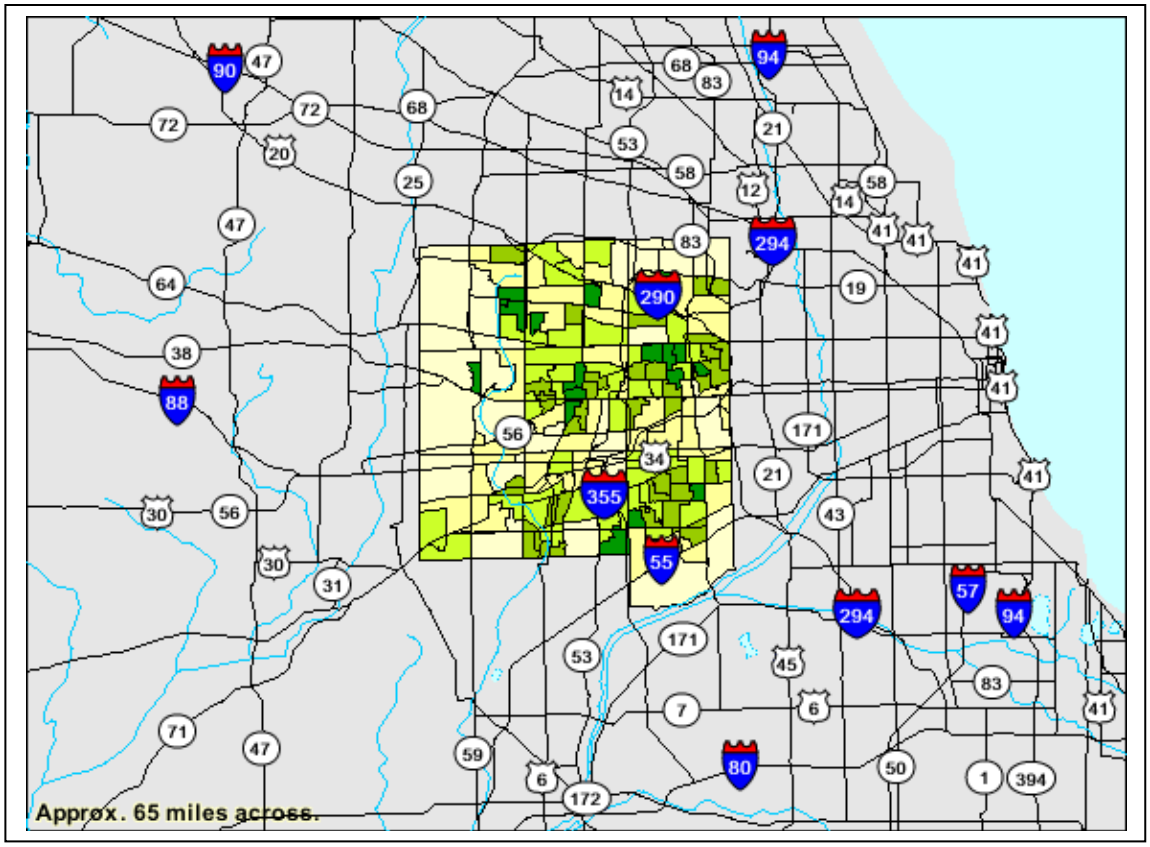


Table 1-5 DuPage County Population and Land Area Information

	Population, 2010 Census						Area in square miles		
Community	**Total Population**	**DuPage**	**Cook**	**Kane**	**Kendall**	**Will**	**Total area**	**DuPage Area**	**Area in Other Counties**
Addison, Village of	37, 198	37,198					9.98	9.98	0
Aurora, City of	197,899	49,433		142,990	840*	2,955*	45.80	19.65	26.15
Bartlett, Village of	41,208	24,411	12,196	2			15.86	10.85	5.01
Batavia, Village of	25,983	2,117*		23,866			9.70	0.53	9.17
Bensenville, Village of	18,352	18,352					5.62	5.41	0.21
Bloomingdale, Village of	22,047	22,018					7.04	7.04	0
Bolingbrook, Village of	73,366	1,571				54,573*	24.26	3.88	20.38
Burr Ridge, Village of	10,559	6,719	3,623*				7.14	4.69	2.45
Carol Stream, Village of	39,740	39,740					9.42	9.42	0
Chicago, City of	2,707,123	2,703,466*	2,896,014*				234.11	2.41	231.7
Clarendon Hills, Village of	8,427	8,427					1.81	1.81	0
Darien, City of	22,086	22,086					6.30	6.30	0
Downers Grove, Village of	47,833	47,833					14.45	14.45	0
Elk Grove Village, Village of	33,127	0					11.41	1.02	10.39
Elmhurst, City of	44,121	44,121					10.31	10.28	0.03
Glendale Heights, Village of	34,208	34,208					5.51	5.51	0
Glen Ellyn, Village of	27,450	27,450					6.77	6.77	0
Hanover Park, Village of	37,973	17,337	20,755*				6.43	3.38	3.05
Hinsdale, Village of	16,816	14,589	2,140*				4.64	3.71	0.93
Itasca, Village of	8,649	8,649					5.07	5.07	0
Lemont, Village of	16,000	10	13,092*				8.35	2.46	5.89
Lisle, Village of	22,390	22,390					7.02	7.02	0
Lombard, Village of	43,165	43,165					10.45	10.45	0
Naperville, City of	141,853	94,533				37,374*	39.32	29.01	10.31
Oak Brook, Village of	7,883	7,876					8.28	8.27	0.01
Oakbrook Terrace, City of	2,134	2,134					1.27	1.27	0
Roselle, Village of	22,763	19,040	3,460*				5.48	4.81	0.67
St. Charles, City of	32,974	543		27,896*			14.93	1.17	13.76
Schaumburg, Village of	74,198	73,333*	75,386*				19.33	0.33	19
Villa Park, Village of	21,904	21,904					4.75	4.75	0
Warrenville, City of	13,140	13,140					5.62	5.62	0
Wayne, Village of	2,431	1,570		834*			5.87	3.16	2.71
West Chicago, City of	27,086	27,086					15.14	15.14	0
Westmont, Village of	24,685	24,685					5.14	5.14	0
Wheaton, City of	52,894	52,894					11.44	11.44	0
Willowbrook, Village of	8,540	8,540					2.75	2.75	0
Winfield, Village of	9,080	9,080					3.03	3.03	0
Wood Dale, City of	13,770	13,770					4.84	4.84	0
Woodridge, Village of	32,971	32,949					9.58	8.94	0.64
Unincorporated DuPage Co.		97,758					97.35	97.35	0
Totals:		**923,222**						**334**	

Table 1-6 Land Use and Development

Before the 1970s, DuPage County was primarily a group of bedroom communities with residents who worked in Chicago. Substantial investments were made into transportation and utility infrastructure, and along with other public improvements, DuPage County has become a major employment center in the Chicago region. Beginning in the 1980s, DuPage County is one of the fastest growing counties in the nation.

Top Local Employers	
Edward Hospital	Naperville
Alacatel Lucent	Naperville/Lisle
Central DuPage Hospital	Winfield
Elmhurst Hospital	Elmhurst
Advocate Good Samaritan Hospital	Downers Grove
Argonne National Laboratory	Argonne
College of DuPage	Glen Ellyn
Fermi National Accelerator Lab	West Chicago
DeVry Institute	Downers Grove
Navistar	Warrenville
Dreyer Medical Clinic	Aurora
Tellabs	Naperville
Nalco	Naperville
McDonalds	Oak Brook
OfficeMax	Naperville
Sraying Systems	Carol Stream
Ace Hardware	Oak Brook
Computer Associates	Lisle
Sara Lee	Downers Grove
The Pampered Chef	Addison
Molex	Lisle
Nicor	Naperville

Table 1-7

DuPage County Land Uses

Land Use	Percent of County
Rural and Undeveloped Land:	
Agricultural/Vacant	5.8
Open Space/water/recreation	19.6
Total Undeveloped	**25.4%**
Urban and Built-Up Land:	
Single Family Residential	32.0
Multifamily Residential	4.6
Commercial	3.9
Office/Industrial/Business	8.3
Laboratory	3.3
Institutional	3.6
Transportation/Communications/Utilities	19.0
Total Developed	**74.6%**

Source: DuPage County Land Use 2003

Transportation facilities in the county include three interstates and toll roads, nine other State and U.S highways, three major rail lines for commuters and freight, and one air traffic facility.

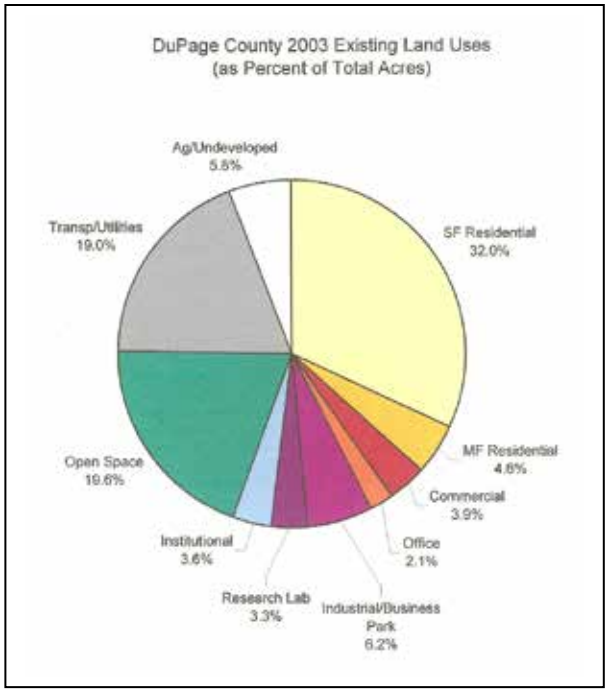
Table 1-5 provides estimated land uses in DuPage County. Almost three-quarters (74.6 percent) of DuPage County is developed. Hazard mitigation is primarily concerned with developed areas of communities - where the people are, where the buildings that they live and work in are. Also of concern is the infrastructure that serves the community.

The "developed" land use category includes residential and commercial development, such as homes, businesses, and industrial uses. The largest category of development in DuPage County is single-family homes (32 percent). The institutional category includes public facilities, schools, churches, hospitals, and offices of federal, state, and regional agencies.

The "undeveloped" land use category includes agricultural land, which is not really "undeveloped." Agricultural land includes things such as farmhouses, nurseries,

agricultural businesses, and improved farmland. However, there is not a concentration of buildings and infrastructure exposed to damage by natural hazards, so it is treated as undeveloped for this *Plan*'s purposes. Also, open space includes the nearly 23,000 acres of land owned by the DuPage County Forest Preserve District.

In keeping with population growth, development has continued to grow in DuPage County. Population growth through 2001 is estimated at 3 percent The County development growth rate is estimated to be 5.6 percent, with much of the future development anticipated in the western portion of DuPage County.



1.5 Critical Facilities

Critical facilities are buildings and infrastructure whose exposure or damage can affect the well-being of a large group. For example, the impact of a flood or tornado on a hospital is greater than on a home or most businesses.

Generally, critical facilities fall into two categories:

- Buildings or locations vital to public safety and the disaster response and recovery effort, such as police and fire stations and telephone exchanges, and
- Buildings or locations that, if damaged, would create secondary disasters. Examples of such buildings or locations are hazardous materials facilities and nursing homes.

Critical facilities in the County and each municipality are included in the Critical Infrastructure Location Manager (CILM), a web-based program that interfaces with the County's GIS. Emergency event parameters can be input into the CILM and a regional database of all critical facilities it provided. Large scale maps and detailed information is readily available to the County and municipal staff, at any time.

Critical facilities were identified by each community participating in this *Plan*. For this mitigation planning effort, the follow seven categories are included in the definition of critical facilities:

1. Hazardous materials sites: These have been broken into two categories based on USEPA classifications: those with "extremely hazardous substances" (EHS) and those without. These definitions are in 40 CFR Part 355, Appendices A and B, which also defines their "threshold planning quantities," i.e., how much of the substance

qualifies as being a concern. EHS includes well over 100 substances, from acetone to zinc phosphide.

2. Health facilities: hospitals and nursing homes.
3. Emergency response facilities: police and fire stations, public works sites, emergency operations centers (EOCs), etc.
4. Utilities: water and wastewater treatment plants, electrical substations, etc.
5. Schools.
6. Places of assembly, such as theaters and churches.
7. Bridges that would be inundated during the base or 100-year flood. These are discussed more in Chapter 2.

Most categories of critical facilities listed above are included in the DuPage County's GIS for emergency management and other planning purposes. Critical facilities included in the broader definition of this Plan are either in other GIS layers (e.g., school) or will be added to the County's database. Due to confidentiality, and due to the large number of critical facilities throughout DuPage County, maps and lists of critical facilities are not printed in this *Plan*. Maps and information on critical facilities are readily available to the County and communities through the County's GIS and the CILM system.

The College of DuPage in Glen Ellyn has nine buildings at the Main Campus and seven buildings at regional sites. Including maintenance facilities and additions, the College maintains 23 building. Construction dates range from 1969 to 2004.

Chapter 2 discusses critical facilities that are impacted by the various types of natural hazard. Hazard mitigation measures for critical facilities are identified in Chapters 4 through 8.

1.6 References

1. Critical facilities data supplied by municipalities and County offices.
2. *DuPage County Economic Profile*, DuPage County Department of Economic Development and Planning, 2006.
3. *DuPage County 2003 Land Use Analysis and Trends*, DuPage County Department of Economic Development and Planning, 2004.
4. *Example Plans*, FEMA/Community Rating System, 2002.
5. *Getting Started – Building Support for Mitigation Planning*, FEMA, FEMA-386-1, 2002.
6. *State and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000*, FEMA, 2002.
7. Survey of County offices and municipalities, July-November 2006.
8. U.S. Census Bureau website.
9. Illinois Emergency Management Agency.
10. DuPage County Flood Insurance Study, FEMA, 2004.

11. *Soil Survey of DuPage County, Illinois*, USDA, National Resource Conservation Service, 1999.
12. DuPage County Information Technology Department.
13. *Student Portrait, Fall Semester 2005*, Meher Choksey and Jan Hunsicker, College of DuPage
14. *Institutional Portrait, 2005-2006*, Terry Perrino, College of DuPage.

Chapter 2 - Hazard Analysis

This chapter will discuss the natural hazards that could impact DuPage County. A list of potential hazards was reviewed by the Hazard Mitigation Workgroup in 2007 and updated by DuPage County in 2012, and priority hazards were selected for analysis. DuPage County assets have been examined in order for potential health, safety and property damage from natural hazards to be estimated.

A section of this chapter is dedicated to the priority hazards. For each hazard there is a hazard analysis and vulnerability analysis. The hazard analysis includes a description of the nature of the hazard, past occurrences and damages, and likelihood or probability of the hazard occurring in the future. The vulnerability analysis compares the probability of the hazard occurring against the possible impact to County assets. A summary of DuPage County hazard analysis is provided at the end of this chapter.

2.1 Natural Hazards

DuPage County is subject to a variety of natural hazards. While flooding has been the most significant natural hazard, the County has experienced damage from severe summer storms, tornadoes, and winter storm events. The most recent severe tornado events occurred in 1976. The most recent flooding occurred in 2008 and 2010 when DuPage County received 10 and 11 inches of rain respectively. DuPage County experienced its most recent blizzard in 2011 with Municipalities receiving approximately between 15-20 inches of snow. These three disasters are the most recent Presidentially Declared Disasters for DuPage County.

Flooding, tornadoes, severe summer and winter storm damage have all warranted federal disaster declarations over the past 39 years. Table 2-1 lists the presidential, or federal, disaster declaration for the County since 1967.

Table 2-1
State and Federal Disaster Declarations for DuPage County

	Fall	Winter	Spring	Summer	Declaration Date	FEMA Disaster Number	Location	Public Assistance*
Tornado			X		4/25/1967	227		
Flood				X	9/5/1972	351		
Flood				X	6/25/1974	438		
Flood			X		9/13/2008	1800	Countywide	$2,328,929
Flood			X		7/24/2010	1935	Eastern DuPage	
Severe Storms				X	6/18/1976	509		
Severe Storms		X			1/16/1979	3068		
Flood				X	8/21/1987	798	Eastern DuPage	
Severe Storms				X	7/25/1996	1129	Western DuPage	$2,460,000

Winter Storms		X			1/8/1999	3134	Countywide	$2,300,000
Winter Storms		X			1/18/2001	3161	Countywide	$1,880,000
Winter Storms		X			1/31/2011	1960	Countywide	$3,041,412
* Dollar amount of public assistance communities received. This estimate does not include individual assistance provided to individual property owners.								

The table shows that disasters have most frequently occurred in the summer and winter. Table 2-2 shows the natural hazards that DuPage County could potentially experience. Using available data, Table 2-2 shows the past frequency of the listed hazards.

Table 2-2
DuPage County Identified and Potential Hazards

Hazard	Area affected or potentially affected (Location)	Past Frequency		
		Occurrences in the last number of years		
		Last 5 years	Last 10 years	Last 30 years
Dam Failure	Downstream areas	0	0	--
Drought	Countywide	9	--	--
Earthquake	Countywide	0	0	--
Extreme heat	Countywide	0	2	--
Extreme cold	Countywide	3	4	--
Flood occurrences	Countywide	14	19	--
Hail*	Storm location	32	56	75+
Lightning*	Storm location	5	--	--
Thunderstorm-microburst*	Storm location	26	56	86+
Tornado	Storm location	0	1	6
Winter Storm – Ice	Countywide	0	0	1
Winter Storm – Snow	Countywide	8	16	--
* Elements of severe summer storms -- No data available.				

The Hazard Mitigation Workgroup undertook an exercise to evaluate the listed hazards in order to determine the level of attention that the hazard warranted in this *Plan*. In the evaluation the Workgroup looked at the expected frequency, impact or consequences of the event and the area of the County that is vulnerable to the hazard. The Workgroup members worked individually, then as small groups to assign points to each hazard for each of the evaluation categories. The results from the small groups were totaled and examined:

Frequency + Impact + Area = Ranking

From a review of the ranking results it was decided that lightning, thunderstorms, and hail storms should be combined under the category of severe summer storms, and snow events, ice storms, and extreme cold should be combined under the category of severe winter storms. The Workgroup selected the following priority natural hazards:

- Floods
- Severe Summer Storms
- Severe Winter Storms
- Tornadoes
- Extreme Heat
- Power Outage*

Power outage is a not a natural disaster but has been a common side effect of several natural disasters affecting jurisdictions throughout DuPage County.

A summary of the Workgroup's ranking of hazards is shown in Table 2-3. This table has been updated in 2012

Table 2-3 DuPage County Workgroup Ranking of Identified and Potential Hazards

Natural Hazard:		Future Frequency:	Impact:	Area Affected:
Priority	**Floods**	Likely	Serious	Large
	Severe Summer Storms	Likely-Frequent	Moderate	Community
	Severe Winter Storms	Likely-Frequent	Moderate	Large
	Tornado	Likely	Serious-Catastrophic	Community
	Extreme Heat	Likely	Moderate	Large
Other	Drought	Seldom	Low-Moderate	Large
	Earthquake	Seldom	Low	Large
	Dam Failure	Seldom	Low	Community
	Power Outage	Likely	Moderate – Serious	Community

The "priority" natural hazards listed in Table 2-3 are discussed in detail in this chapter, and mitigation activities for each hazard are identified in Chapters 4 through 9. Other natural hazards have been recognized, but not addressed in detail at this time.

Information and data for the hazard analysis was collected from the municipalities, regional, state and federal agencies. Other data was developed from DuPage County records and the County's GIS. An important source of information on recorded events was the National Climate Data Center (NCDC) at the U.S. National Oceanic and Atmospheric Administration.

For the vulnerability analysis, the County's GIS was used to examine DuPage County's exposure to floods. The use of FEMA's HAZUS software was not warranted for this *Plan* due to the superior information contained in the County's GIS, as compared to the default data in HAZUS. Also, a HAZUS earthquake analysis was determined to be unnecessary due to the County being only in a "guarded" region of Illinois for earthquake hazard according to the 2010 Illinois Natural Hazards Mitigation Plan by the Illinois Emergency Management Agency.

2.2 Assets and Property Value

2.2.1 Assets

DuPage County's assets include people, buildings, infrastructure, businesses and institutions, the land and natural resources. These assets are summarized in Table 2-4 for purposes of evaluating potential hazards against the potential damage or loss of assets.

People: There are several population groups in DuPage County: Residents, residents who work in DuPage County, residents who commute to DuPage County for work and the college student population who commute to DuPage County schools. While these groups are described below, for purposes of this *Plan*'s vulnerability analysis, calculation will focus on DuPage County residents.

Residents: According to the 2010 U.S Census, the total DuPage population is 916,924. A list of populations by municipality is provided in Table 1-3 in Chapter 1.

It is worth noting that the average density of people in the State of Illinois is 231 persons per square mile. The average density in DuPage County is 2,799 persons per square mile.

Work force: Many residents commute to work locations outside of DuPage County, while at the same time, numerous people commute into DuPage County. The daytime workforce has areas of concentration in the Naperville area, and also in the general Lombard-Oak Brook-Downers Grove area of the County. The student population is another notable group. Again, for the purpose of this *Plan*, it is assumed that the number of commuters who enter the County each day is similar to the number of who commute outside the County.

Students: The majority of the daytime student population is at the elementary, middle and high schools in the County. These students are also resident. Another student population group is those who attend college in the daytime classes in the evening. It is difficult to determine which portions of the college population are also resident and also members of the work force.

Buildings: Buildings shown in Table 2-4 provide a representation of the residential, commercial, industrial and institutional structures in DuPage County estimated by the 2010 U.S. Census and from the 2011 DuPage County Profile report. Not all structures in the County are captured by these numbers. Government owned buildings is an estimate made for the purposes of this plan for the 35 participating communities, agencies, and institutions. It includes village halls, police and fire stations, public works buildings, libraries, and park district buildings.

Residential, or housing, units: Table 2-5 shows the estimated number of housing units in each municipality. Both total housing units in a community are shown, along with the number of housing units in DuPage County. The total housing units represents a municipality's residential exposure to hazards. Housing units in DuPage County will be used for calculating overall vulnerability of the County. There are an estimated 356,179 housing units within DuPage County.

Manufactured housing (mobile homes): There are five manufactured home communities in DuPage County, located near or in Bartlett, Elmhurst, West Chicago, Winfield and Wood Dale. These homes are particularly vulnerable to damage from wind-related hazards. The value of these structures is estimated to be $38,000 (U.S. Census default data).

Housing Density: The average density of housing in DuPage County is approximately 1,300 housing units per square mile. The average housing unit density for the State of Illinois is 88 housing units per square mile.

Non-residential, or non-housing, buildings: As shown in Table 2-4, there are nearly 40,000 non-residential buildings in DuPage County (businesses, hospitals, churches, schools, government facilities, etc.). The range of building types, sizes, and uses makes it difficult to estimate a value. When the County's GIS is expanded for the evaluation of a stormwater utility in DuPage County (in 2007), non-residential buildings can be better assessed.

Resources: The resources category in Table 2-4 provides a snapshot of the open space, recreational and cultural assets in DuPage County.

Table 2-4
DuPage County Estimate of Assets

People:	
Residents	916,924
Workforce	727,776
Students (Elem., High School, Unit)	171,752
Buildings:	
Housing Units	356,184
Businesses	38,648
Churches	717
Hospitals & Rehabilitation Centers	7
Schools	242
Colleges	17
Government Owned	
Transportation:	
Roads (Lanes)	3,427 miles
Bridges	
Airports	1
Rail Stations	27
Resources:	
Forest Preserves	24,718 Acres
Parks	12,436 Acres
Trails	145 miles
Golf Courses	48
Museums, Historic & Nature Centers	53
Agricultural	17,000 acres
Assessed Valuation of Property	$23,659,071,233

Table 2-5
Estimate of Housing Units per Community

Population and Housing Units: 1990 to 2010; and Area Measurements and Density: 2010—Con.

[For information concerning historical counts and geographic change, see "User Notes." For information on confidentiality, nonsampling error, and definitions, see Appendixes]

State County/County Equivalent County Subdivision Place	Population			Housing units			Area measurements in square miles		Average per square mile of land	
	2010	2000	1990	2010	2000	1990	Total area	Land area	Population density	Housing unit density
DuPage County	916,924	904,161	781,689	356,179	335,621	292,543	336.41	327.50	2,799.8	1,087.6
Addison township	88,612	88,900	82,727	31,820	30,968	29,426	32.42	31.74	2,791.8	1,002.5
Addison village (part)	32,103	31,345	28,169	10,741	10,119	9,604	8.09	7.94	4,043.2	1,352.8
Bensenville village (part)	18,352	20,703	17,767	6,743	7,120	6,825	5.44	5.40	3,398.5	1,248.7
Elk Grove Village village (part)	–	–	–	–	–	–	0.71	0.71	–	–
Elmhurst city (part)	11,001	10,590	11,016	3,954	3,898	3,808	3.77	3.75	2,933.6	1,054.4
Itasca village (part)	6,952	6,452	5,436	2,644	2,455	1,881	4.01	3.91	1,778.0	676.2
Lombard village (part)	40	10	20	11	5	6	0.52	0.51	78.4	21.6
Villa Park village (part)	519	435	387	144	139	129	0.47	0.43	1,207.0	334.9
Wood Dale city	13,770	13,535	12,394	5,529	5,220	4,685	4.84	4.72	2,917.4	1,171.4
Bloomingdale township	111,899	111,709	96,050	42,395	39,872	34,133	35.30	34.01	3,290.2	1,246.5
Addison village (part)	4,839	4,569	3,889	1,840	1,686	1,421	1.89	1.82	2,658.8	1,011.0
Bloomingdale village	22,018	21,675	16,614	9,156	8,399	6,221	7.04	6.78	3,247.5	1,350.4
Carol Stream village (part)	17,506	17,683	13,705	6,660	6,217	5,026	5.37	5.21	3,360.1	1,278.3
Glendale Heights village (part)	30,741	29,585	26,580	10,536	10,083	9,379	5.01	4.88	6,299.4	2,159.0
Hanover Park village (part)	6,529	6,672	6,235	2,207	2,099	2,040	1.70	1.65	3,957.0	1,337.6
Itasca village (part)	1,697	1,850	1,511	929	803	706	1.06	1.04	1,631.7	893.3
Lombard village (part)	–	8	(X)	–	2	(X)	0.09	0.09	–	–
Roselle village (part)	19,040	19,655	17,499	7,534	7,122	6,031	4.74	4.67	4,077.1	1,613.3
Schaumburg village (part)	–	–	–	–	–	–	0.12	0.12	–	–
Winfield village (part)	–	–	(X)	–	–	(X)	0.01	0.01	–	–
Chicago city (part)	–	2	–	–	1	–	2.28	2.24	–	–
Downers Grove township	146,795	148,110	137,885	60,438	58,515	53,854	50.93	49.56	2,962.0	1,219.5
Bolingbrook village (part)	–	–	(X)	–	–	(X)	–	–	–	–
Burr Ridge village (part)	6,719	6,785	4,605	2,589	2,320	1,500	4.52	4.39	1,530.5	589.7
Clarendon Hills village	8,427	7,610	6,994	3,338	2,939	2,810	1.81	1.80	4,681.7	1,854.4
Darien city	22,086	22,860	18,140	9,275	8,929	6,700	6.30	6.18	3,573.8	1,500.8
Downers Grove village (part)	38,381	38,824	37,889	15,806	15,197	14,258	9.43	9.37	4,096.2	1,686.9
Hinsdale village (part)	14,036	14,623	13,383	4,829	5,190	5,173	3.52	3.50	4,010.3	1,379.7
Lemont village (part)	10	6	(X)	3	3	(X)	0.75	0.52	19.2	5.8
Oak Brook village (part)	80	81	104	28	20	27	0.08	0.08	1,000.0	350.0
Westmont village (part)	22,476	21,711	19,036	9,648	8,994	8,048	4.43	4.36	5,155.0	2,212.8
Willowbrook village	8,540	8,967	8,701	4,375	4,504	4,144	2.75	2.69	3,174.7	1,626.4
Willow Springs village (part)	–	(X)	(X)	–	(X)	(X)	–	–	–	–
Woodridge village (part)	6,742	5,349	2,668	2,537	1,967	1,258	2.94	2.88	2,341.0	880.9
Lisle township	116,268	117,604	108,452	47,174	44,899	40,619	35.97	35.36	3,288.1	1,334.1
Bolingbrook village (part)	1,571	1,748	1,472	505	503	397	0.33	0.33	4,760.6	1,530.3
Downers Grove village (part)	5,983	6,315	5,476	3,158	3,083	2,770	1.99	1.97	3,037.1	1,603.0
Lisle village (part)	22,231	20,993	19,512	9,860	8,940	8,338	6.93	6.75	3,293.5	1,460.7
Naperville city (part)	46,432	47,314	42,303	16,821	16,193	14,048	11.16	11.03	4,209.6	1,525.0
Woodridge village (part)	26,207	25,585	23,564	10,845	9,741	8,932	5.70	5.60	4,679.8	1,936.6
Milton township	117,067	118,616	108,148	45,153	43,668	40,357	35.27	34.36	3,407.1	1,314.1
Carol Stream village (part)	6,645	6,665	5,325	3,373	3,095	2,801	1.49	1.46	4,551.4	2,310.3
Downers Grove village (part)	–	–	–	–	–	–	0.66	0.61	–	–
Glendale Heights village (part)	3,467	2,180	1,393	1,328	1,022	831	0.51	0.50	6,934.0	2,656.0
Glen Ellyn village (part)	26,872	26,443	24,301	10,704	10,174	9,391	6.68	6.52	4,121.5	1,641.7
Lisle village (part)	159	189	–	55	57	–	0.09	0.09	1,766.7	611.1
Lombard village (part)	2,089	2,241	1,634	741	895	620	1.14	1.05	1,989.5	705.7
Naperville city (part)	15	–	–	4	–	–	0.21	0.19	78.9	21.1
Wheaton city (part)	52,890	55,416	51,450	20,111	19,881	18,624	11.35	11.17	4,735.0	1,800.4
Winfield village (part)	2,471	2,405	847	839	752	273	0.82	0.82	3,013.4	1,023.2
Naperville township	100,019	85,736	49,533	39,999	34,232	20,705	35.89	34.95	2,861.8	1,144.5
Aurora city (part)	47,604	37,891	14,038	17,460	14,166	5,773	13.37	12.98	3,667.5	1,345.1
Naperville city (part)	48,096	43,670	30,629	20,687	18,355	13,141	14.54	14.18	3,391.1	1,458.9
Warrenville city (part)	345	387	428	124	127	142	1.36	1.30	265.4	95.4
Wayne township	66,582	63,776	40,379	21,787	19,986	13,289	36.50	35.42	1,879.8	615.1
Bartlett village (part)	24,411	24,508	12,100	8,055	7,665	3,726	9.90	9.72	2,511.4	828.7
Carol Stream village (part)	15,560	16,090	12,686	5,017	4,888	4,271	2.56	2.43	6,403.3	2,064.6
Hanover Park village (part)	10,808	10,851	7,998	3,434	3,396	2,711	2.06	2.00	5,404.0	1,717.0
St. Charles city (part)	543	169	10	256	104	3	0.40	0.39	1,392.3	656.4
Wayne village (part)	1,570	1,303	720	540	445	260	3.09	3.00	523.3	180.0
West Chicago city (part)	9,224	6,134	1,925	2,818	1,827	706	6.61	6.47	1,425.7	435.5
Winfield township	46,233	45,155	37,969	15,856	14,865	13,013	36.19	34.80	1,328.5	455.6
Aurora city (part)	1,829	1,014	773	829	313	276	1.07	1.07	1,709.3	774.8
Batavia city (part)	–	–	–	–	–	–	0.02	0.02	–	–
Naperville city (part)	–	–	–	–	–	–	–	–	–	–
Warrenville city (part)	12,795	12,976	10,905	5,001	4,940	3,984	4.26	4.16	3,075.7	1,202.2
West Chicago city (part)	17,862	17,335	12,871	4,945	4,740	4,171	8.53	8.33	2,144.3	593.6
Wheaton city (part)	4	–	14	1	–	6	0.09	0.09	44.4	11.1
Winfield village (part)	6,609	6,313	6,249	2,705	2,272	2,213	2.20	2.16	3,059.7	1,252.3
York township	123,449	124,553	120,546	51,557	48,615	47,147	35.67	35.07	3,520.1	1,470.1
Downers Grove village (part)	3,469	3,585	3,493	1,514	1,197	1,138	2.38	2.35	1,476.2	644.3
Elmhurst city (part)	33,120	32,172	31,013	12,636	12,249	11,678	6.51	6.47	5,119.0	1,953.0
Glen Ellyn village (part)	578	556	643	347	341	356	0.09	0.09	6,422.2	3,855.6
Hinsdale village (part)	553	586	573	402	361	351	0.17	0.15	3,686.7	2,680.0
Lombard village (part)	41,036	40,063	37,754	17,702	16,117	15,222	8.70	8.61	4,766.1	2,056.0
Oak Brook village (part)	7,796	8,621	9,074	3,157	3,238	3,085	8.14	7.82	996.9	403.7
Oakbrook Terrace city	2,134	2,300	2,251	1,256	1,327	1,204	1.27	1.25	1,707.2	1,004.8
Villa Park village (part)	21,385	21,640	21,866	8,377	7,848	8,085	4.29	4.27	5,008.2	1,961.8
Westmont village (part)	2,209	2,643	2,192	1,577	1,275	1,345	0.70	0.67	3,297.0	2,353.7

Source: 2010 U.S. Census

Infrastructure: Infrastructure, beyond transportation-related infrastructure, includes water mains, sewers, treatment plants, utilities, such as electrical distribution, natural gas lines, and communication networks. Estimates of these infrastructure areas have not been made for purposes of this plan.

2.2.2 Property Value

Assessed property values in DuPage County are maintained by the township assessor offices. Residential property market value can be estimated by multiplying the assessed valuation of the home and property by three. Non-residential properties generally need to be appraised to determine their property value. For cost-benefit analyses, FEMA requires the use of replacement values, which is an examination of each structure's feature and the determination of a per-square-foot replacement cost. A calculation of replacement cost does not, however, include the value of the land.

Given the total number of properties in DuPage County, the determination of total assessed valuation, market value, or replacement costs was not feasible. Therefore, for purposes of this *Plan*'s vulnerability analysis, median home prices have been used.

Commercial building sales have not been examined. The 2006 median home prices are most likely an overestimate of residential property value, but still they provide an overall sense of residential property value in DuPage County.

Median home price: Table 2-6 shows median (middle) home prices for all DuPage County municipalities with housing units in DuPage County. 2005 and 2006 median prices are provided, and these numbers are dependant on the number of home sales in the given year. Some communities saw a decrease in median home prices from 2005 to 2006, though overall, median prices went up 3 percent from 2005 to 2006. Using the 2006 median price time the number of housing units in a community, the weighted average median home price for DuPage County is estimated to be approximately $300,971 or $301,000.

Again, this analysis made use of median or middle home prices, not average home prices. Also, significant housing development has been constructed in DuPage County since 2000, along with tear-down homes being replaced with new construction. It, therefore, can be concluded that the total residential property value in DuPage County is over $101 billion.

U.S. Census building replacement costs: *The U.S. Census for 2000 placed the following replacement costs for buildings in Illinois*

Building Type:	Replacement Cost:
Single family homes	$135,000
Multifamily residential	$720,000
Non-residential	$2,500,000

**2010 Census data not provided at the time of this report regarding replacement costs*

The replacement cost of $135,000 for a home in DuPage County in not reasonable for the area, and it is unknown how many of the 335,641 housing units are multifamily buildings. The replacement value for non-residential structures – as an average – seems

appropriate. Using the estimate of 39,631 non-residential buildings, shown in Table 2-4, times $2.5 million, estimates non-residential property value in DuPage County are $99 billion.

Property Value Summary: With consideration of the median home price and the U.S. Census Bureau replacement cost of non-residential structures, the following figures were used throughout this chapter for the vulnerability analysis:

DuPage County:	334 square miles
Population Density:	2,795 persons per square mile
Density of housing units:	1,005 homes per square mile

Residential property value:	$301,000/house
Non-residential property value:	$2,500,000/building

Value of all residential property in DuPage County:	$101 billion
Value of all non-residential property in DuPage County:	$ 99 billion
Value of all developed property in DuPage County:	$200 billion

Table 2-6
DuPage County Median Home Prices

PLACE	Housing Units in DuPage County	2010 Median Home Price	Estimated Total Housing Value
Addison, Village of	12,449	$ 280,300	$ 2,622,050,000
Aurora, City of	66,541	$ 205,600	$ 10,410,682,500
Bartlett, Village of	13,902	$ 316,500	$ 2,402,977,500
Bensenville, Village of	7,039	$ 258,300	$ 1,993,600,000
Bloomingdale, Village of	9,359	$ 311,700	$ 2,208,590,000
Bolingbrook, Village of	23,352	$ 245,700	$ 128,768,000
Burr Ridge, Village of	4,076	$ 706,700	$ 1,403,600,000
Carol Stream, Village of	14,667	$ 261,200	$ 4,011,500,000
Clarendon Hills, Village of	3,157	$ 576,900	$ 1,293,160,000
Darien, City of	8,984	$ 331,700	$ 2,589,410,000
Downers Grove, Village of	20,048	$ 351,500	$ 6,476,102,500
Elmhurst, City of	16, 396	$ 387,100	$ 6,014,757,500
Glendale Heights, Village of	12, 206	$ 221,100	$ 1,443,650,000
Glen Ellyn, Village of	11, 441	$ 433,200	$ 3,559,327,500
Hanover Park, Village of	11, 723	$ 219,400	$ 2,022,190,000
Hinsdale, Village of	6, 179	$ 829,400	$ 4,474,106,000
Itasca, Village of	3,335	$ 356,500	$ 1,042,560,000
Lisle, Village of	10, 027	$ 331,500	$ 1,511,496,000
Lombard, Village of	18, 567	$ 267,400	$ 4,561,092,000
Naperville, City of	51, 302	$ 402,900	$ 11,055,360,000
Oak Brook, Village of	3,086	$ 845,400	$ 2,476,080,000
Oakbrook Terrace, City of	1,331	$ 340,400	$ 418,005,000
Roselle, Village of	8,844	$ 286,100	$ 2,208,805,000
St. Charles, City of	12, 932	$ 308,200	$ 36,972,000
Villa Park, Village of	9, 135	$ 269,300	$ 2,012,724,000
Warrenville, City of	5,059	$ 245,100	$ 1,190,745,000
Wayne, Village of	899	$ 731,200	$ 664,172,500
West Chicago, City of	8, 045	$ 260,500	$ 1,654,884,000
Westmont, Village of	11, 300	$ 321,100	$ 2,947,203,000
Wheaton, City of	20,033	$ 357,400	$ 6,262,515,000
Willowbrook, Village of	4,416	$ 285,700	$ 1,066,265,000
Winfield, Village of	3,594	$ 308,700	$ 1,077,957,500
Wood Dale, City of	5,247	$ 288,000	$ 1,270,307,500
Woodridge, Village of	13,410	$ 268,700	$ 2,515,417,500

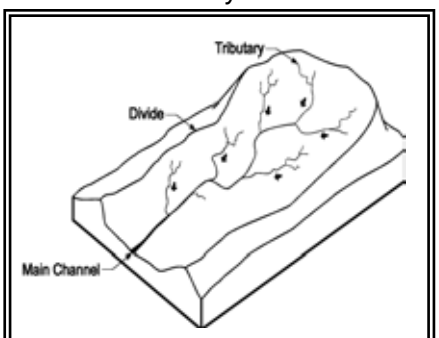
2.3 Floods

2.3.1 Flood Hazard Assessment

There are three major watersheds in DuPage County - Salt Creek, the East DuPage River and the West DuPage River. The watersheds associated with these streams encompass most of DuPage County. A watershed is the land area that all rain or snowmelt will drain or "runoff" to. Within each watershed there are smaller streams that can be identified as subwatersheds. The Salt Creek watershed flows to the Des Plaines River watershed in Cook County. The East Branch DuPage River and the West Branch DuPage River flow south to the DuPage River in Will County. All watersheds in the County eventually drain south and are tributary flows to the Illinois River. Exhibit 2-1 shows the DuPage County watersheds. Table 2-7 lists DuPage County's watersheds and subwatersheds.

2.3.1.1 Flood Considerations and Terminology

Watersheds: In a watershed, runoff from rain or snowmelt is collected by smaller channels (tributaries), which send the water to larger channels and eventually to the lowest body of water in the watershed (main channel). When a channel receives too much water, the excess flows over its banks and into the adjacent area – causing a flood.



A watershed includes all land that drains to a common channel

Watershed Topography and Development: The condition of the land in the watershed affects what happens to the precipitation. For example, more rain will run off the land and into the streams if the terrain is steep. For DuPage County, the conditions of saturated ground from previous rains, the land being covered with impervious pavement and parking lots, and the probable loss of depressional storage areas influence what happens to the precipitation.

Precipitation: DuPage County receives an average of 36.6 inches of total precipitation each year. From April to September, rainfall averages 19.6 inches. Average annual snowfall is 36 inches (generally, 7 inches of snow has the equivalent water content of one inch of rain).

In northeastern Illinois a 24-hour precipitation amount of 7.58 inches is considered to be a 100-year rainfall event. For a relatively short, intense rainfall event of 3 hours, the 100-year rainfall amount is 4.85 inches.

Riverine Flooding: The most common and most damaging floods occur along rivers and streams and this is called overbank flooding. Overbank flooding of rivers and streams can be caused by one or more of three factors:

- Too much precipitation in the watershed for the channels to convey

Exhibit 2-1
Map of DuPage County Watersheds

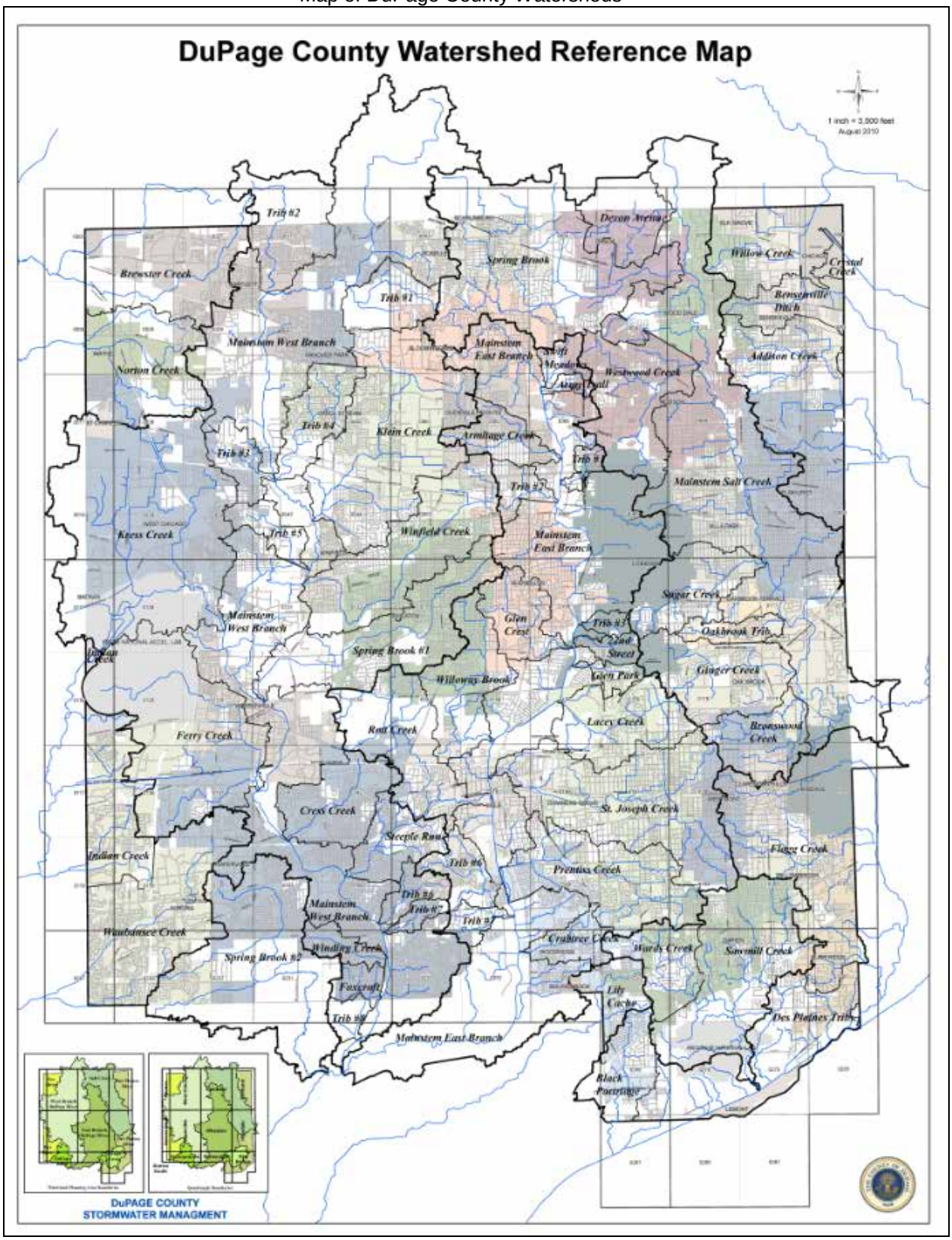


Table 2-7
DuPage County Watersheds

Watershed	Total Area	Area Within DuPage County
Subwatershed	**Square Miles**	**Square Miles**
Des Plaines River Tributaries	**39.60**	**38.51**
Addison Creek	9.09	9.09
Bensenville Ditch	2.56	2.56
Black Partridge	2.73	2.43
Crystal Creek	0.42	0.42
Des Plaines Main Stem	7.82	7.79
Flagg Creek	11.89	11.14
Willow Creek	5.09	5.09
DuPage River Tributaries	**14.39**	**10.88**
Lily Cache	1.84	1.84
Spring Brook 2	12.55	9.03
East Branch DuPage River	**81.29**	**75.22**
Armitage Creek	2.13	2.13
Army Trail	0.44	0.44
Crabtree Creek	1.54	1.54
Tributary 1	0.67	0.67
Tributary 2	1.23	1.23
Tributary 3	0.49	0.49
Tributary 6	1.85	1.85
Tributary 7	0.86	0.86
DuPage River Main Stem	33.61	27.54
Glencrest Creek	2.72	2.72
Glen Park	0.71	0.71
Lacey Creek	4.62	4.62
Prentiss Creek	7.04	7.04
Rott Creek	5.99	5.99
St. Joseph Creek	11.26	11.26
Swift Meadows	0.87	0.87
22nd Street	0.77	0.77
Willoway Bay	4.50	4.50
Fox River Tributaries	28.08	28.08
Brewster Creek	7.00	7.00
Indian Creek	5.16	5.16
Norton Creek	6.56	6.56
Waubansee Creek	9.36	9.36

Watershed	Total Area	Area Within DuPage County
Subwatershed	**Square Miles**	**Square Miles**
Salt Creek	**65.23**	**57.92**
Bronswood Creek	3.27	3.27
Devon Avenue	3.08	1.81
Ginger Creek	5.36	5.36
Oakbrook	1.20	1.20
Spring Brook	14.68	11.82
Salt Creek Main Stem	27.64	24.45
Sugar Creek	4.06	4.06
Westwood Creek	5.95	5.95
Sawmill Creek	**12.55**	**12.55**
Sawmill Creek Main Stem	9.48	9.48
Wards Creek	3.07	3.07
West Branch DuPage River	**127.64**	**113.15**
Cress Creek	4.21	4.21
Ferry Creek	12.38	12.35
South of Foxtrot	0.92	0.88
Klein Creek	12.65	12.65
Kress Creek	18.93	15.95
Spring Brook 1	7.69	7.69
Steeple Run	2.75	2.75
Tributary 1	2.69	2.69
Tributary 2	4.69	2.16
Tributary 3	1.69	1.69
Tributary 4	2.95	2.95
Tributary 5	1.37	1.37
Tributary 6	1.21	1.21
Tributary 7	0.59	0.59
South of 87th	0.77	0.04
West Branch Main Stem	42.54	34.36
Winfield Creek	8.47	8.47
Winding Creek	1.14	1.14

What are the odds of a flood?

The term "100-year flood" has caused much confusion for people not familiar with statistics. Another way of looking at it is to think of the odds that a base flood will happen sometime during the life of a 30-year mortgage (26% chance).

Chance of Flooding over a Period of Years

	Flood Size			
Period	10-year	25-year	50-year	100-year
1 year	10%	4%	2%	1%
10 years	65%	34%	18%	10%
20 years	88%	56%	33%	18%
30 years	96%	71%	45%	26%
50 years	99%	87%	64%	39%

Even these numbers do not convey the true flood risk because they focus on the larger, less frequent, floods. If a house is low enough, it may be subject to the 10- or 25-year flood. During the proverbial 30-year mortgage, it may have a 26% chance of being hit by the 100-year flood, but the odds are 96% (nearly guaranteed) that a 10-year flood will occur during the 30 year period. Compare those odds to the only 5% chance that the house will catch fire during the same 30-year mortgage.

- Obstructions in a channel, such as an ice jam or beaver dam, and
- Large release of water when a dam or other obstruction fails.

During a riverine flooding event other flood problems can also occur. Streets can flood when rainwater can't flow into a storm sewer. Basements can flood when rainwater can't flow away from the house or when the sewers back up. These problems are usually caused by heavy local rains and can occur when not related to overbank flooding.

Flash Floods: Flash floods are generated by severe storms that drop much rainfall in a short time. All flash floods strike quickly and end swiftly. In urban areas, flash flooding can occur where impervious surfaces, gutters and storm sewers speed runoff. Flash floods also can be caused by dam failure, the release of ice-jam flooding, or the collapse of a debris dam.

Obstructions: Obstructions can be channel obstructions, such as small bridge openings or log jams, or floodplain obstructions, such as road embankments, fill and buildings. Channel obstructions will cause smaller, more frequent floods, while floodplain obstructions impact the larger, less frequent floods where most of the flow is overbank, outside the channel.

Obstructions can be natural or manmade. Natural obstructions, like log jams, can be cleared out or are washed away during larger floods. DuPage County also has a history of problems with beaver dams. The greater problem is manmade obstructions, which tend to be more permanent. They are discussed in Chapter 4's section on floodways.

Flood Risk: Past floods are indications of what can happen in the future, but flood studies and mitigation plans are based on the *risk* of future flooding. Flood studies extrapolate from historical records to determine the statistical potential that storms and floods of certain magnitude will recur. Such events are measured by their "recurrence interval," i.e., a 10-year storm or a 50-year flood.

These terms are often misconstrued. Commonly, people interpret the 50-year flood definition to mean "once every 50 years." This is incorrect. Statistically speaking, a 50-year flood has a 1/50 (2 percent) chance of occurring in any given year. In reality, a 50-year flood could occur two times in the same year, two years in a row, or four times over

the course of 50 years. It is possible not to have a 50-year flood over the course of 100 years.

FEMA uses the "base" flood as the basis for its regulatory requirements and flood insurance rate setting; it is also the basis for this analysis. The base flood is the one percent chance flood, i.e., the flood that has a one percent (one out of 100) chance of occurring in any given year. The one percent chance flood has also been called the 100-year flood.

The "500-year flood" has a 0.2 percent chance of occurring in any given year. While the odds are more remote, it is the national standard used for protecting critical facilities, such as hospitals and power plants.

The Base Floodplain: The area inundated by the base flood is the "base floodplain." FEMA maps (called Flood Insurance Rate Maps, or FIRMs) also call this the Special Flood Hazard Area or A Zone.

The central part of the floodplain is called the floodway. The floodway is the channel and that portion of the adjacent floodplain which must remain open to permit passage of the base flood. Floodwaters generally are deepest and swiftest in the floodway, and anything in this area is in the greatest danger during a flood. The remainder of the floodplain is called the fringe, where water may be shallower and slower.

Floodplain maps were originally developed by FEMA for DuPage County. However, as part of the DuPage County Stormwater Management Program, new floodplain maps have been developed by the County and adopted by FEMA. DuPage County regulatory floodplains can be accessed at www.dupageco.org. Table 2-8 shows the 100-year flood elevations for the major rivers in DuPage County, which are included in the FEMA Flood Insurance Studies.

Table 2-8
DuPage County 100-year Flood Elevations

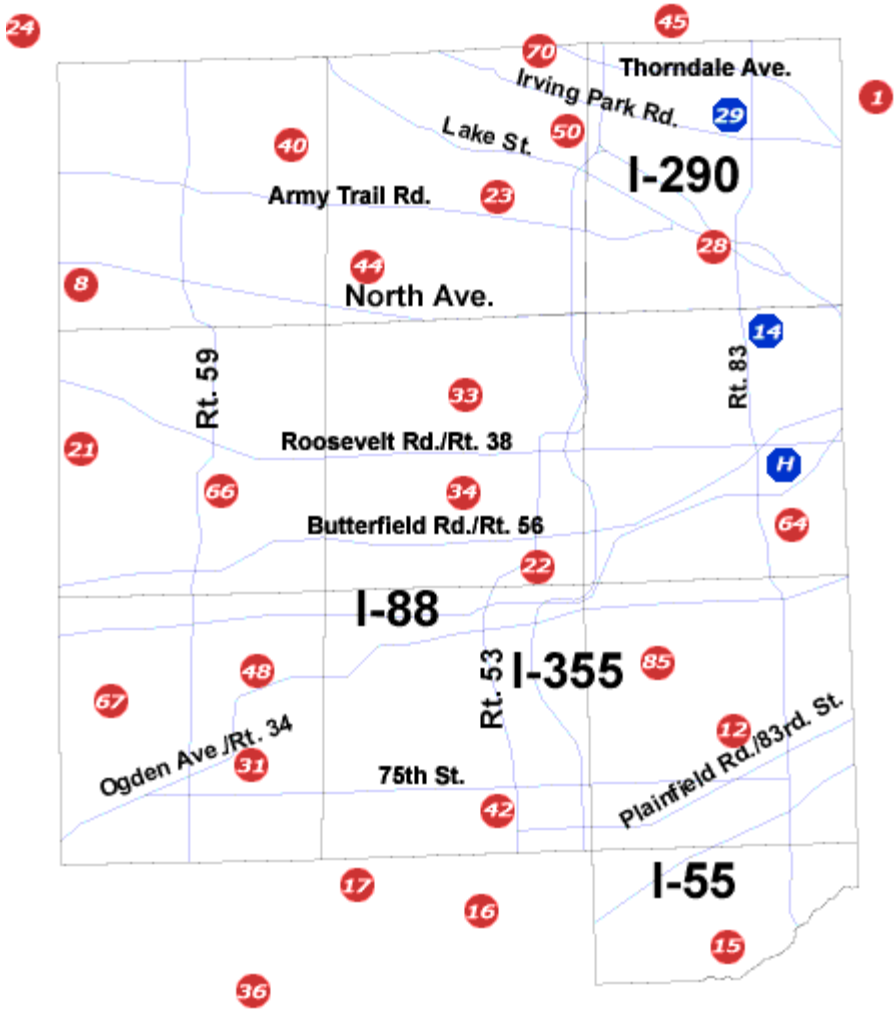
River	Location	Approximate 100-year Flood Elevation
East Branch DuPage River	Butterfield Rd (Rte. 56)	677.3 feet
East Branch DuPage River (downstream)	DuPage-Will County Line	649.0 feet
Salt Creek	North Avenue (Rte. 64)	672.6 feet
Salt Creek (downstream)	DuPage-Cook County Line	643.5 feet
West Branch DuPage River	Lake Street (Rte 20)	674.5 feet
West Branch DuPage River (downstream)	DuPage-Will County Line	646.2 feet

Source: FEMA Flood Insurance Study, September 2004

Velocity: The speed of moving water, or velocity, is measured in feet per second. Flood velocity is important to mitigation because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation. The FEMA Flood Insurance Study (FIS) typically includes the

Rain Gage & Stream Gage Map

| Rain Data | Stream Levels | Rain Chart | Comm Status |



BLUE dots with numbers are Rain gage & Stream gage locations
RED dots with numbers are Rain gages ONLY

Exhibit 2-2
DuPage County Rain and Stream Gage Locations

"average floodway velocity" for those streams that were studied in detail. This figure is helpful in determining the relative hazard of an area, but is not an accurate indication of the velocity of a flood at any individual site. The FIS shows floodway velocities ranging from 1 foot per second up to 9.6 feet per second through certain bridge openings.

Flood Depths: There are several stream gages in DuPage County that are jointly funded and maintained by the U.S. Geological Survey (USGS), the Illinois Department of Natural Resources (IDNR) and the County. Gages are in place on Salt Creek, the East Branch DuPage River and the West Branch DuPage River. Exhibit 2-2 shows the gage locations. Exhibit 2-3 shows a graphical representation of a gage that was located on the East Branch DuPage River at Lisle. The figure was developed by IDNR, and it shows flood damage beginning at stage 10.0 or at elevation 659.0 (zero elevation of 649.0 plus 10). Also shown is the flood depth reached during the 1987 flood. This gage is no longer in place, but it provides an example of how all gages can be interpreted.

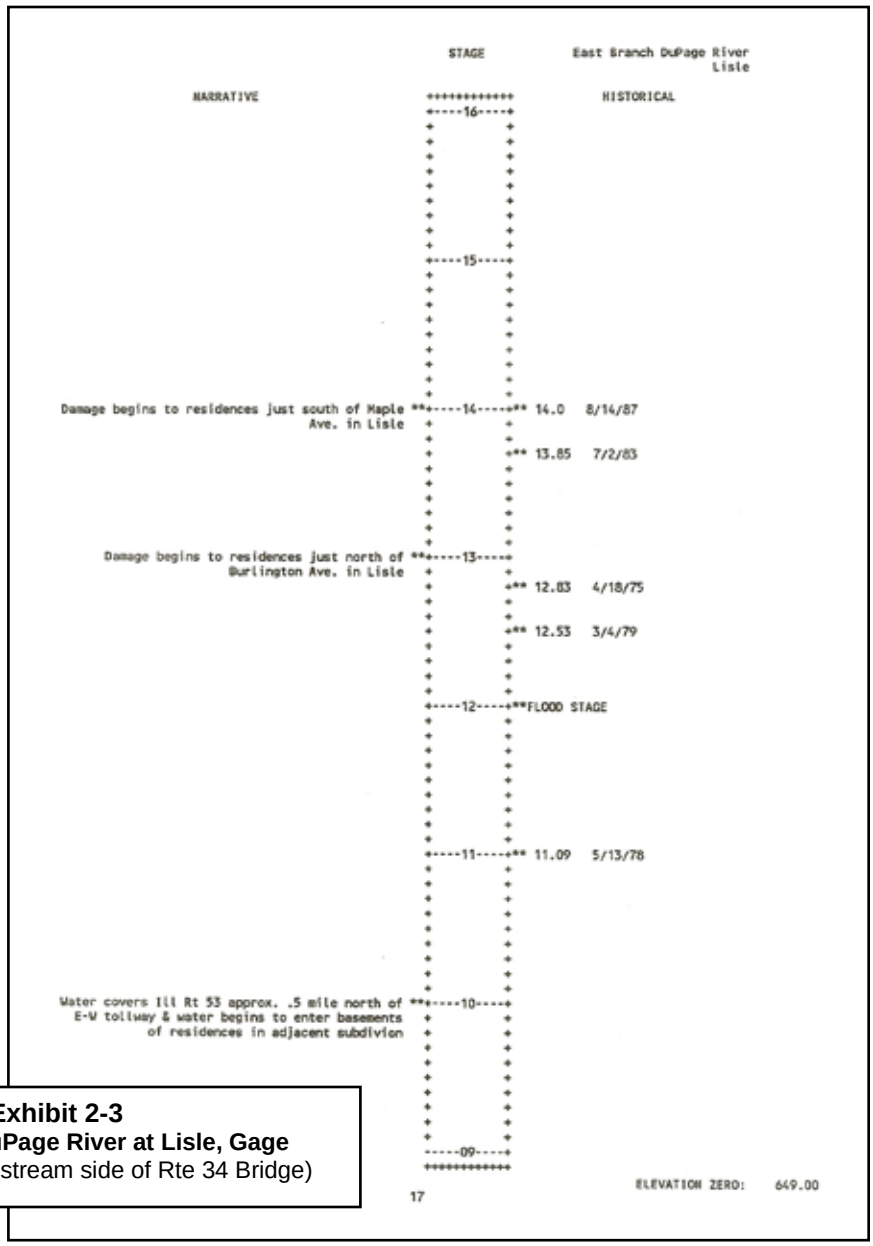


Exhibit 2-3
East Branch DuPage River at Lisle, Gage Description (at upstream side of Rte 34 Bridge)

DuPage County gage information can be found at the web sites in the box to the right.

DuPage County Stormwater Management Division

http://ec.dupageco.org/dec/cfm/raindata.cfm

Or

IDNR's
"Flood Surveillance Bookmarks" Website:

http://dnr.state.il.us/owr/Surveillance.htm

http://solon.er.usgs.gov/nwis-w/IL/datasum.components/owrtable.cgi?table=norm

Gives stage and precipitation records and forecasts.

The Table 2-9 shows average difference between flood stage, the 10-year, 50-year, and the 100-year flood for a location in the Salt Creek, East Branch DuPage River, and West Branch DuPage River. The Table shows that the East Branch DuPage River reaches flood stage at Route 34 at 661.0. The River will rise another 4.6 feet before reaching the 10-year flood elevation. There is an average of 1.4 feet difference between the 10-year and 50-year levels, and around 1.5 feet in difference between the 50-year and 100-year flood levels for the East Branch DuPage River. Flood stage information is not available for the other major watersheds in the County.

Table 2-9
DuPage County Comparison of Flood Elevations (In feet)

Stream	Flood Stage	10-Year	*Difference 10-yr to flood stage*	50-year	*Difference 10-yr to 50-yr*	100-Year	*Difference 50-yr to 100-yr*
East Branch DuPage River at Rte 34 in Lisle	661.0*	665.6	*4.6*	667.0	*1.4*	668.5	*1.5*
Salt Creek at North Avenue in Addison	---	670.5	---	671.8	*1.3*	672.6	*0.6*
West Branch DuPage River at Lake Street near Bartlett	---	673.7	---	674.2	*0.5*	674.5	*0.3*

**Datums may not be the same.*

2.3.1.2 Safety, Health and Damage Considerations

Safety: A car will float in less than 2 feet of moving water and can be swept downstream into deeper waters. This is one reason floods kill more people trapped in vehicles than anywhere else (see table). The National Water Service sponsors a safety campaign of "Turn Around, Don't Drown." While DuPage County experiences relatively shallow flooding in floodplain areas, the hazard is still significant at underpasses and viaducts.

People die of heart attacks, especially from exertion during a flood fight. Electrocution is a cause of flood deaths, claiming lives in flooded areas that carry a live current created when electrical components short out. Floods also can damage gas lines, floors, and stairs, creating secondary hazards such as gas leaks, unsafe structures, and fires. Fires are particularly damaging in areas made inaccessible to fire-fighting equipment by high water or flood-related road or bridge damage.

Warning and Evacuation: The threat to life posed by a flood can be avoided if people can evacuate before the waters reach their buildings or close their evacuation routes. This requires advance notice that a flood is coming and a system to disseminate flood warnings. For smaller, urban, streams, flood waters can rise so fast during a heavy local rain, that expensive systems of remote rain and stream gages would be needed to provide adequate notice to emergency managers. Even with those types of systems, there is often little time to reach high ground.

Flood Related Fatalities in the United States

	Vehicle		Total	
Year	**IL**	**US**	**IL**	**US**
1995	0	39	1	80
1996	0	79	2	131
1997	1	46	1	118
1998	0	86	1	136
1999	0	40	1	77
2000	3	30	4	41
2001	1	31	1	66
2002	0	31	2	50
2003	1	47	1	99
2004	0	51	0	79
2005	0	20	0	42
2006	0	32	0	63
2007	0	67	0	105
2008	3	46	5	80
2009	3	45	4	56
2010	1	50	1	104
2011	3	68	4	113
Total	**16**	**808**	**28**	**1440**

Source: NWS - 2011

Bridges: A key evacuation and safety concern is when roads and bridges go under water. Generally, the larger the road, the more likely it will not flood, but this is not always the case. Interstate highways have flooded in the Chicago metropolitan area. A bridge does not have to be under water to be damaged or to cut off an evacuation route. In some cases the bridge is high, but the access road may be flooded. In other cases, the bridge or culvert can be washed out. This is especially dangerous if a person drives on a flooded road and assumes that the bridge is still there.

Health: While such problems are often not reported, three general types of health hazards accompany floods. The first comes from the water itself. Floodwaters carry pollutants from the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals.

Flood waters saturate the ground which leads to infiltration into sanitary sewer lines. When wastewater treatment facilities are flooded, there is often nowhere for the treated sewage to be discharged or inflowing sewage to be stored. Infiltration and lack of treatment lead to overloaded sewer lines which back up into low-lying areas and some homes. Even though diluted by flood waters, raw sewage can be a breeding ground for bacteria, such as E. coli, and other disease-causing agents. Because of this threat, tetanus shots are given to people affected by a flood.

The second type of health problem comes after the water is gone. Stagnant pools become breeding grounds for mosquitoes, and wet areas of a building that have not been

cleaned breed mold and mildew. A building that is not thoroughly and properly cleaned becomes a health hazard, especially for small children and the elderly.

Another health hazard occurs when heating ducts in a forced-air system are not properly cleaned after inundation. When the furnace or air conditioner is turned on, the sediments left in the ducts are circulated throughout the building and breathed in by the occupants.

If the water system loses pressure, a boil order may be issued to protect people and animals from contaminated water.

The third problem is the long-term psychological impact of having been through a flood and seeing one's home damaged and irreplaceable keepsakes destroyed. The cost and labor needed to repair a flood-damaged home puts a severe strain on people, especially the unprepared and uninsured. There is also a long-term problem for those who know that their homes can be flooded again. The resulting stress on floodplain residents takes its toll in the form of aggravated physical and mental health problems.

> "These follow-up studies show a consistent pattern of increased psychological problems among flood victims for up to 5 years after the flood. The findings regarding non-psychiatric morbidity are less consistent, but many of the reported morbidity problems such as hypertension and cardiovascular disease-and even leukemia and lymphoma-may be stress related." – *The Public Health Consequences of Disasters*, page 74.

Building Damage: Deep or fast moving waters will push a building off its foundation. Structural damage can also be caused by the weight of standing water, known as "hydrostatic pressure."

Basement walls and floors are particularly susceptible to damage by hydrostatic pressure. Not only is the water acting on basement walls deeper, a basement is subjected to the combined weight of water and saturated earth. In addition, water in the ground underneath a flooded building will seek its own level, resulting in uplift forces that can break a concrete basement floor.

Another common type of damage inflicted by a flood is caused by soaking. When soaked, many materials change their composition or shape. Wet wood will swell and, if dried too quickly, will crack, split or warp. Plywood can come apart. Gypsum wallboard will fall apart if it is bumped before it dries out. The longer these materials are wet, the more moisture, sediment and pollutants they will absorb.

Soaking can cause extensive damage to household goods. Wooden furniture may become so badly warped that it cannot be used. Other furnishings such as upholstery, carpeting, mattresses, and books usually are not worth drying out and restoring. Electrical appliances and gasoline engines will not work safely until they are professionally dried and cleaned.

In short, while a building may look sound and unharmed after a flood, the waters can cause a lot of damage. To properly clean a flooded building, the walls and floors should be stripped, cleaned, and allowed to dry before being recovered. This can take weeks and is expensive.

Past Events: The NCDC began keeping consistent records of flood events for DuPage County in 1996. Review of gage records shows other flood events prior to 1996. Municipal records provide a picture of the flood event and a description of needed emergency action and resulting damages. Based on the NCDC, gage records and municipal data, Table 2-10 shows the known flood events for DuPage County.

Following Table 2-10 is a description of damage that municipalities reported from the August 1987 and July 1996 floods.

Table 2-10
DuPage County Recorded Flood Events

Location:	Date:	Time:	Description:
Western DuPage	6/10/1967		Flooding in Winfield and West Chicago.
Central and Eastern DuPage	8/27/1972		Flooding in Elmhurst. Residents in Glen Hill area in Glendale Heights were evacuated in boats.
West and Central DuPage	4/18/1975		Flooding in Lisle, Winfield and West Chicago.
Eastern DuPage	3/5/1976		Flooding in Wood Dale.
Eastern DuPage	9/19/1977		Flooding in Wood Dale.
Central DuPage	5/13/1978		Flooding in Lisle.
Central and Eastern DuPage	3/4/1979		Flooding in Lisle, Wood Dale.
Western DuPage	3/19/1979		Flooding in Winfield and West Chicago.
Eastern DuPage	12/3/1982		Flooding in Elmhurst at Route 83 and North Avenue. 23 businesses in the area received major damages; 3 with minor damage.
Western DuPage	12/2/1982		Flooding in Winfield and West Chicago.
Central DuPage	7/2/1983		Flooding in Lisle.
Countywide	8/14/1987		Flooding through County.
South and Central DuPage	7/17/1996	6:00 PM	Damage estimates between $74 and $150 million.
South and Central DuPage	2/20/1997	6:00 PM	4 inches of rain in Aurora; 3.6 inches of rain in Wheaton. Woman died in Matteson after driving into a barricaded flooded railroad viaduct.
Northeast DuPage	8/16/1997	6:00 PM	3 to 9 inches of rain over northeast DuPage County into north-central Cook County.
Bolingbrook	8/3/1998	11:00 PM	5 inches of rain in Will County; 3.5 inches in Bolingbrook. Roads, viaducts and underpasses flooded.
Southwest DuPage	8/4/1998	11:00 AM	2-day total rain for Bolingbrook was 6 inches; Naperville was 5 inches. Lisle experienced flooding. In Bolingbrook a young boy died when swept into a storm drain and pinned against a grate.
Wheaton	7/21/2001	7:35 PM	1 foot of water over Main Street in Wheaton.
Countywide	10/13/2001	3:25 PM	Numerous streets and major roads flooded and closed, including Route 53 where several motorists were trapped in their vehicles and had to be rescued. Hale Street and a block of houses were flooded in Wheaton. A train viaduct and several streets and basements flooded in Lombard. The Villages of Lisle and Glendale Heights also recorded damages.
Countywide	10/24/2001	1:30 PM	Minor street flooding in DuPage.
Wheaton and West Chicago	7/9/2002	2:00 AM	2.92 inches of rain in Wheaton 5.6 inches in Batavia. Street and basement flooding in Wheaton and West Chicago.
Carol Stream	8/22/2002	3:00 AM	Basement flooding in Carol Stream
Westmont, Wheaton, Clarendon Hills	11/4/2003	7:30 PM	2.4 inches of rain in Westmont; 1.68 inches in Wheaton. Low lying areas in Clarendon Hills flooded.
Clarendon Hills	3/28/2004	5:00 PM	1.5 to 2 inches of rain in 3 hours in Clarendon Hills.
Lisle	5/13/2004	5:00 PM	Flooding on Route 53 south of Burlington railroad tracks in Lisle.
Naperville	5/21/2004	8:54 PM	Washington Avenue and Route 34 flooded in Naperville.
Naperville, Winfield and Wheaton	5/30/2004	10:05 AM	Street flooding in Naperville, Winfield, Clarendon Hills, and Wheaton. Park and Main Streets in Wheaton closed.
Naperville	6/12/2004	12:25 AM	River Road and Wilshire Blvd., and Route 59 and North Aurora Road in Naperville flooded, along with 59th Street and Fairview Avenue in Downers Grove.
Glendale Heights	10/2/2005	2:30 PM	1 foot of water over North Avenue in Glendale Heights.
Countywide	10/2/2006	8:50pm	Widespread flooding across all of DuPage County. Underpasses were flooded and buildings took on water throughout the County.
Countywide	9/13/2008	5:00am	A warm front moved across northern Illinois during the morning hours of September 13th as the remnants of tropical storm Lowell and hurricane Ike moved across the region. These two features combined to produce heavy rain and flash flooding across many areas of northern Illinois.
Countywide	7/24/2010	12:13am	Strong to severe thunderstorms moved across northern Illinois during the afternoon and evening hours of July 23rd producing strong winds. Additional thunderstorms developed in the late evening of July 23rd and lasted in the early morning hours of July 24th producing very heavy rain and widespread flash flooding in many parts of the Chicago Metro Area. Rainfall rates were as much as two to three inches per hour in some areas.

Source: NCDC & municipal surveys

August 1987: On August 13 to 14, 1987, 3 inches to 9.4 inches of rain fell on DuPage and Cook Counties. Four deaths were attributed to the flood. An estimated 400 vehicles were stranded at depths as much as six feet. At least 30 intersections and stretches of roadway were closed due to flooding. 3,000 homes were damaged. Total damage estimates range from $75 to $150 million.

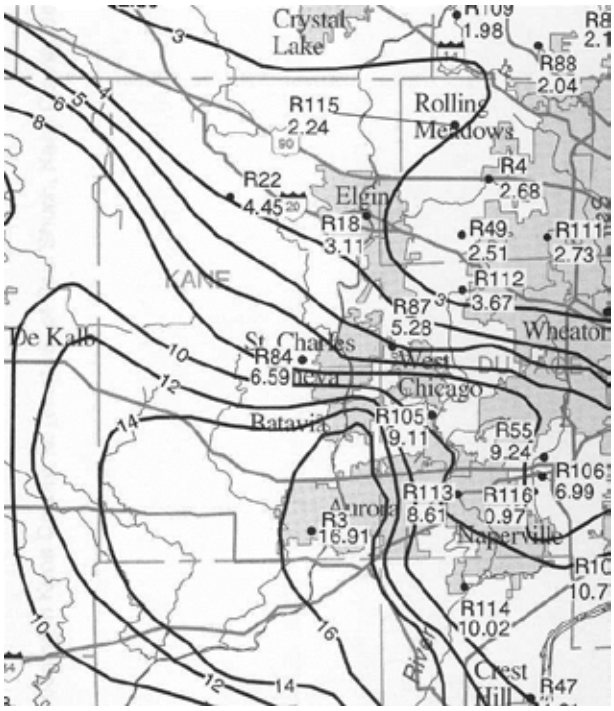
DuPage County suffered the worst in the Salt Creek watershed. The Village of Addison estimated that 30 percent of the community was affected, and over 100 homes were damaged. Some elderly people were evacuated from their residences. Businesses were significantly impacted, along with critical facilities, such as their treatment plants. Injuries were limited, but damage totaled to several million dollars.

In Elmhurst the southwest third of the City was impacted. 3,100 homes were damaged, their wastewater treatment facility was flooded, and 3,500 phones were lost due to submerged phone cables. Damage totaled over $33 million.

Flooding extended to the East Branch DuPage River watershed. For example, in Glendale Heights several businesses flooded at the intersection of North Avenue (Illinois State Route 64) and Glen Ellyn Road. In Wheaton, homes and businesses in the floodplain were flooded, and City Hall was damaged. Also impacted were two water mains, storm and sanitary sewers and a bridge abutment. Some businesses and schools were forced to close due to the impact of the flood in the region.

July 1996: Beginning on July 17, 1996, rain from thunderstorms began to fall across northeastern Illinois. Naperville reported that the first of the thunderstorms began around 10:00 a.m. By 7:00 p.m. Route 59 in Naperville was closed. The thunderstorms continued into the next day. Record rainfall came from several thunderstorms that tracked along a stalled west to east low-pressure front. Around 1:45 a.m. on July 18, 1996 the National Weather Service issued a flash flood warning.

Exhibit 2-4. Isohyets of the July 1996 Rainfall



Source: Illinois State Water Survey

Around 2:00 a.m. the DuPage Emergency Operations Center was opened and response plans executed. By 6:00 a.m. the mayors of Naperville and Lisle declared a state of emergency. The County worked to evacuate portions of Steeple Run subdivision in Lisle Township. The West Branch DuPage River crested around 6:00 p.m. on July 18th.

The pattern of the rain is shown in Exhibit 2-4. It can be seen that the heaviest rainfall concentrated over southeastern Kane County and northeastern Kendall County. An Aurora rain gage recorded 16.91 inches in 24 hours, a record for the state. Record peak flows were recorded at 19 stream flow gages in the area. The US Geological Survey estimated that the flooding was greater than a 100-year flood on Blackberry Creek near Yorkville and the Fox River at Dayton.

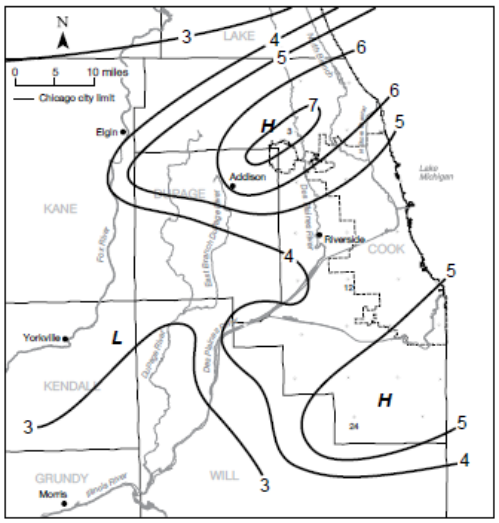
The severity of the July 1996 flood was due to a combination of wet conditions (July was the wettest month on record for Aurora) and heavy local rain.

The City of Naperville and the City of Aurora were extremely hard hit. Naperville estimated total public damage at $2.2 million. Private property damage was estimated at $30.7 million. For business, many were forced to close temporarily. Downtown businesses with basements were adversely affected.

For the 1996 flood, the cost to the Village of Woodridge for response and clean-up was $256,061. The flooding was village-wide. Homes and cars were flooded throughout the village. Some businesses were closed temporarily. Woodridge also experienced streambank erosion, sewer back-ups and street flooding. Total damages were not recorded in the Village of Lisle, but the Village was reimbursed $28,590 by the Illinois Emergency Management Agency for emergency response and recovery costs. In Downers Grove an estimated 180 homes were damaged. Damage was estimated at $1,020,000.

2008

On September 13, 2008 major flooding was experienced throughout much of DuPage County. The severe storm and flood event was a result of the remnants of Hurricane Ike that struck the Gulf coast and traveled up through the Midwest of the United States. The Chicago area rainfall for September 13, 2008 set a new daily rainfall record. As shown on the figure to the right, the northeast portion of DuPage County received over six inches of rain.



Rainfall in the Chicago area on September 13, 2008

Source: ISWS Report of Investigation 117 (ISWS/RI-117/2009)

Thirteen counties in Illinois, including DuPage County, received a federal disaster declaration on October 3, 2008 (FEMA 1800-DR, Illinois) for the severe storms and flooding.

From a survey of municipalities (conducted for the 2009 Natural Hazard Mitigation Plan Annual Report), 30% of streets within several municipalities were impacted by the September 13, 2008 flooding. Entrance and exit ramps of Interstates 290 and 88 were affected, along with a notable number of major intersections in the northern and eastern halves of the county. Eighteen communities reported residential flooding, and nine

communities reported flooding in downtown or commercial areas. A number of critical facilities were also impacted.

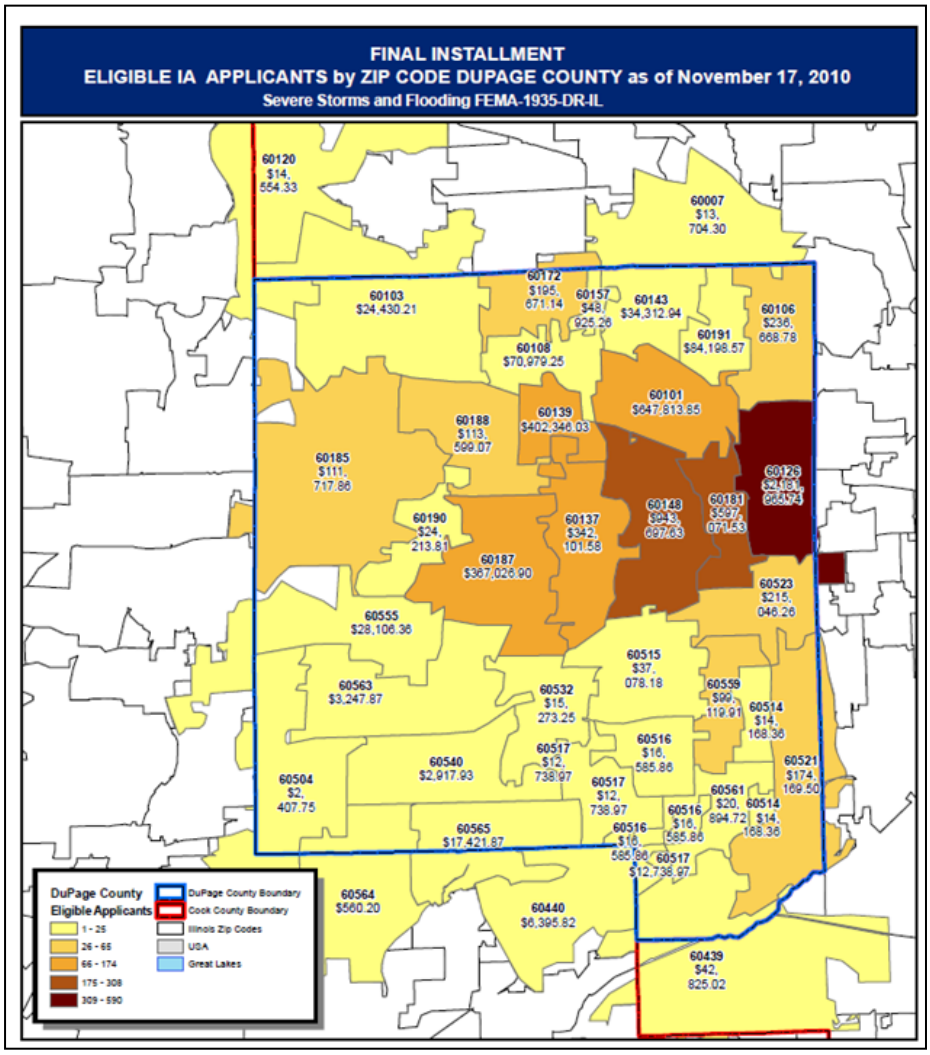
2010

During a period from Monday July 19th, 2010 through Saturday, August 7th, 2010, several severe rainstorms produced record rainfall totaling over 11 inches. This rainfall resulted in serious roadway and residential flooding throughout DuPage County. The heaviest rain fell across north central DuPage County during the early morning hours of July 24th producing widespread flooding and flash flooding.

Widespread street and basement flooding was reported. North Avenue at Interstate 290 was flooded with a car stuck in the water. Lake Ellyn overflowed its banks with six inches or more of water covering nearby streets. The Village Links Golf Course was flooded with waist high water and a mail truck was submerged in the flood waters. In Elmhurst, Interstate 290 was closed near York Street with two cars floating in water at least four feet deep; Route 83 was flooded and closed under the Union Pacific tracks with several cars floating in the water; Robert Palmer Drive was flooded and closed below the railroad tracks and all roads near Elmhurst Memorial Hospital were impassible. In Lombard, the Main Street viaduct was flooded with stranded cars in the flood waters and 15 residents were evacuated by boat along Finley Road. In Villa Park, significant flooding occurred near Wildwood and Monterey Avenues. Salt Creek quickly rose out of its banks and flooded nearby areas. In the Graue Mill Condominiums, 250 residents were evacuated after four feet of water surrounded the community when Salt Creek overflowed its banks. Storm total rainfall amounts included 7.26 inches one mile northwest of Villa Park; 7.19 inches near Carol Stream; 7.08 inches one mile northwest of Glen Ellyn; 7.01 inches two miles west of Elk Grove Village; 6.98 inches in Oak Brook; 6.92 inches one mile northwest of Lombard; 6.52 inches near Wheaton; 5.57 inches two and a half miles north of West Chicago; 4.51 inches two miles southwest of Burr Ridge; 4.40 inches one mile southeast of Westmont and 3.45 inches in Lisle.

Throughout the entire event (including response and recovery) the DuPage County EOC conducted and facilitated conference call briefings with subject matter experts including the National Weather Service, DuPage County Storm Water Department, FEMA and IEMA, to over 121 DuPage County stakeholders. Additionally, during the ongoing recovery phase of the disaster, the DuPage County Office of Homeland Security and Emergency Management facilitated individual community damage assessment tours with FEMA, IEMA, and SBA. As a result of these meetings, DuPage County residents were able to recover the following:

Individual Assistance:	$7,228,007.12
Housing Assistance:	$6,717,179.88
Other Needs Assistance:	$510,827.24
Small Business Loans Approved:	$3,116,400.00
Total Assistance Granted for DuPage County:	$17,572,414.24



Other Flood Events: For the August 4, 1998 event, the Village of Lisle estimated 3.5 inches of rain in 24 hours. The Village received over 30 calls from residents and businesses. Flooding was limited to yards and basements. From 5 inches of rain in about 12 hours, DuPage County suffered widespread flooding. Lisle reported 39 locations of street flooding. Short Street at the East Branch DuPage River was closed for 24 hours. Route 53 was also flooded. In Lisle, ten homes suffered storm sewer backups and ten homes suffered sanitary sewer backups. In October 2002 Addison experienced community-wide flooding where dozens of home were damaged. The cost was estimated at several hundred thousand. After an August 28, 2004 heavy rainfall, the Village of Woodridge spent $10,000 on barricades, inlet cleaning and other clean-up after the event.

The most recent localized flooding event occurred October 2 to 3, 2006. Street flooding, vehicles flooded at viaducts, sewer backups, basement flooding, and overflowing detention ponds occurred in numerous municipalities. Eight municipal vehicles in Wheaton received flood damage. Communities who reported damage include Villa Park, Lombard, Woodridge, Lisle and Wheaton.

Frequency: Frequency for the 100-year flood is 1 percent in any given year. Frequency for a 10-year event is 10 percent in any given year.

2.3.2 Flood Vulnerability Analysis

Past and future flood impacts, in terms of people and costs, will be discussed in this section. Impacts being considered are summarized under four categories: damage to buildings, damage to critical facilities, health and safety, and economic impact (damage to businesses and infrastructure).

All DuPage County communities are vulnerable to flooding due to the relatively flat topography of the County, and due to the amount of urbanization and developed land. Flooding is not limited to floodplain areas. Most all of the flooding that DuPage County has experienced has been a combination of stormwater and floodplain flooding.

DuPage County's vulnerability to flooding, while still significant, has been greatly reduced due to the implementation of the DuPage County Stormwater Management Plan of 1989. Flooding experienced in the 1987 flood has been mitigated through the construction of flood control facilities, such as the Elmhurst Quarry Reservoir in the Salt Creek watershed, the adoption and enforcement of countywide stormwater management ordinance, the acquisition of floodplain properties, and the implementation of watershed plans. The 1996 flood showed the County's continued vulnerability to flooding, due to the urban nature of the entire County.

Damage to Buildings: To examine the exposure of buildings to flooding, the County's GIS was used to estimate the number of buildings in the 100-year floodplain. Exhibit 2-5 shows the 100-year floodplain in DuPage County. Table 2-12 summarizes the findings for buildings exposed to the 100-year flood event and the estimate of losses.

Table 2-11
Buildings Located in DuPage County 100-year Floodplains

DuPage County	Area (Acres)	Area (Square Miles)	Number of Buildings Estimate:
100-year Floodplain	19,280	30.13	2,895
100-year Floodway	5,531	8.64	428

The 2,895 buildings located in the floodplain represent a range of land uses. An estimate of the types of buildings in the floodplain is shown in Table 2-12. These numbers are based on the count of floodplain parcels and the buildings in DuPage County as shown in Table 2-4.

Table 2-12 examines the value of properties located in the floodplain. The estimates are taken from the guidance in FEMA's Understanding Your Risks, page 3-11. For residential structures, contents are valued at 50 percent of the building's value. For non-residential structures, 100 percent is used.

Table 2-12
Estimate of DuPage County Flood Vulnerability

Building:	Number of Buildings:	Estimate of Structure Value:	Estimate of Contents	Estimate of 100-year Flood Floodplain Exposure:
Residential (90%)	2,605	$301,000	$150,500	$1.176 billion
Non-Residential (9%)	260	$2,500,000	$2,500,000	$1.130 billion
Critical Facilities (1%)	29	$2,500,000	$2,500,000	$0.145 billion
Total	2,895			$2.421 billion

The figure of $2,421 million is the estimate of DuPage County property vulnerable or exposed to flood damage in the 100-year floodplain. The full exposure of DuPage County to 100-year flood damages includes the damages to structures outside the 100-year floodplain, transportation losses, recreation and environmental losses, and the cost of response and recovery.

Examination of flood insurance claims: Another source of damage data is past claims paid by the National Flood Insurance Program. Table 2-13 summarizes flood insurance claims in DuPage County. Table 2-13 and 2-14 summarize flood insurance claims made in DuPage County from the beginning of the program through 2003. There are currently over 2,200 active flood insurance policies in DuPage County. It is not known how many of those policies are for floodplain properties (flood insurance is available for any property in a community participating in the NFIP). Over 2,000 flood insurance claims have been made since 1979; over 1,500 claims have been paid for a total of $12.3 million.

Flood insurance claims figures do not include items not covered by a flood insurance policy, such as landscaping, automobiles, and the value of lost family heirlooms. They also do not include damage to uninsured or underinsured properties.

Local drainage problems: Table 2-13 shows that average claim paid to be $7,992. With the frequent years that claims have been made (Table 2-14) it can be assumed that many insurance claims are a result of local drainage problems. If 1 percent of all housing units experience local drainage problems in a given event, and damage averaged $7,992, the estimate damages would be $26.8 million. It is reasonable to expect that damage to this level occurred as a result of the October 2-3, 2006 localized flood event.

"Repetitive Loss Properties: There are several different definitions of a "repetitive loss property." The current FEMA definition of a repetitive loss property is a flood-insured structure that has received two or more flood insurance claim payments of more than 25% of the market value within any 10-year period. Formerly, the definition was any property which has received two flood insurance claim payments in any ten year period. The identification and mitigation of repetitive loss properties are important to the National Flood Insurance Program because even though they comprise 2 percent of the policy base, they account for 33 percent of the country's flood insurance claim payments. There are a total of 173 repetitive loss properties included on the FEMA list for DuPage County. Of those properties, 65 have been mitigated (acquired) and several additional

properties are included in an applications to IEMA/FEMA funding for acquisition. Most repetitive loss properties are being addressed through the County's stormwater management activities and through municipal efforts. As shown in Table 2-13" approximated half of the remaining repetitive loss properties do have flood insurance.

Table 2-13: DuPage County FEMA Repetitive Flood Loss Properties

Community	Number of Repetitive Loss (RL) Properties	Insured RL Properties	RL Properties that have been Mitigated	Remaining RL Properties
Village of Addison	32	12	18	14
Village of Bensenville	11	--	1	10
Village of Bloomingdale	2	--	0	2
Village of Clarendon Hills	1	--	0	1
City of Darien	2	--	0	2
Village of Downers Grove	4	2	0	4
City of Elmhurst	6	--	3	3
Village of Glen Ellyn	5	2	0	5
Village of Glendale Heights	6	2	0	6
Village of Hinsdale	1	--	0	1
Village of Itasca	3	1	0	3
Village of Lisle	5	5	0	5
Village of Lombard	7	1	4	3
City of Naperville	5	11	2	3
Village of Oak Brook	7	5	0	7
Village of Villa Park	1	--	0	1
City of Warrenville	3	2	0	3
Village of Westmont	3	--	1	2
City of Wheaton	10	4	2	8
Village of Winfield	6	3	0	6
City of Wood Dale	21	3	16	5
DuPage County	32	2	18	14
Total:	173	55	65	108

Note that the FEMA repetitive loss list for DuPage County includes properties in Aurora, Bolingbrook and St. Charles. These communities are part of the Kane County or Will County mitigation plans."

Exhibit 2-5
DuPage County 100 & 500 year Floodplains Map

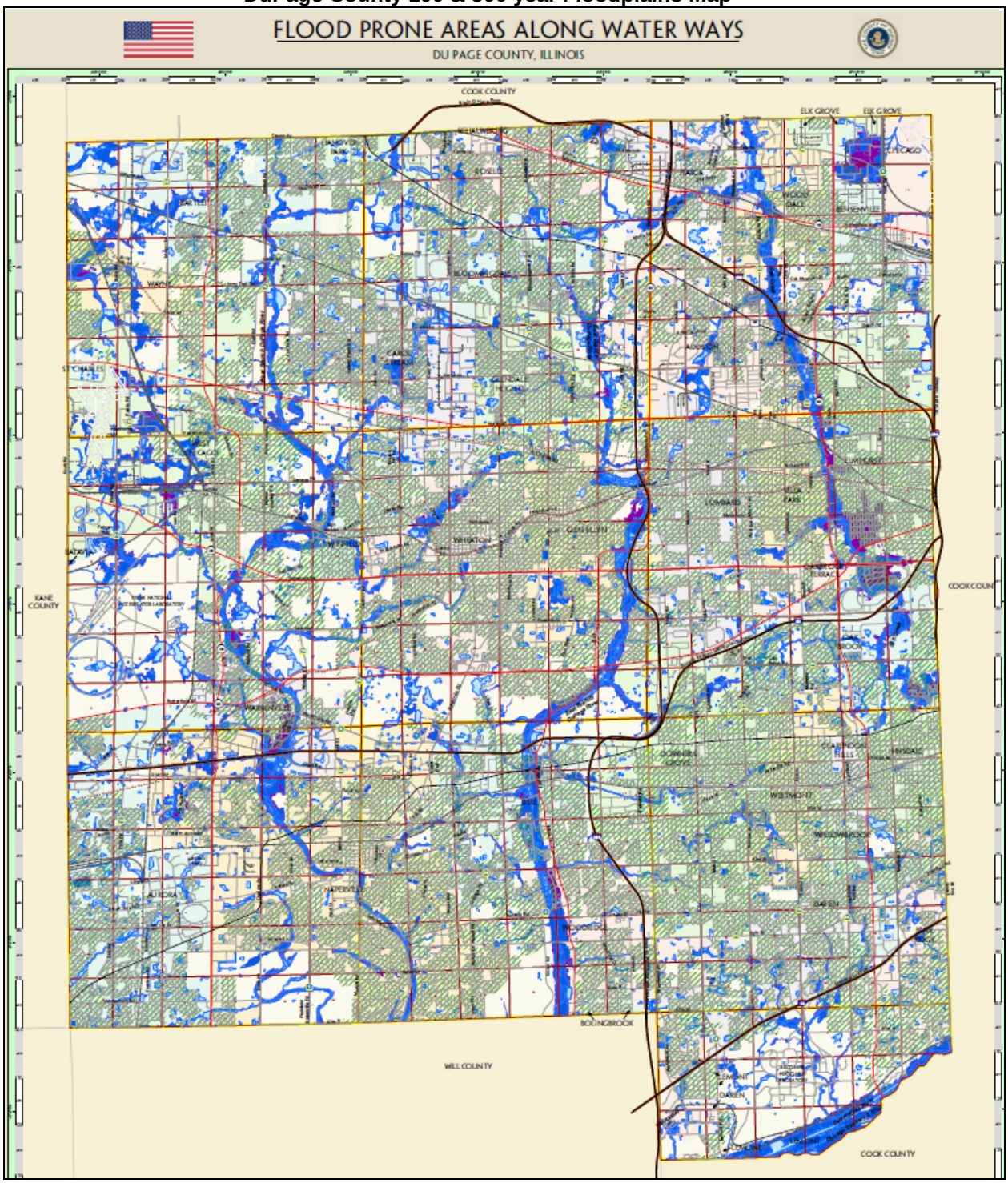


Table 2-14
DuPage County Flood Insurance Claims (1978 to 2012) Summary

Community	Number of Claims	Number of Claims Paid	Total Paid	Average Paid	Number of Active Policies
Village of Addison	536	430	$ 7,345,507	$ 17,082	514
Village of Bartlett	7	4	$ 16,974	$ 4,243	44
Village of Bensenville	118	98	$ 2,924,452	$ 29,841	74
Village of Bloomingdale	16	13	$ 81,212	$ 6,247	48
Village of Bolingbrook	35	24	$ 469,099	$ 19,545	48
Village of Burr Ridge	19	16	$ 103,007	$ 6,437	30
Village of Carol Stream	133	119	$ 2,117,541	$ 17,794	102
Village of Clarendon Hills	25	10	$ 48,880	$ 4,888	15
City of Darien	25	13	$ 74,950	$ 5,765	52
Village of Downers Grove	92	66	$ 440,514	$ 6,674	139
City of Elmhurst	259	191	$ 2,055,687	$ 10,762	199
Village of Glendale Heights	46	40	$ 179,528	$ 4,488	49
Village of Glen Ellyn	97	68	$ 378,759	$ 5,569	182
Village of Hanover Park	28	19	$ 246,400	$ 12,968	21
Village of Hinsdale	45	30	$ 1,834,516	$ 61,150	181
Village of Itasca	41	32	$ 563,140	$ 17,598	42
Village of Lemont	8	7	$ 44,791	$ 6,398	8
Village of Lisle	96	70	$ 435,247	$ 6,217	306
Village of Lombard	98	77	$ 398,845	$ 5,179	56
City of Naperville	137	95	$ 652,832	$ 6,871	454
Village of Oak Brook	72	56	$ 2,828,748	$ 50,513	60
City of Oakbrook Terrace	13	11	$ 94,252	$ 8,568	38
Village of Roselle	31	25	$ 142,205	$ 5,688	24
Village of Villa Park	53	35	$ 279,355	$ 7,981	53
City of Warrenville	40	29	$ 520,901	$ 17,962	33
Village of Wayne	-	-	$ -	-	-
City of West Chicago	8	8	$ 42,730	$ 5,341	21
Village of Westmont	30	20	$ 60,441	$ 3,022	30
City of Wheaton	154	118	$ 651,929	$ 5,524	163
Village of Willowbrook	9	5	$ 13,103	$ 2,620	185
Village of Winfield	65	44	$ 401,204	$ 9,118	40
City of Wood Dale	232	201	$ 3,566,081	$ 17,741	137
Village of Woodridge	15	12	$ 63,900	$ 5,325	37
Unincorporated DuPage County	323	249	$ 3,054,955	$ 12,268	716
Total:	2,906	2,235	$ 32,131,658	$ 407,387	4,101

Table 2-15
DuPage County Flood Insurance Claims Activity (1978 to 2005)

Community	Number of Claims	Number of Active Policies	Properties with More Than 1 Claim	Active Policies That Have Made A Claim	Years of Claims
Village of Addison	376	384	61	68	78-'80,'82-'87,'89-'91,'94-'97,'99,'01
Village of Bartlett	2	8	0	0	78,'97
Village of Bensenville	73	42	14	7	78'-82,'85-'87,'89,'90,'94,'97,'98,'01,'02,'05
Village of Bloomingdale	14	23	2	2	78,'79,'87,'95
Village of Burr Ridge	17	17	2	1	77-'79,'81,'83-'85,'89,'93,'96
Village of Carol Stream	43	97	4	22	78,'79,'83,'87,'96,'01
Village of Clarendon Hills	22	9	5	0	78-'81,'83-'85,'87,'96,'97
City of Darien	21	42	4	5	78,'79,'85,'90,'93,'96,'03
Village of Downers Grove	80	73	15	11	78-'83,'85,'87,'88,'89,'90,'96-'98
City of Elmhurst	226	76	21	18	79-'88,'90,'94,'95,'97,'01
Village of Glendale Heights	34	41	6	1	78-'80,'82,'85,'87,'01
Village of Glen Ellyn	69	82	10	5	78-'80,'82,'85,'87,'96,'97,'99,'01
Village of Hanover Park	17	21	2	5	78,'80,'82,'87,'89,'90,'99,'01
Village of Hinsdale	20	51	2	1	79,'80,'82,'83,'85-'87,'92,'94,'96,'97
Village of Itasca	27	34	6	4	79,'81,'82,'87,'97,'01
Village of Lemont	7	9	1	1	82,'83,'96,'03,'04
Village of Lisle	67	189	12	30	79,'80,'82,'83,'87,'90,'96-'98,'01,'02
Village of Lombard	86	38	17	2	78-'80,'82,'83,'85-'87,'90,'94-'99,'01
City of Naperville	120	209	14	24	78-'85,'87,'91,'96-'98,'00,'01
Village of Oak Brook	51	57	12	14	78-'83,'85,'87,'90,'96,'97,'99
City of Oakbrook Terrace	12	10	1	0	78,'79,'82,'83,'87
Village of Roselle	22	14	4	2	78,'79,'82,'85,'87,'89,'93,'01,'03
Village of Villa Park	38	48	6	5	78,'82,'84,'89,'97
City of Warrenville	24	23	4	3	79,'81,'83,'85,'96,'97
Village of Wayne	0	6	0	0	N/A
City of West Chicago	6	16	0	0	78,'79,'82,'96
Village of Westmont	29	13	6	3	77-'80,'82-'84,'87,'90,'96
City of Wheaton	109	102	19	16	78-'90,'94-'98,'01,'04
Village of Willowbrook	8	35	0	4	83,'85,'90,'93,'96
Village of Winfield	38	31	7	6	78,'79,'82,'84,'85,'87,'90,'96,'97,'01,'02
City of Wood Dale	179	58	35	19	78-'85,'87,'89,'90,'94,'97,'99,'01,'02
Village of Woodridge	11	17	0	1	79,'83,'85,'93,'96,'97
Unincorporated DuPage County	242	339	34	23	78-'87,'89-'98,'00-'05
Total:	2,090	2,214	326	303	77-'05

There are several FEMA programs that encourage communities to identify the causes of their repetitive losses and develop a plan to mitigate the losses (this *Plan* meets FEMA's repetitive loss planning criteria). Based on an initial review of 1,546 paid insurance claims, there are potentially 326 properties that at one time were repetitive loss properties in the County. There are relatively few remaining repetitive loss properties in DuPage County municipalities and the unincorporated areas (detailed information has not yet been provided by FEMA). Most repetitive loss properties have been addressed through the County's stormwater management activities.

Overall impact of floods to buildings is **high**.

Critical Facilities: Critical facilities that could be impacted by flooding are primarily located in the floodplain. Table 2-4 shows an estimated dollar amount of assets located in the floodplain (1 percent of all floodplain structures). This estimate does not include wastewater treatment facilities. As the County's GIS is expanded, a more accurate count of critical facilities in the floodplain will be developed.

Transportation: During the 1996 flood, only County road shoulders were damaged. The County bridges and roadways faired well given the magnitude of rainfall in the western portion of the County. The flow of traffic during a flood event will always be of great concern in DuPage County. The need for County and municipal officials to be aware of rain events and hazardous intersections remains great.

Health and safety: The flooding experienced in DuPage County over the last ten years shows that the safety and lives of people is of concern during flood events. The response time for rainwater to become runoff in DuPage County is short, due to the amount of urbanization (buildings, parking lots, streets, sidewalks). The runoff can quickly reach sewers. When sewers are full, runoff will make its way down streets and low-lying areas on its way to streams. This leaves viaducts and underpasses extremely susceptible to flooding. People continue to be at risk in driving through floodwaters. Fast moving waters are a hazard to people in and out of cars as emphasized in the death during the August 1996 flood event.

Past flood events show that warning, evacuation, and rescue is important. Chapter 1 shows an estimate of 74.6 percent of the County being developed. That percent of developed land is expected to grow. The amount of impervious surfaces in the County will increase with that development, which could potentially increase flash flood hazards. As shown in Section 2.2 of this Chapter, DuPage County has a large resident population and a large number of people who travel in and out of the County for work.

Based on the number of historic injuries and deaths, the impact to health and safety is **moderate** during flood events.

Economic Impact: Flood damage to businesses is difficult to estimate. Businesses that are disrupted by floods often have to be closed. They lose their inventories, customers cannot reach them, and employees are often busy protecting or cleaning up their flooded homes. Business can be disrupted regardless of the business being located in the floodplain when customers and clients cannot reach their location.

Historic data tells us that many businesses around the County are impacted when there is flooding, but there is insufficient data to determine a dollar impact. Therefore, overall economic impact to businesses is **high**.

Budget impact: As with flooded roads, public expenditures on flood fighting, sandbags, fire department calls, clean-up and repairs to damaged public property affect all residents of the County, not just those in the floodplain.

2.4 Severe Summer Storms

In this *Plan*, severe storms are considered to be thunderstorms, microbursts or high wind events, lightning events, and hail storms.

2.4.1 Severe Summer Storm Hazard Assessment

Thunderstorms are most likely to happen in the spring and summer months and during the afternoon and evening hours, but can occur year-round and at all hours. The biggest threats from thunderstorms are flash flooding and lightning. In most cases, flash flooding occurs in small drainage areas where water quickly accumulates before it drains to floodplains.

The National Weather Service classifies a thunderstorm as severe if its winds reach or exceed 58 mph, produces a tornado, or drops surface hail at least 0.75 inch in diameter. Compared with other atmospheric hazards such as tropical cyclones and winter low pressure systems, individual thunderstorms affect relatively small geographic areas. The average thunderstorm system is approximately 15 miles in diameter (75 square miles) and typically lasts less than 30 minutes at a single location. However, weather monitoring reports indicate that coherent thunderstorm systems can travel intact for distances in excess of 600 miles.

Other threats from thunderstorms include downburst winds, high winds, hail and tornadoes. Downdraft winds occur during the dissipating stage of all thunderstorms. Downburst winds are strong, concentrated, straight-line winds created by falling rain and sinking air that can reach speeds of 125 mph and are often associated with intense thunderstorms. Downbursts may produce damaging winds at the surface.

Lightning, which occurs during all thunderstorms, can strike anywhere. Generated by the buildup of charged ions in a thundercloud, the discharge of a lightning bolt interacts with the best conducting object or surface on the ground. The air in the channel of a lightning strike reaches temperatures higher than 50,000°F. The rapid heating and cooling of the air near the channel causes a shock wave which produces thunder.

Building damaged by a microburst, July 7, 1994 storm in Aurora

Source: Aurora Emergency Management

When lightning strikes a human being, death, or at a minimum, serious burns are the common outcomes. For every person killed by lightning, three people are injured. For those who survive, their injuries can lead to permanent disabilities. Seventy percent of the survivors suffer serious, long-term effects, such as memory loss, sleep disorders, depression, and fatigue.

Table 2-16

DuPage County Hail Events
From 1961 to July 01, 2012

Size (inches):	Number of Events:
0.75	47
0.88	25
1.00	45
1.25	7
1.50	5
1.75	19
2.00	2
Total:	150

Gap between May 30, 2005 and Oct 02, 2006

Microbursts can form from intense thunderstorms. A microburst is a convective downdraft with an affected outflow area of less than 2½ miles wide and peak winds lasting less than 5 minutes. Microbursts may induce dangerous horizontal or vertical wind shears, which can cause property damage (and adversely affect aircraft performance).

Hailstones are ice crystals that form within a low-pressure front due to warm air rising rapidly into the upper atmosphere and the subsequent cooling of the air mass. Frozen droplets gradually accumulate on the ice crystals until, having developed sufficient weight, they fall as precipitation. The size of hailstones is a direct function of the severity and size of the storm. Significant damage does not result until the stones reach 1.5 inches in diameter, which occurs in less than half of all hailstorms.

Safety: The threat to life and the cause of death vary by the type of storm. Between 1995 and 2000, the National Weather Service reported 20 people in Illinois were killed by flash floods, wind, and lightning brought by thunderstorms.

Hail rarely causes loss of life. Most deaths can be prevented through safe practices. Much information has come out over the last 20 years about lightning safety, for example, which has reduced the loss of life. Before 1990, an average of 89 people were killed by lightning each year.

Health: No special health problems are attributable to thunderstorms, other than the potential for tetanus and other diseases that arise from injuries and damaged property.

Past Events: Tables 2-16 and 2-17, and Exhibit 2-6 show recorded hail events for DuPage County. Of the 31 hail events shown in Table 2-16, all but 4 events occurred in the afternoon or evening.

During the July 6, 2003 hail event, 4,400 to 5,000 properties in Glendale Heights suffered roof or siding damage as a result of 2-inch hail. In the summer of 1992, a microburst in Woodridge knocked down a wall under construction. Multiple injuries were sustained with one fatality from falling debris. Also a wind event in November 2004 in Woodridge cost the Village around $40,000 for the removal of hanging limbs and branch clean-up.

Frequency: Table 2-17 shows recorded severe summer storms for DuPage County. The DuPage County area averages 5.8 thunderstorm events each year with winds in excess of 50 miles per hour. They average an hour in duration. It is estimated that only five storms each year have the hailstorms and high winds to be considered a severe thunderstorm. Assuming the average severe storm affects 100 square miles, the odds of a severe thunderstorm hitting any particular square mile in DuPage County are 1 to 1 or 100 percent.

Table 2-17
DuPage County Hail Event Details
2006-2012

Date:	Time:		Size:	Location:
			(inches)	
10/02/2006	12:16	p.m.	0.75	Clarendon Hills
10/02/2006	12:25	p.m.	0.75	Naperville
10/02/2006	12:51	p.m.	0.88	Darien
10/02/2006	6:53	p.m.	0.75	Bensenville
10/02/2006	7:23	p.m.	1.00	Addison
10/02/2006	7:28	p.m.	0.88	Elmhurst
10/02/2006	9:22	p.m.	0.75	Aurora
11/29/2006	9:47	a.m.	0.75	Willowbrook
04/03/2007	6:16	a.m.	1.00	Addison
04/03/2007	6:53	a.m.	0.75	Glendale Heights
06/27/2007	3:19	p.m.	0.88	Downers Grove
04/25/2008	4:29	p.m.	0.88	Naperville
04/25/2008	4:29	p.m.	0.75	Unincorporated
07/10/2008	7:04	p.m.	1.00	Woodridge
08/04/2008	6:51	p.m.	0.75	Woodridge
08/04/2008	7:14	p.m.	1.00	Unincorporated
06/01/2009	1:30	p.m.	0.75	Naperville
06/01/2009	1:45	p.m.	0.75	Woodridge
06/19/2009	9:23	a.m.	0.88	Unincorporated
06/19/2009	11:00	a.m.	1.25	Bensenville
06/19/2009	11:07	a.m.	0.75	West Chicago
06/19/2009	11:20	a.m.	1.00	Bloomingdale
06/19/2009	11:28	a.m.	0.88	Itasca
07/11/2009	3:25	a.m.	0.75	Carol Stream
07/11/2009	3:26	a.m.	1.50	Glen Ellyn
03/11/2010	8:09	p.m.	0.75	Glen Ellyn
04/05/2010	9:28	p.m.	1.25	Hanover Park
04/05/2010	9:30	p.m.	0.75	Hanover Park
04/05/2010	9:36	p.m.	1.00	Itasca
06/23/2010	4:35	p.m.	0.88	Oak Brook
06/23/2010	4:40	p.m.	0.88	Oak Brook

03/20/2011	6:51	p.m.	1.00	Unincorporated
04/19/2011	6:17	p.m.	0.88	Oak Brook
05/22/2011	2:10	p.m.	1.00	Unincorporated
05/31/2011	1:53	p.m.	1.00	Carol Stream
08/13/2011	12:59	p.m.	0.88	Naperville
08/13/2011	1:01	p.m.	1.00	Naperville
08/13/2011	1:03	p.m.	1.00	Oak Brook
08/13/2011	1:04	p.m.	1.00	Unincorporated
08/13/2011	1:09	p.m.	1.00	Lisle
08/13/2011	1:13	p.m.	1.00	Unincorporated
08/13/2011	1:15	p.m.	0.75	Woodridge
08/13/2011	1:20	p.m.	1.00	Westmont
05/20/2012	8:00	p.m.	0.75	Willowbrook
07/01/2012	11:22	a.m.	1.50	Wheaton
07/01/2012	11:27	a.m.	1.00	Glen Ellyn
07/01/2012	11:30	a.m.	0.75	Wheaton
07/01/2012	11:32	a.m.	0.75	Villa Park

Source: NCDC

National Weather Service's Hail Description

Description	Diameter (inches)
Pea	0.25
Marble or Mothball	0.50
Penny or Dime	0.75
Nickel	0.88
Quarter	1.00
Half Dollar	1.25
Walnut or Ping Pong Ball	1.50
Golf ball	1.75
Hen's Egg	2.00
Tennis Ball	2.50
Baseball	2.75
Tea Cup	3.00
Grapefruit	4.00
Softball	4.50

Exhibit 2-6
DuPage County Recorded Hail Events

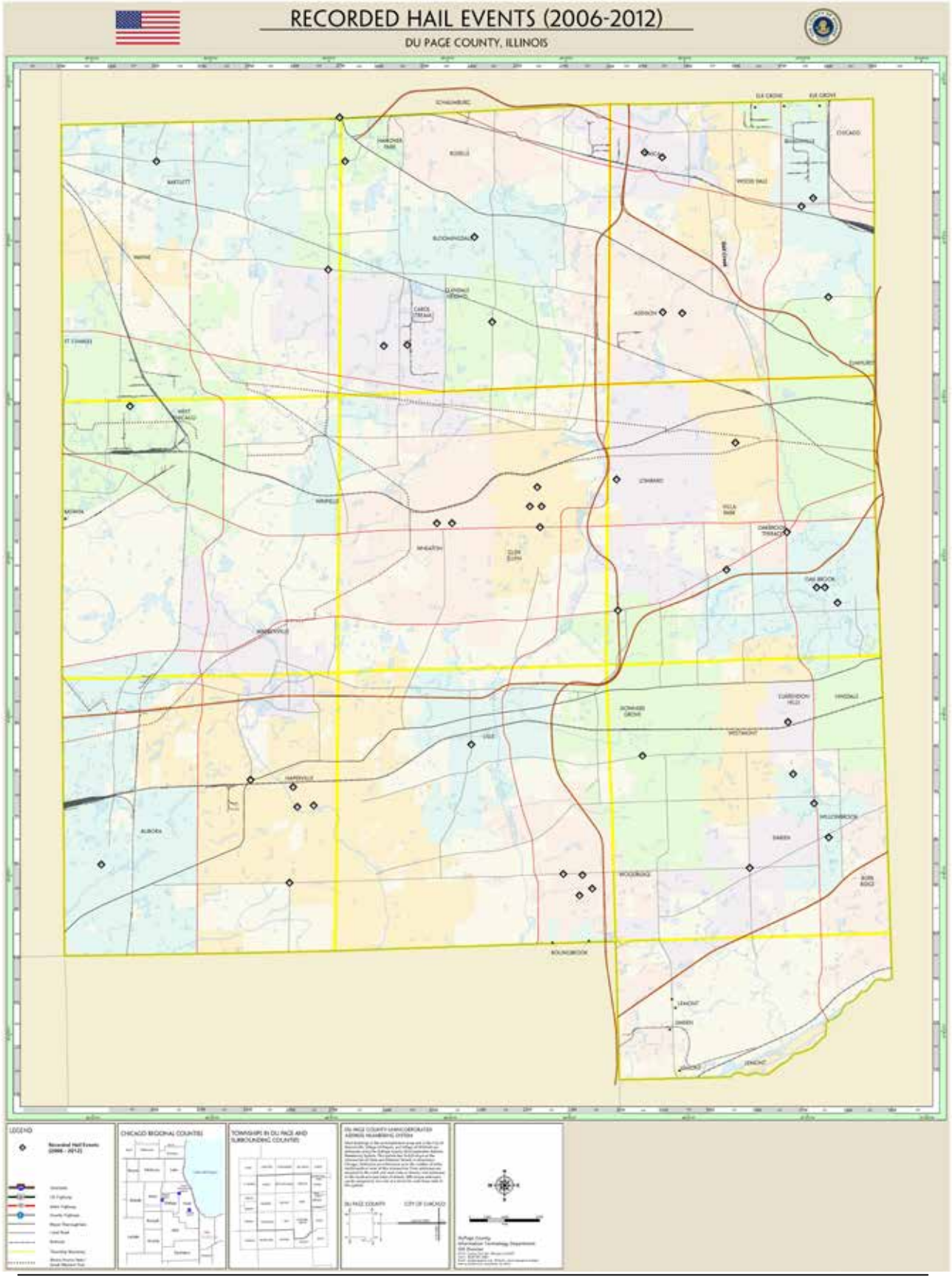


Table 2-18
DuPage County Frequency of Severe Summer Storms

Year	Number of Storms	Magnitude
1996	2	48-50 mph
1997	7	36-64 mph
1998	7	50-65 mph
1999	--	-- mph
2000	3	52-61 mph
2001	5	50-55 mph
2002	3	50-60 mph
2003	13	50-65 mph
2004	11	50-60 mph
2005	5	50-55 mph
2006	2	50-55 mph
2007	4	57-89 mph
2008	6	57-70 mph
2009	2	57-70 mph
2010	4	57-89 mph
2011	7	57-80 mph
2012	3	59-117 mph

Source: National Weather Service - 2012

2.4.2 Severe Summer Storms Vulnerability Assessment

Damage to Buildings: As with tornadoes, mobile homes are at a high risk for damage from thunderstorms. Wind and water damage can result when windows are broken by flying debris or hail. Lightning can cause direct damage to structures (especially those without lightning protection systems) and can cause fires that damage forests and structures.

Hail can inflict severe damage to roofs, windows and siding, depending on hailstone size and winds. One study of insured losses in St. Louis found that 75 percent of the dollar damage was to roofing, 12 percent to awnings, 6 percent to exterior paint, 4 percent to glass and 3 percent to siding (*Hail Loss Potential in the US*, page 2).

If a severe summer storm impacts a 100 square mile area of the County, then approximately a third of the of the County would be affected (DuPage County area equals 334 square miles). If 1 percent of the homes in that area were subject to damage, the vulnerability of DuPage County buildings would be:

(100 square miles x 1,005 housing units per square mile x $301,000 per home) x 1% =
= $302 million in property value exposed

Impact to buildings is considered **moderate**.

Damage to Critical Facilities: Critical facilities are susceptible to the same damage and disruption from thunderstorms as other buildings. Emergency operations can be disrupted as thunderstorms and lightning affect radio communications and antennas are a prime target for lightning. To date, there is not record of critical facilities having incurred any damages due to severe storms. Damage to critical facilities is considered **moderate**.

Health and Safety: Severe summer storms pose a real danger to people's lives. With thunderstorms, high winds, lightning and hail, there is a large risk of injury and death. Impact to health and safety is considered **moderate**.

Economic Impact: Thunderstorms can impact transportation and utilities. Airplanes have crashed when hit by downbursts or lightning. Automobiles and their windshields are subject to damage by hail. Power lines can be knocked out by lightning or knocked down by wind and debris. In Addison, at Lake Street and 4th Avenue, a billboard was damaged due to high winds on March 31, 2006. Repair costs were in the tens of thousands.

Lightning can also cause power surges that damage appliances, electronic equipment and computers. Cost of clean-up by towns can add up.

Economic impact is considered **moderate**.

2.5 Winter Storms

2.5.1 Winter Storm Hazard Assessment

The Illinois Emergency Management Agency defines a severe winter storm as a storm that meets one or more of the following criteria:

- A snowstorm that produces six inches or more of snow within 48 hours or less,
- An ice storm in which 10 percent of the cooperative National Weather Service stations in Illinois report glaze, and/or
- A snowstorm or ice storm in which deaths, injuries, or property damage occurs.

There are many ways for winter storms to form, but certain key ingredients are needed. First temperatures must be below freezing in the clouds and near the ground. There must be a source of moisture in the form of evaporating water. Then lift in the atmosphere causes the moisture to rise and form clouds of precipitation.

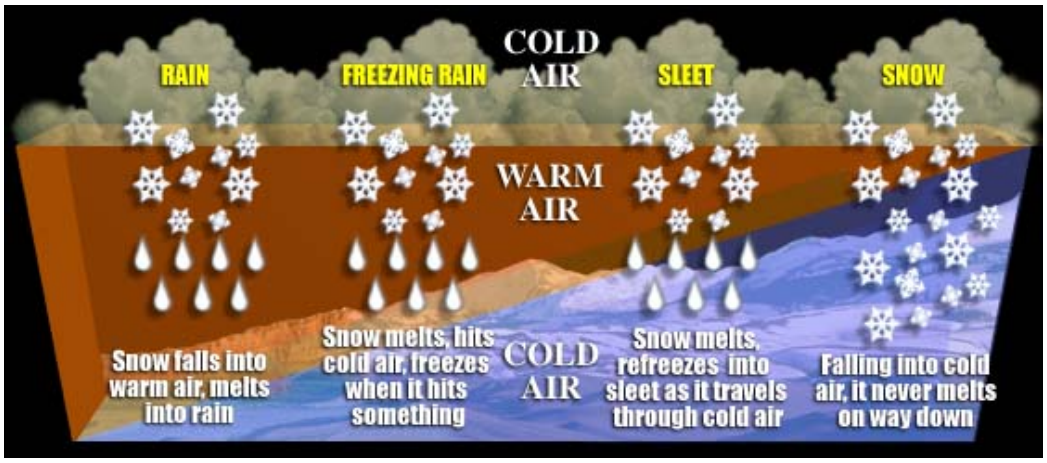
Winter storms in the Midwest are caused by Canadian and Arctic cold fronts that push snow and ice deep into the interior region of the United States. DuPage County is also subject to lake effect snowstorms that develop from the passage of cold air over the relatively warm surface of Lake Michigan which can cause heavy snowfall and blizzard conditions.

Winter storms can occur as heavy snowfalls, ice storms or extreme cold temperatures. Winter storms can occur as a single event or they can occur in combination which can make an event more severe. For example, a moderate snowfall could create severe conditions if it were followed by freezing rain and subsequent extremely cold temperatures. The aftermath of a winter storm can impact a community or region for weeks, and even months.

Snow: Heavy snowfalls can range from large accumulations of snow over many hours to blizzard conditions with blowing snow that could last several days. The National Weather Service's snow classifications are shown on the following page.

Snow Classifications	
Blizzard	Winds of 35 miles per hour or more with snow and blowing snow reducing visibility to less that ¼ mile for at least 3 hours.
Blowing Snow	Wind-driven snow that reduces visibility. Blowing snow may be falling snow and/or snow on the ground picked up by the wind.
Snow Squalls	Brief, intense snow showers accompanied by strong, gusty winds. Accumulation may be significant.
Snow Showers	Snow falling at varying intensities for brief periods of time. Some accumulation possible.
Snow Flurries	Light snow falling for short duration with little or no accumulation.
Source: National Weather Service	

Ice Storms: An ice storm occurs when freezing rain falls from clouds and freezes immediately upon impact. Freezing rain is found in between sleet and rain. It occurs when the precipitation falls into a large layer of warm air and does not have time to refreeze in a cold layer (near or below 32°F) before it comes in contact with the surface, which is also near or below 32°F, as illustrated below.



Source: University of Nebraska website, http://hpccsun.unl.edu/nebraska/icestorms.html

Past Events: Recorded winter storm events are shown Table 2-19. The average annual snowfall for DuPage County is 36 inches. The largest snowfall over a period of days was recorded on January 25, 1979, with a total of 29 inches.

Reports on recent winter storms are summarized in Table 2-20. The January 1999 snow event blanketed the entire County. In Naperville, 11 inches of snowfall was recorded. The event brought a federal disaster declaration. DuPage County spent $187,000 over their regular costs. Woodridge spent over $102,000, Downers Grove spent over $44,000, and Wheaton over $82,000. Elmhurst spent over $90,000 and Lisle over $40,000.

Exhibit 2-7
Illinois Average Snowfall

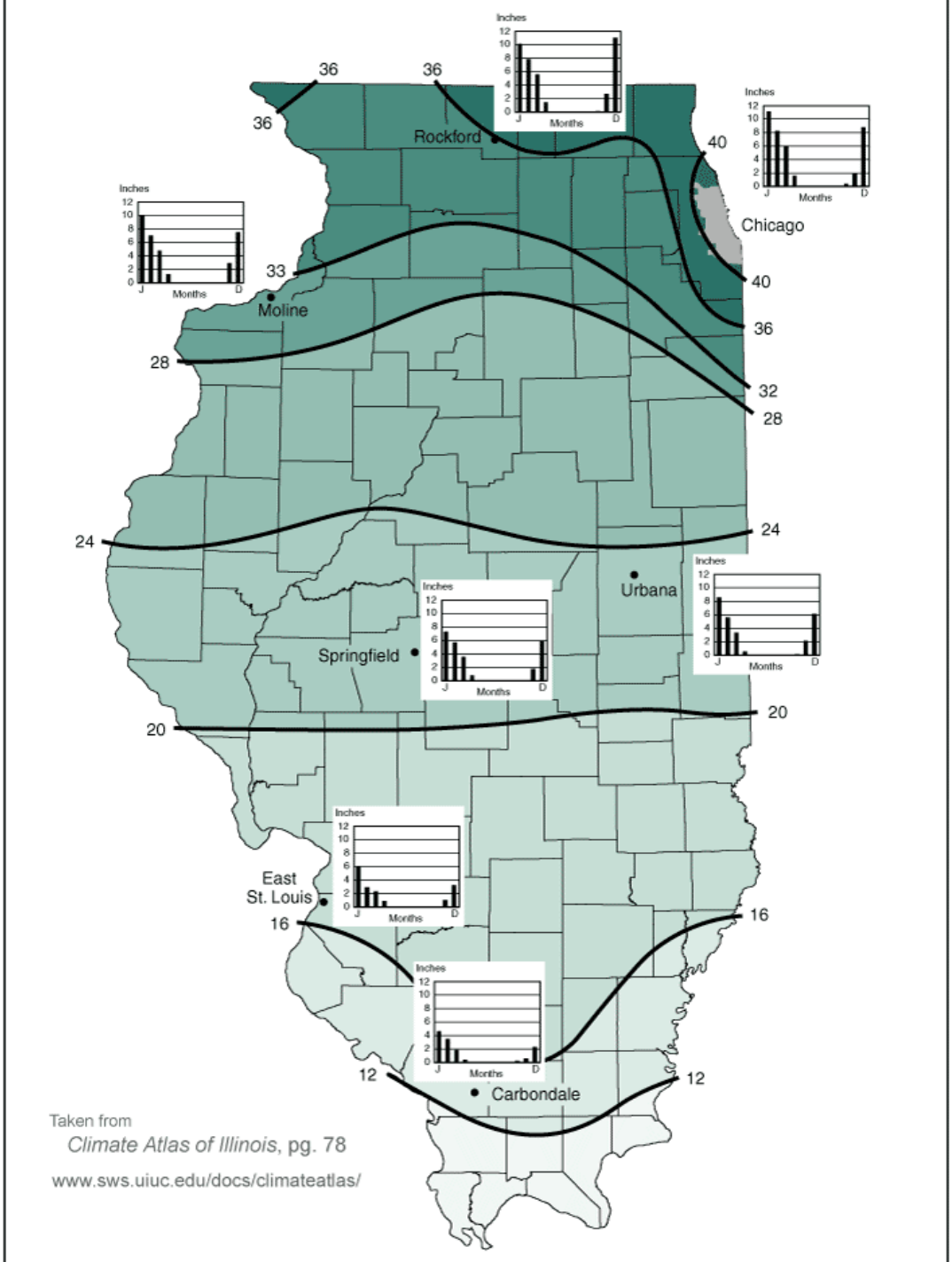


Figure 3-32. Average annual snowfall (inches), 1971-2000.

The December 2000 snow event cost Elmhurst $74,000, Lisle $21,500, and Wheaton $51,103. Numerous deaths of people had been recorded for people suffering heart attacks following snow shoveling.

2007

Heavy snow fell across northern Illinois on February 13th with some areas receiving over one foot of snow. In addition, wind gusts were frequently blowing at or above 35 mph, creating blizzard and whiteout conditions across many areas.

Willowbrook measured 11.8 inches of snowfall, Oak Brook measured 11.0 inches of snowfall, Winfield measured 10.5 inches of snowfall and Wheaton measured 10.1 inches of snowfall.

2011

Between January 31 and February 3, 2011, Northern Illinois, including all of DuPage County, experienced heavy snowfall. Most areas in DuPage County received over 20 inches of snow. O'Hare and Midway airports reported totals of 21.2 and 20.9 inches, respectively. Both airports were closed for several days. Peak wind gusts were measured at over 65mph. Major roadways such as Lake Shore Drive were shut down and impassable. While there were no blizzard-related deaths reported in DuPage County, every community in DuPage County was significantly impacted. Response cost countywide related to this event was estimated at over $3 million, resulting in State and Presidential Disaster Declarations. As a result of the Presidential Declaration, Public Assistance reimbursements totaling $3,041,412 were received by 133 entities throughout DuPage County.

Thousands of motorists and their vehicles became stranded during the evening hours as conditions deteriorated and snow quickly accumulated. The National Guard was activated to assist stranded motorists traveling on interstates but large sections of interstates, including Interstate 80 and Interstate 39 were eventually closed. Many communities began assisting stranded motorists using plow trucks and many police officers began riding with plow truck drivers to respond to emergency calls because their cars were getting stuck in the snow. Many communities also had plow trucks escort ambulances and fire trucks. Other rescue personnel used snowmobiles to respond to emergency calls.

During the height of the storm from the evening of February 1st into the morning of February 2nd, many communities pulled their plow trucks off the roads out of concern for the safety of their drivers. Many communities declared roads closed to traffic with little hope of a rescue for anyone who ventured out into the blizzard and needed help. Whether roads were officially closed or not, most were impassible.

The high winds also blew down tree limbs and power lines causing numerous power outages. A portion of a garden center roof collapsed under the weight of heavy snow in Naperville. On Sunday February 13th, a 10 foot section of brickwork on the parapet along the roof of a building collapsed on Westmore Avenue in Lombard. Heavy snow and ice slid into the parapet and knocked it down.

Table 2-19
DuPage County Recorded Winter Storm Events

Date	Type
January 26, 1994	Ice Storm
December 6, 1994	Winter Storm
December 8, 1995	Winter Storm
February 2, 1996	Extreme Cold
January 9, 1997	Winter Storm
January 15, 1997	Winter Storm
March 9, 1998	Heavy Snow
January 1, 1999	Heavy Snow
March 5, 1999	Heavy Snow
March 8, 1999	Heavy Snow
February 18, 2000	Heavy Snow
December 11, 2000	Blizzard
January 30, 2002	Winter Storm
March 2, 2002	Winter Storm
January 23, 2003	Extreme Cold
March 4, 2003	Winter Storm
January 4, 2004	Heavy Snow
January 29, 2004	Extreme Cold
January 21, 2005	Heavy Snow
December 8, 2005	Winter Storm
January 20, 2006	Winter Storm
February 18, 2006	Extreme Cold
February 3, 2007	Extreme Cold
February 13, 2007	Blizzard
February 25, 2007	Winter Storm
January 29, 2008	Winter Storm
February 10, 2008	Extreme Cold
December 18, 2008	Winter Storm
January 9, 2009	Winter Storm
January 15, 2009	Extreme Cold
February 5, 2009	Extreme Cold
February 8, 2010	Winter Storm
December 11, 2010	Winter Storm
January 1, 2011	Extreme Cold
January 31, 2011	Blizzard
January 12, 2012	Winter Storm
January 20, 2012	Winter Storm

Source: NCDC

Some of the highest snowfall totals from the blizzard include: 20.9 inches three miles southwest of Chicago Midway Airport; 20.6 inches six miles northwest of St. Charles; 20.0 inches at Chicago O'Hare Airport; 17.9 inches in Naperville; 17.7 inches in Oak Brook; 17.0 inches Lisle; 16.3 inches at the National Weather Service in Romeoville.

Four deaths occurred caused by heart attacks while shoveling snow included; a 61 year old man and a 62 year old man, both in Carol Stream; a 69 year old man in Glendale Heights and a 69 year old man in Downers Grove.

Frequency: Since 1994 when the National Climate Data Center (NCDC) started recording events, DuPage County has been impacted by one to three snow or ice events each winter. Therefore, the odds of a winter storm hitting DuPage County in any given year are 1:1 or a 100 percent chance.

2.5.2 Vulnerability Assessment – Winter Storms

Damage to Buildings: Historically, roofs would collapse due to heavy snow loads, but most buildings are now constructed with low temperatures, snow loads and ice storms in mind. With today's energy consciousness, buildings are much better insulated than they were 50 years ago. Winter storms do not have a major impact on buildings. Impact on critical facilities is **low**.

Critical Facilities: The major impacts of snow and ice storms on property are to utilities and roads. Power lines and tree limbs are coated with heavy ice resulting in disrupted power and telephone service, often for days. Even small accumulations of ice can be extremely dangerous to motorists and pedestrians. Bridges and over passes are particularly dangerous because they freeze before other surfaces. Impact on critical facilities is **low**.

Health and Safety: Winter storms bring the following two types of safety hazards:

– Weather-related hazards, including hazardous driving and walking conditions and heart attacks from shoveling snow.

– Extreme cold, from the low temperatures, wind chill, and loss of heat due to power outages.

In the United States, the number of deaths peaks in midwinter and reaches a low point in late summer, but most deaths are not directly related to the weather. The table to the right shows that winter storms have led to more deaths in Illinois than any other natural hazard. Certain populations are especially vulnerable to the cold, including the elderly, the homeless, and lower income families with heating problems.

About 70 percent of the injuries caused by snow and ice storms result from vehicle accidents and 25 percent occur to people caught out in the storm.

The effect of cold on people is usually made more severe by the impact of wind chill factors. Wind chill is reported as a temperature, but is not the actual temperature. Rather it is how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature.

Winter Storm Deaths
Illinois and United States

	Winter Weather		Cold Related		Total	
	IL	US	IL	US	IL	US
1995	0	11	0	22	0	33
1996	1	86	5	62	6	148
1997	10	90	8	51	18	141
1998	2	68	0	11	2	79
1999	2	41	1	7	3	48
2000	1	33	0	15	1	48
2001	0	18	0	4	0	22
2002	0	17	0	11	0	28
2003	0	28	4	20	1	48
2004	1	28	1	28	2	56
2005	0	34	8	24	8	58
2006	0	17	1	2	1	19
2007	1	16	15	47	16	63
2008	0	21	26	44	26	65
2009	0	28	15	33	15	61
2010	0	21	18	34	18	55
2011	2	17	8	29	10	46
Total	20	574	96	444	127	1018

Source: National Weather Service

Injuries Related to Cold

– 50 percent happen to people over 60 years old
– More than 75 percent happen to males
– About 20 percent happen at home

Extreme cold can result in people and animals suffering from frostbite and hypothermia. Frostbite is damage to tissue caused by the effects of ice crystals in frozen tissue. Extremities (hands, feet, ears, and nose) with more circulation difficulties are most frequently affected.

Hypothermia is the lowering of the core body temperature. It is “clinically significant” when the body temperature is below 95°F. Severe hypothermia occurs when the body’s temperature drops below 85°F, resulting in unconsciousness. If help does not come, death follows. Great care is needed to properly re-warm a person, even mild cases.

Health and safety impact is **moderate**.

Economic Impact: Loss of power means businesses and manufacturing concerns must close down. Loss of access due to snow or ice covered roads has a similar effect. There are also impacts when people cannot get to work, to school, or to the store.

Budget impact: As shown by the funds spent by the County and municipalities, the cost of snow removal for a winter storm event can add up. For the January 1999 snow event, the $187,000 spent by DuPage County Highway Division was the amount spent above their budgeted amount for snow events, which is about $50,000.

Economic impact is **moderate**.

2.6 Tornado

2.6.1 Tornado Hazard Assessment

Enhanced Fujita Scale

Enhanced Fujita Scale*			Original Fujita Scale	
	Derived EF Scale	Operational EF Scale		
Enhanced Fujita Scale	3 Second Gust (mph)	**3 Second Gust (mph)**	Fujita Scale	3 Second Gust (mph)
EF0	65 - 85	**65 - 85**	F0	45 - 78
EF1	86 - 109	**86 - 110**	F1	79 - 117
EF2	110 - 137	**111 - 135**	F2	118 - 161
EF3	138 - 167	**136 - 165**	F3	162 - 209
EF4	168 - 199	**166 - 200**	F4	210 - 261
EF5	200 - 234	**>200**	F5	262 - 317

* Effective February 1, 2007

Tornadoes are one of nature's most violent storms. A tornado is a violently rotating column of air extending from a thunderstorm to the ground. The most violent tornadoes are capable of tremendous destruction with wind speeds of 250 mph or more. Damage paths can be in excess of one mile wide and 50 miles long. A majority of tornadoes, however, have wind speeds of 112 mph or less. The box to the right provides the newly adopted "Enhanced Fijuta (EF) Scale" for evaluating tornado magnitude scale. The EF Scale replaces the Fujita Tornado Scale, used to categorized tornado events. A tornado isn't classified until the damaged area is inspected to determine the level of damage. The EF Scale provides for guidance for assessing various types of damage.

Fujita Tornado Scale (Magnitude)

F0 Gale tornado 40-72 mph, chimney damage, tree branches broken

F1 Moderate tornado 73-112 mph, mobile homes pushed off foundations or overturned

F2 Significant tornado 113-157 mph, considerable damage, mobile homes demolished, trees uprooted

F3 Severe tornado 158-206 mph, roofs and walls torn down, trains overturned, cars thrown around

F4 Devastating tornado 207-260 mph, well-constructed walls leveled

F5 Incredible tornado 261-318 mph, homes lifted off foundation and carried considerable distances, autos carried as far as 100 meters

Tornadoes are classified as F0 through F5, based on wind speed and damage.

Debris hurled by the wind can hit with enough force to penetrate walls. Tornadoes create localized low-pressure areas that can make a building explode. Windows, chimneys and roofs are the most vulnerable parts of buildings to tornado damage.

Tornadoes can move forward at up to 70 miles per hour, pause, slow down and change directions. Most have a narrow path, less than 100 yards wide and a couple of miles long. However, damage paths can be more than 1 mile wide and 50 miles long.

Tornadoes come in all shapes and sizes and can occur anywhere in the U.S. at any time of the year. In the southern states, peak tornado season is March through May, while peak months in the northern states are during the summer months.

In an average year, about 1,000 tornadoes are reported across the United States. Since 1995, deaths due to tornadoes are about 55 per year. Illinois is tied for 7th in the United States with an average of 26 tornadoes per year. A tornado can occur any time of year and at any time of day, though statistics show that over half strike between 3:00 p.m. and 7:00 p.m.

Tornado Fatalities in the United States

Year	Vehicle	Permanent Home	Mobile Home	Other	Total
1995	4	15	8	3	30
1996	2	8	14	1	25
1997	3	38	15	11	67
1998	16	46	64	4	130
1999	6	39	36	13	94
2000	3	6	18	2	29
2002	3	15	17	5	40
2003	-	24	25	5	54
2004	-	-	-	-	34
2005	2	3	32	1	38
2006	7	29	28	2	66
2007	3	16	51	11	81
2008	14	43	55	14	126
2009	1	5	12	3	21
2010	33	236	112	172	553
Totals	60	332	290	203	1388

Source: National Weather Service

The chart to the right shows the tornado-related fatalities in the United States for the last ten years and where they occurred. The number of people who live in mobile homes is far smaller than the number of people who live in permanent homes; however they have practically the same number of deaths. The table also shows that the residents in mobile homes are at

Table 2-20
DuPage County Recorded Tornadoes

Date	Time	Magnitude	Length (miles)	Width (yards)	Deaths	Injuries	Property Damage
4/28/1955	9:05 p.m.	F1	9	33	0	3	$2.5 million
9/26/1959	5:45 p.m.	F2	9	33	0	0	$ 250,000
9/30/1961	1:30 p.m.	F1	2	33	0	0	$ 25,000
5/26/1965	7:45 a.m.	F2	14	70	0	11	$ 250,000
6/23/1965	5:45 p.m.	F1			0	0	$ 3,000
11/12/1965	2:48 p.m.	F2	1	20	0	0	$ 25,000
4/19/1966	10:30 p.m.	F2	1	40	0	0	$ 250,000
4/21/1967	5:10 p.m.	F1	1	33	0	0	$ 25,000
4/21/1967	5:10 p.m.	F1	7	20	0	0	$ 250,000
7/26/1969	3:50 p.m.	F1	5	37	0	0	$ 25,000
8/24/1971	7:15 p.m.	F2	1	83	0	2	$ 250,000
7/17/1972	7:10 p.m.	F2			0	0	$2.5 million
6/20/1974	6:40 p.m.	F0			0	0	-
6/18/1975	12:50 p.m.	F0			0	0	$ 3,000
3/12/1976	12:57 p.m.	F3	15	30	0	3	$2.5 million
3/12/1976	1:20 p.m.	F2			0	25	$2.5 million
6/13/1976	4:48 p.m.	F4			0	0	$ 250,000
8/2/1978	3:30 p.m.	F0	4	880	0	0	-
4/23/1991	12:50 p.m.	F1		100	0	0	$ 3,000
7/18/1997	2:30 p.m.	F1	3	150	0	0	-
8/23/2007	2:08 p.m.	F1	2.67	300-500	0	0	$15,000
8/4/2008	6:47 p.m.	F1	.8	50			$250,000
6/21/2011	7:31 p.m.	F1	2.06	200			$500,000

Source: NCDC

the greatest risk.

Health and Safety: Although no deaths have been attributed to a tornado in DuPage County, the risk of loss of life is still great. The August 1990 twister in Plainfield, Illinois caused 28 deaths. The Utica, Illinois tornado of 2004 killed eight people in one location.

The major health hazard from tornadoes is physical injury from flying debris or being in a collapsed building or mobile home. Based on national statistics for 1970 – 1980, for every person killed by a tornado, 25 people were injured and 1,000 people received some sort of emergency care. The August 1990 twister in Plainfield, Illinois injured 350 people.

Within a building, flying debris or missiles are generally stopped by interior walls. However, if a building has no partitions, any glass, brick or other debris blown into the interior is life threatening. Following a tornado, damaged buildings are a potential health hazard due to instability, electrical system damage, and gas leaks. Sewage and water lines may also be damaged.

Past Events: Table 2-19 shows the recorded tornado events for DuPage County from 1950 to 2011, as recorded by NOAA's National Climate Data Center. Those events are plotted in Exhibit 2-8. From 1950 to 2011, DuPage County has had one F3 tornado and one F4 tornado during the same month, June 1976. There have been seven F2 events. There were no deaths attributed to the tornadoes shown in Table 2-19, however there were several injuries.

2007

On August 23rd, 2007 an EF1 tornado touched down near Prince Crossing Road south of Geneva Road in Winfield. The tornado had a path length of 2.67 miles and a path width of 300 to 500 yards. The tornado lifted just west of Gary Avenue south of Geneva Road. The main damage from the tornado included several large uprooted hardwood trees. Shingles and power lines were also blown down.

2008

On August 4th, 2008 a brief EF1 tornado touched down in an industrial area near Fox Court. It continued east northeast across South Gary Drive and dissipated near Stratford Square Mall. A large warehouse had a wall blown out near Fox Court and Madsen Drive.

A second, brief tornado touched down in Bloomingdale, near an apartment complex on Century Point Lane. There was roof and window damage at two apartment buildings. Significant damage was done to roofs of houses and to trees from Cardinal Drive east across Bloomingdale Road through Norton Lane and into the area around Sterling Drive.

2011

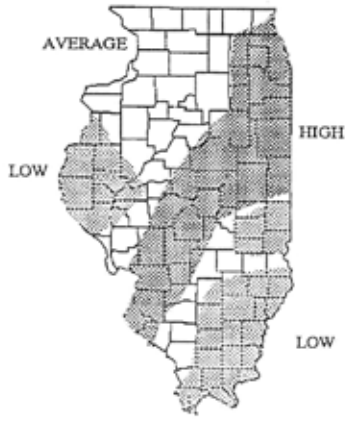
On June 21st, 2011 the National Weather Service storm survey confirmed an EF1 tornado touched down near Sunnydale Park and lifted near 55th and Main in Downers Grove. Most of the damage was to trees. Many mature hardwood trees had been snapped or

knocked down. A fence was blown down at Downers Grove High School. An estimated 35 homes were damaged by falling trees.

Frequency: For DuPage County tornadoes appear to occur March through September. There doesn't appear to be a prominent month of tornado activity. Peak months in the northern states are during the summer.

In the 2010 Illinois Natural Hazard Mitigation Plan, DuPage County had 23 of the 2,225 tornadoes recorded in Illinois between 1950 and 2009. This ranks DuPage County 6th in the State for the highest normalized number of tornadoes per 1000 square miles. DuPage County is classified as having an "elevated" tornado risk based on historic tornado wind speeds and the number of recorded tornadoes per 1,000 square miles.

Tornado Frequency



Source: Illinois Emergency Management Agency

Though there are no official recurrence intervals calculated for tornadoes, with 20 occurrences over 57 years (1950 to 2007), the likelihood of a tornado hitting somewhere in the county is 0.35 (35 percent) in any given year. The width and the length of a tornado's path can vary greatly, but with an assumption that a tornado affects one square mile of land, and there are 334 square miles in DuPage County, the odds of a tornado hitting any particular square mile in the County is 1 in 960 each year, or a 0.001% chance.

2.6.2 Tornado Vulnerability Assessment

Damage to Buildings: Although tornadoes strike at random, making all buildings vulnerable, three types of structures are more likely to suffer damage:

- Mobile homes,
- Homes on crawlspaces (more susceptible to lift), and
- Buildings with large spans, such as airplane hangers, gymnasiums and factories.

Structures within the direct path of a tornado vortex are often reduced to rubble. However, structures adjacent to the tornado's path are often severely damaged by high winds flowing into the tornado vortex, known as inflow winds. It is here, adjacent to the tornado's path where the building type and construction techniques are critical to the structure's survival.

In 1999, FEMA conducted an extensive damage survey of residential and non-residential buildings in Oklahoma and Kansas following an outbreak of tornadoes on May 3, 1999, which killed 49 people. The assessment found:

- The failure for many residential structures occurred where the framing wasn't secured to the foundation, or when nails were used as the primary connectors between the roof structure and the walls. A home in Kansas, for example, was lifted from its foundation. The addition of nuts to the foundation anchor bolts (connected to the wood framing) may have been all that was needed to prevent this.
- Roof geometry also played a significant role in a building's performance.
- Failure of garage doors, commercial overhead doors, residential entry doors or large windows caused a significant number of catastrophic building failures.
- Manufactured homes on permanent foundations were found to perform better than those that were not on solid foundation walls.

For DuPage County for an estimated that 5 square mile area of tornado damage could impact 5,025 homes (1005 housing unites per square mile x 5 square miles). For an EF4 tornado and damage would average 50 percent of the value. Note, for manufactured homes, damage would be 100 percent of the structure damaged.

5,025 x $301,000 x 50% = $756 million

For a 10 square mile area the County's exposure to tornado damage would be $1.5 billion

Tornado impact to buildings is **high.**

Damage to Critical Facilities: Because a tornado can hit anywhere in the County, all of them are susceptible to being hit. Schools are a particular concern, though for two reasons:

Exhibit 2-8
DuPage County Recorded Tornado Occurrences (1950-2011)

- They have large numbers of people present, either during school or as a storm shelter, and
- They have large span areas, such as gyms and theaters.

The 1990 Plainfield tornado was an unfortunate example of this. It struck the Plainfield High School, Grand Prairie Elementary School, St. Mary Immaculate Church and the gymnasium to the Church's elementary school. Cost to repair the two public schools was estimated at up to $35 million. The cost for the church and its school was $5 million.

Large span buildings were also affected in 1990. In addition to the schools and their gyms, hangers at the Aurora airport and Joliet's Essington Road Fire Station were damaged. At this time, we do not know which critical facilities in DuPage County may have large span structures.

Impact to critical facilities for tornadoes is **moderate.**

Impact on People: DuPage County has lost a life to a tornado and had injuries. Residents living in mobile homes are more vulnerable than people in permanent homes. People can inadvertently put their lives in danger during a tornado, or have little or no warning.

Impact to people is **high**.

Economic Impact: The major impact of a tornado on the local economy is damage to businesses and infrastructure. A heavily damaged business, especially one that was barely making a profit, often has to be closed. The post-disaster damage report stated that at least 50 businesses were destroyed by the 1990 tornado.

Infrastructure damage is usually limited to above ground utilities, such as power lines. Damage to roads and railroads is also localized. If it can't be repaired promptly, alternate transportation routes are usually available. Public expenditures include search and rescue, shelters, and emergency protection measures. The large expenses are for repairs to public facilities and clean-up and disposal of debris. Most public facilities are insured, so the economic impact on the local treasury may be small.

Clean-up and disposal can be a larger problem, especially with limited landfill capacity near the damage site.

Economic impact of tornadoes is **moderate.**

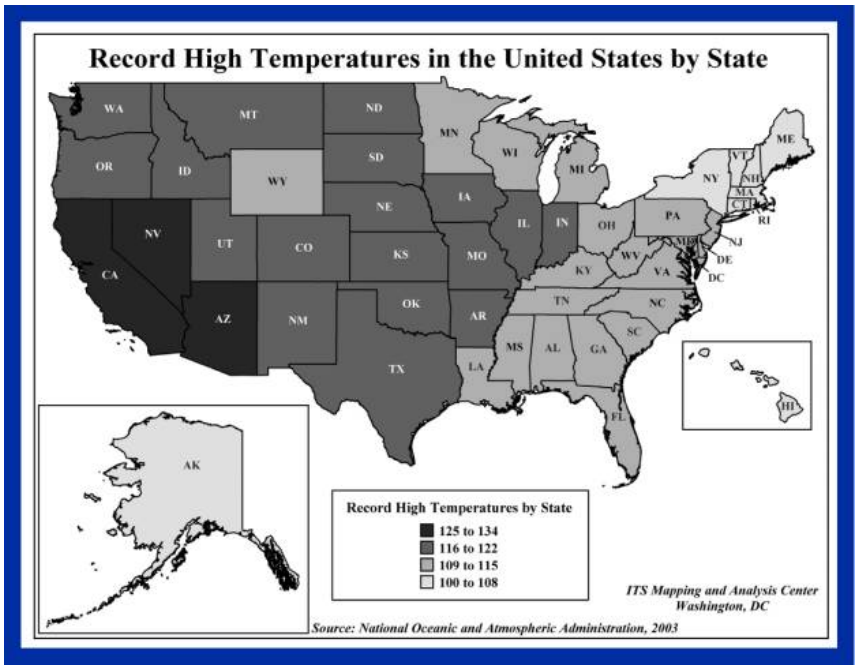
2.7 Extreme Heat and Drought

2.7.1 Extreme Heat and Drought Hazard Assessment

Extreme heat is when temperatures are 10 degrees, or more, above the average high temperature for the region, and last for several weeks. Humid or muggy conditions, which add to the discomfort of high temperatures, occur when a "dome" of high atmospheric

pressure traps hazy, damp air near the ground. Excessively dry and hot conditions can provoke dust storms and low visibility.

Heat kills by pushing the human body beyond its limits. Under normal conditions, the body's internal thermostat produces perspiration that evaporates and cools the body. However, in extreme heat and high humidity, evaporation is slowed and the body must work extra hard to maintain a normal temperature.



Most heat disorders occur because the victim has been overexposed to heat or has over exercised for his or her age and physical condition. Other conditions that can induce heat-related illnesses include stagnant atmospheric conditions and poor air quality.

Extreme heat events can be just as deadly as other natural hazards due to the nature of the event. Extreme heat doesn't immediately impact people when it sets in, instead it is when the periods of extreme heat last for days and weeks that it takes its toll on people. The elderly are at particular risk.

Droughts occur when a long period passes without substantial rainfall. A heat wave combined with a drought creates a very dangerous environment. Also, a prolonged drought, such as the drought that remained in the Midwest from 1987 to 1991, can have a serious economic impact

Table 2-21
DuPage County Recorded Heat and Drought Events

July 12, 1995	Excessive Heat
July 21, 1999	Excessive Heat
July 28, 1999	Excessive Heat
June 15, 2005	Drought
July 1, 2005	Drought
August 1, 2005	Drought
September 1, 2005	Drought
October 1, 2005	Drought
November 1, 2005	Drought
December 1, 2005	Drought
January 1, 2006	Drought
February 1, 2006	Drought
July 4, 2012	Excessive Heat

Source: NCDC

on a community. Increased demand for water and electricity may result in shortages of resources. Moreover, food shortages may occur if agricultural production is damaged or destroyed by a loss of crops or livestock.

Past Events: Table 2-21 shows the limited data available for DuPage County for heat and drought events.

2012

Northern Illinois experienced an intense heat wave during the first week of July. High temperatures at Chicago O'Hare Airport reached 102 on the 4th, 103 on the 5th and 6th and 98 on the 7th. Low temperatures remained in the upper 70s to lower 80s during much of the heat wave with a low temperature of just 82 degrees on the morning of the 6th. Maximum heat index values were mostly in the range of 105 to 115 each day across northeast Illinois. A cold front moved across the area during the late morning and early afternoon of July 7th, bringing several days of near normal temperatures for mid-July.

Frequency: The 2010 Illinois Hazard Mitigation Plan estimated that the frequency of droughts in the state "occurs about once every 21 years." Extreme heat events have occurred more frequently in DuPage County. A 15 year overall recurrence for extreme heat and drought is used (annual recurrence of 0.067).

2.7.2 Extreme Heat and Drought Vulnerability Assessment

Damage to Buildings: Heat and drought have little or no impact on structures. Impact on buildings is **low**. Since impact is low, the vulnerability of extreme heat and drought has not been calculated.

Damage to Critical Facilities: Extreme heat and drought can have an impact on water supply, but since DuPage County's water source is Lake Michigan, the demands on municipal water systems can be managed. The demand on electric utilities is elevated. The impact of extreme heat and drought to critical facilities is **low**.

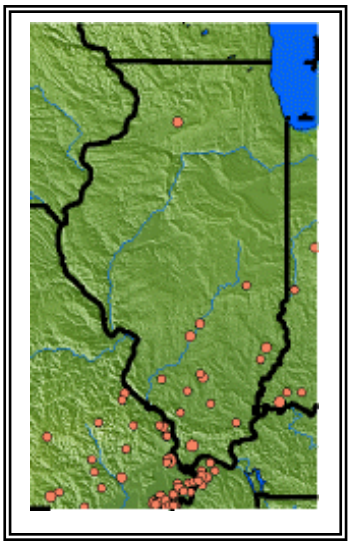
Impact on People: DuPage County, like most areas of the Midwest, is very vulnerable to extreme heat. Urban areas are exposed more acutely to the dangers of extreme heat due to heat being retained in asphalt and concrete and being released at night. This effect brings little relief to the area even in the nighttime. DuPage County is at risk due to its highly urbanized setting. People are at risk for heat stroke or sun stroke, heat exhaustion, and dehydration. Children and the elderly are most at risk. Loss of life is common with extreme heat events. Impact on people is **high**.

Economic Impact: Generally, extreme heat, and especially drought impact agricultural areas in the State. Less than 5.8 percent of the County is still in agricultural use. Economic impact of extreme heat and drought is **low**.

2.8 Other Natural Hazards

Other natural hazards that exist in DuPage County are shown in the table on page 2-3, including, drought, dam failure, and earthquakes. Droughts were included with extreme heat events in the previous section. As shown in Table 2-3, these hazards have a low frequency and low impact. They are, however, hazards that can impact the region. Wildland fires and ice jams will not be discussed in detail in this *Plan*. A hazard analysis of these hazards may be performed in future revisions or updates to this *Plan*. Information regarding earthquakes is presented in the following section.

2.8.1 Earthquakes



USGS Earthquake Hazards Program
http://earthquake.usgs.gov/

Earthquakes are one of nature's most damaging hazards. Earthquakes, and the potential damage from earthquakes, are more widespread than people realize. Earthquakes are caused by the release of strain between or within the Earth's tectonic plates. The severity of an earthquake depends on the amount of strain or energy that is released along a fault or at the epicenter of an earthquake. The energy released by an earthquake is sent to the earth's surface and released.

USGS maps and other earthquake resources were examined to determine DuPage County's exposure to earthquakes. A major earthquake near the New Madrid Fault or other fault areas in the Midwest will be felt in Chicago. However it was concluded that DuPage County is not vulnerable to serious earthquake damage. Earthquakes are discussed here in the event that DuPage County opted in the future to put more emphasis on the potential earthquake hazard.

Earthquake Measurements: There are several common measures of earthquakes, including the Richter Scale and the Modified Mercalli Intensity (MMI) scale. The Richter Scale is a measurement of the magnitude, or the amount of energy released by an earthquake. Magnitude is measured by seismographs. The Modified Mercalli Intensity is an observed measurement of the earthquake's intensity felt at the earth's surface. The MMI varies, depending on the observer's location to the earthquake's epicenter.

An earthquake's intensity depends on the geologic makeup of the area and the stability of underlying soils. The effects of earthquakes can be localized near its epicenter or felt significant distances away. For example, a 6.8-magnitude earthquake in the New Madrid Fault in Missouri would have a much wider impact than a comparable event on the California Coast. The thick sandstone and limestone strata of the central United States behave as "conductors" of the earthquake's energy, and tremors can be felt hundreds of miles away. By contrast, the geology of the West Coast allows the energy to be dissipated relatively quickly which keeps the affects of the earthquake more localized.

Earthquakes can trigger other types of ground failures which could contribute to the damage. These include landslides, dam failures, and liquefaction. In the last situation, shaking can mix groundwater and soil, liquefying and weakening the ground that supports buildings and severing utility lines. This is a special problem in floodplains where the water table is relatively high and the soils are more susceptible to liquefaction.

The Modified Mercalli and Richter Scales are compared in the table on page 2-48, but it is important to note that the Mercalli Intensity varies based on the observer's proximity to the epicenter. Using the example of a 6.8-magnitude earthquake event at the New

Measuring Earthquakes:

For many years, the Richter Scale was the most common and familiar earthquake magnitude scale. As recording instruments have become increasingly sophisticated, more accurate calculations have evolved to determine magnitude. Today, the Richter Scale is seldom used, and scientists prefer to designate any given earthquake with just the word "magnitude," which can represent a number of different scales used in the calculation process.

There are two important things to remember about earthquake magnitude:

- The size of an earthquake increases by a factor of 10 as magnitude increases by one whole number. So, a magnitude 6.0 earthquake is 10 times larger than a 5.0; a magnitude 7.0 is 100 times larger, and a magnitude 8.0 is 1,000 times larger than a 5.0.
- The amount of energy released, however, increases by a factor of about 32. Looking at the same magnitudes, a magnitude 6.0 earthquake releases 32 times more energy than a magnitude 5.0; a 7.0 releases about 1,000 times more energy, and a magnitude 8.0 releases about 32,000 times more energy than a 5.0. It is easy to see why magnitude 7.0 and 8.0 earthquakes cause such widespread damage and destruction.

From these numbers it can also be observed that even when a fault produces many small earthquakes, there is simply not enough energy released to prevent a large one. A fault would have to have 1,000 4.0 earthquakes to prevent the occurrence of one 6.0 earthquake, or a million 4.0 events to prevent a single 8.0 earthquake.

Madrid Fault, the intensity in St. Louis may be “IX”, but in Chicago the intensity may be observed as a “VI.”

Table 2-22 Recent Earthquakes Felt in Illinois

Richter	Date	Epicenter
5.0	May 10, 1987	Near Lawrenceville, IL
4.5	Sep. 28, 1989	15 miles south of Cairo, IL
4.7	Apr. 27, 1989	15 miles SW of Caruthersville, MO
4.6	Sep. 26, 1990	10 miles south of Cape Girardeau, MO
4.6	May 3, 1991	10 miles west of New Madrid, MO
4.2	Feb. 5, 1994	Lick Creek-Goreville Area
Source: Illinois Hazard Mitigation Plan 2000		

Historical Events: In the United States, the most frequent reports of earthquakes come from the West Coast, but the largest earthquakes felt in the U.S. occurred in Missouri in 1811 and 1812 along the New Madrid Fault. The Great New Madrid Earthquakes are the benchmarks from which all earthquakes in the Midwest are measured. An important fact is that the earthquakes of 1811 and 1812 were not single events. Rather the earthquakes were a series of over 2,000 shocks in five months.

Five of these quakes were larger than a magnitude of 8.0 on the Richter Scale, which totally destroyed the town of New Madrid. The earthquakes caused the land to roll in visible waves that raised and sank land as much as 20 feet. The tremors of these earthquakes were no doubt felt throughout all of Illinois, since the quakes are said to have rung church bells in New England.

Magnitude	Mercalli Intensity	Abbreviated Modified Mercalli Intensity Scale
1.0 to 2.9	I	Not felt except by a very few under especially favorable conditions.
3.0 to 3.9	II	Felt only by a few persons at rest, especially on upper floors of buildings.
	III	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.
4.0 to 4.9	IV	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
	V	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
5.0 to 5.9	VI	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.
	VII	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
6.0 to 6.9	VIII	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned.
	IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
7.0 and higher	X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.
	XI	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
	XII	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

*Typical Maximum Modified Mercalli Intensity – at epicenter

There was a report of a quake at Fort Dearborn (Chicago) in August 1804. On October 31, 1895 an earthquake near Charlestown, Missouri measured 6.2 on the Richter Scale and caused damage up to level IX on the MMI Scale.

Property Damage: Generally, wood frame buildings and structures on solid ground fare best during an earthquake. Wood frame buildings are flexible enough to withstand ground shaking and swaying. Evaluations of recent earthquakes found that damage was primarily caused to:

- Unreinforced masonry structures,
- Older buildings with some degree of deterioration,
- Buildings without foundation ties,
- Multi-story structures with open or “soft” first floors, and

The New Madrid Fault

The New Madrid seismic zone (NMSZ) extends more than 120 miles southward from Cairo, Illinois, at the junction of the Mississippi and Ohio rivers, into Arkansas and parts of Kentucky and Tennessee. It roughly follows Interstate 55 through Blytheville down to Marked Tree, Arkansas, crossing four state lines and the Mississippi River in three places as it progresses through some of the richest farmland in the country.

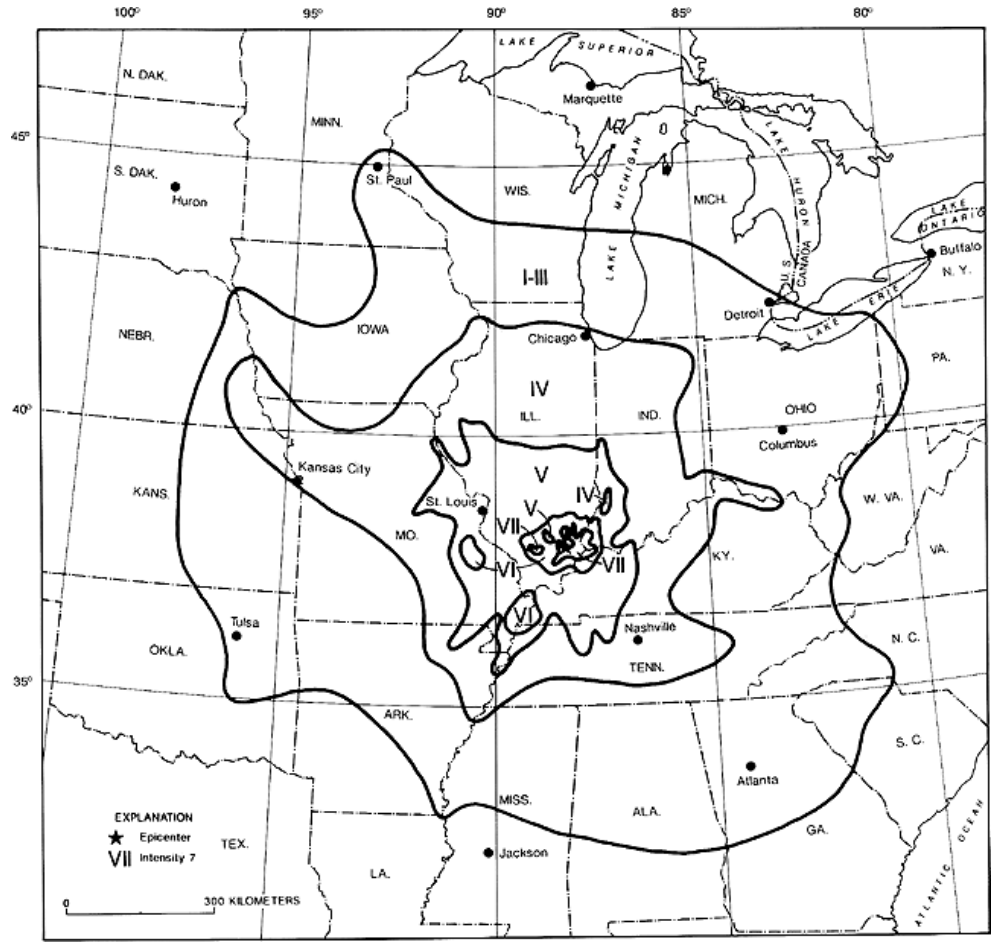
The greatest earthquake risk east of the Rocky Mountains is along the NMSZ. Damaging earthquakes are not as frequent as in California, but when they do occur, the destruction covers more than 15 times the area because of the underlying geology and soil conditions prevalent in the region. The zone is active, averaging about 200 earthquakes per year, though most of them are too small to be felt. With modern seismic networks, the capability to detect earthquakes has greatly increased, and many more very small earthquakes are being detected now than in the past. There is a common misconception that the number of earthquakes has increased over the years, but the increase is due to more sophisticated recording methods that can detect earthquakes that were previously unrecorded. The history of the region tells us, however, that the earthquake risk is the most serious potential disaster we could face.

In the winter of 1811-1812, a series of very large earthquakes occurred along the fault system buried deep within the NMSZ. Using felt information reported in newspapers and from eyewitness accounts of effects, magnitudes have been estimated to be 7.8, 8.0, and 8.1. In addition to the main shocks in December, January, and February, there were more than a thousand aftershocks, some of which were almost as large as the main shocks. The earthquakes were felt throughout the eastern United States and into Canada, ringing church bells as far away as Richmond, Virginia, and Charleston, South Carolina. Closer to home, much of the area was flooded, making it unfit for farming for many years, and most of the building infrastructure in the epicentral region was destroyed. In some areas, land rose or subsided as much as 20 feet, and small waterfalls or rapids were observed on the Mississippi River, causing part of the river to flow backwards for a short time. Seismologists now believe the New Madrid earthquakes represent the greatest known release of seismic energy in the world. As a result of the earthquakes, Congress passed the nation's first disaster assistance bill, offering arable land to farmers in exchange for ruined cropland, the initiation of a federal disaster policy that continues today.

Since 1811 and 1812, two more large earthquakes have occurred in the NMSZ – an estimated magnitude 6.4 near Marked Tree, Arkansas, in 1843, and an estimated magnitude 6.8 near Charleston, Missouri, in 1895. While scientists believe magnitude 8.0 earthquakes are very rare in this area, they are concerned about smaller but potentially damaging earthquakes similar in size to those in 1843 and 1895, which occur more frequently. With the older infrastructure in our region and the relatively unprepared population, even a magnitude 6.0 event could be devastating to people and communities in the epicentral region.

Scientists have also learned that the New Madrid fault system may not be the only fault system in the Central U.S. capable of producing damaging earthquakes. The Wabash Valley fault system in Illinois and Indiana shows evidence of large earthquakes in its geologic history, and there may be other, as yet unidentified, faults that could produce strong earthquakes.

Source: Illinois Emergency Management Agency



November 9, 1968 Earthquake of magnitude 5.3 and an intensity of VII. Intensity felt in DuPage County estimated to be IV. *Source: USGS*

Most building codes have standards related to the first three concerns. This means that the most threatened buildings are older ones (built before current codes), masonry ones, and taller ones with open first floors.

In addition to the building type, damage is related to the underlying soils. Buildings on solid ground fare better, while those on loose or sandy soils will suffer more from shaking. These can be found in floodplains. If there is enough water present, the shaking can liquefy the underlying soils, which removes the support under the foundation.

At risk in DuPage County, given the low threat of an earthquake at a Mercalli Intensity of VII or greater, are unreinforced masonry structures. Most of these structures can be considered to be history masonry buildings found in downtown areas. An estimate of damage is two percent of the value of non-residential structures in the County.

Damage to Critical Facilities: The overall earthquake damage to critical facilities is **low**.

Health and Safety: While injury and loss of life are important factors in other parts of Illinois when assessing earthquakes, they are of low concern for DuPage County. During

an earthquake, injuries are expected to be few. However, should a major earthquake impact southern Illinois, there exists the potential for damage to natural gas pipelines. This would be of greatest concern in the winter in northeastern Illinois. However, the overall impact to health and safely is considered to be **low**.

Economic Impact: The impact of an earthquake would be on the local economy if any damage was sustained to businesses and infrastructure. Public expenditures for repairs to public facilities and clean-up and disposal of debris can be high, especially if the structures are not insured for earthquakes. The overall expected economic impact is considered to be **low**.

2.8.2 Power Outage

Overview

Although power outages are classified as technological disasters, they are a common secondary effect of natural disasters and were chosen to be included in the 2012 update to the DuPage County Natural Hazard Mitigation Plan.

A power outage is the loss of electrical power in a facility or community. Power outages can cause the failure of key systems such as lighting, heating, air conditioning, ventilation, computer systems, life support, and water pumping stations, sewage treatment, telecommunications, and many others. Failure of one or more of these systems in jurisdictions can cause life safety or health concerns.

Power outages may be the cause of several natural disasters; most commonly wind events, or the cause of a man made incident such as accidental cutting of a power line. The most common scenarios of natural disasters resulting in power outages include:

- Winds may blow down trees or tree limbs which fall onto power lines, breaking them (most common)
- High winds may blow down utility poles snapping power lines
- Ice and snow may weigh down power lines causing breakage

Construction or maintenance operations may also accidentally cut power lines. Most of these incidents are localized to a small area.

A power outage may last anywhere from several minutes to weeks. The duration of the outage depends on several factors including: size and scope of the disaster, type of facilities affected, availability of response resources by the utility owner.

Within DuPage County ComEd owns the vast majority of the electrical utility infrastructure. The City of Naperville owns and operates their electrical generation systems and distribution grid.

Measurements

Power outages are measured by the number of facilities, or percent of a jurisdiction, without electrical power. A power outage may affect only one single family house, or be jurisdiction wide spanning entire states, in extreme cases.

The size and scope of the natural disaster affects the numbers of customers. Existing utility infrastructure may also affect the quantity of outages throughout the jurisdiction

Historical Events

Note, there have been numerous large power outage pre-2012, however DuPage County first began keeping accurate documentation regarding power outages since 2012

July 2012

Property Damage

In itself, lack of power rarely causes damage to facilities. Secondary effects due to lack of power, such as freezing pipes may cause extreme localized property damage.

Damage to Critical Facilities

Many critical facilities throughout DuPage County have partial or complete backup power sources such as standby generators which will automatically start up when electrical power is lost. Facilities that typically have back up power generation include: Hospitals, Police and Fire Stations, and Emergency Operations Centers (EOCs).

Smaller systems such as computers, life support, alarm and telecommunications systems may have a local Uninterrupted Power Supply (UPS) directly attached to maintain power during a disaster.

Health and Safety

Loss of electrical power can cause an immediate significant threat to life safety and public health. Critical facilities such as hospitals, nursing homes, and long term care facilities are dependent upon electricity to maintain life support systems. First responder facilities such as police and fire department require power to ensure effective emergency response efforts. Lack of power at these facilities can potentially place residents within the jurisdiction in immediate danger.

Public health may be negatively affected due to the sanitation systems that require electricity to function. Water treatment facilities and restaurants require sufficient power to ensure drinking water and food are treated properly. Lack of electricity at these locations may cause both short- and long-term health issues.

Downed live power lines also pose an immediate life safety issue. Live power lines on the ground or close to the ground as a result of a storm can kill or severely injure anyone who comes in contact with them. Vehicles or facilities in contact with live downed power lines are also susceptible to damage and the people within them are susceptible to injury or death.

Economic Impact

Businesses without power may be unable to process transactions, or maintain adequate heating/cooling regulations, and therefore be forced to close until power is restored. The actual dollar amount of economic impact is dependent upon the size, scope, and duration of the power outage.

2.9 Summary – Impact of the Hazards

The impacts of the hazards are summarized according to the four major concerns:

- Health and safety,
- Damage to buildings,
- Damage to critical facilities, and
- Economic impact.

After the conclusion of the hazard assessments and vulnerability assessments of the priority hazards (Table 2-3), the Workgroup discussed the findings in order to determine the overall impact the hazard has on the County and the communities. The hazards and their impact are shown in Table 2-22, "Summary of the Hazards," and they are in order of the overall impact to DuPage County.

The different columns on the table represent the following:

Annual Chance or Frequency: The annual chance column in the table shows the likelihood of occurrence in any given year. These numbers are discussed in the "Frequency" section of each hazard.

Location: The location and area affected by a single occurrence is shown.

Impact on Property: The vulnerability of structural damage to buildings or other property damage.

Value of vulnerable property: The property damage exposure column is the computed dollar amount from the vulnerability analysis.

Critical Facilities: The types of critical facilities and infrastructure that are affected are listed.

Impact on People: This category relates to health and safety hazards. Ratings of high, medium, or low are shown.

Economic Impact: Typical impacts on businesses and utilities are listed in this column.

The County, all municipalities, other agencies and institutions involved in this *Plan* are exposed to all identified hazards. This is due to the relatively flat topography of the County, and due to the amount of urbanization and developed land. Flooding, for example, is not limited to floodplain areas.

Table 2-23
Summary of DuPage County Hazards

Hazard	Annual Chance	Impact Location	Square miles Affected	Impact on Property	Value of Vulnerable Property	Impact on Critical Facilities	Impact on Health and Safety	Economic Impact
Floods	1%	Floodplains	30.13	High	$2.4 billion	Moderate	Moderate	High
	10%	(Local Drainage)	334	Moderate	($26.8 million)	Moderate	Moderate	Moderate
Severe Storms	100%	Communities	334	Moderate	$302 million	Moderate	Moderate	Moderate
Winter Storms	100%	Countywide	334	Low	---	Low	Moderate	Moderate
Tornadoes	0.001%	Countywide	10	High	$1.5 billion	Moderate	High	Moderate
	0.01%	Communities	5	High	$756 million	Moderate	High	Moderate
Extreme Heat/Drought	6.7%	Countywide	334	Low	---	Low	High	Low
Earthquakes	< 1%	Countywide	334	Low	---	Low	Low	Low
Power Outage	high	Countywide	334	Low	--	Low	Low	Moderate

As a comparison, the State of Illinois 2010 Natural Hazards Mitigation Plan's assessment of DuPage County's hazard risk is summarized below:

Illinois Hazard Rating By County

County Name	Population	Severe Storms	Floods	Severe Winter Storms	Drought	Extreme Heat	Earth-quake	Tornado
DuPage	916,924	Severe	Elevated	Severe	Guarded	High	Guarded	Elevated

2010 Illinois Natural Hazards Mitigation Plan, October 2010, page III-14.

From a review of Table 2-23 "Summary of DuPage County Hazards," the assessment of hazards for DuPage County done by the DuPage County Hazard Mitigation Planning Workgroup is consistent with the assessment shown in the State Plan.

2.10 Conclusions:

1. DuPage County is a highly populated county, with 75.1 percent of the land developed, and similar topography throughout. Total property value of the County is estimated to be over $200 billion.
2. All communities and agencies involved in this *Plan*, share the same vulnerability to natural hazards.
3. The priority hazards identified by the Mitigation Workgroup are floods, severe summer storms, severe winter storms, tornadoes, and extreme heat.
4. Identification and analysis of natural hazards is consistent with the State's *2010 Natural Hazard Mitigation Plan*.
5. Floods have the highest impact on property and have the highest potential for economic impact.
6. Tornadoes have a high potential impact on both property damage and loss of life.

2.11 References

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Chapter 3. Goals

The goals for this *Natural Hazards Mitigation Plan* were developed during the Mitigation Workgroup's September and October 2006 meetings and updated by the 2012 Mitigation Workgroup. The goals were developed to reflect current community priorities, to be appropriate with the natural hazards that impact DuPage County, and to be consistent with other planning efforts. At the September 2006 meeting, the Workgroup conducted three exercises to outline the goals for this *Plan*. At the October 2006 meeting, the Workgroup reviewed the goals and developed guidelines for their implementation. The goals and guidelines presented in this chapter are the foundation of the Action Plan, presented in Chapter 9. These goals were reviewed in 2012, and have not changed.

3.1 Community Priorities

Workgroup members, working in five small groups, were given a handout listing various community priorities listed in alphabetical order. The handout asked: "What are the top five priorities for your community and DuPage County? What do your community leaders hold as most important?" Workgroup members were asked not to answer these questions from their personal views, but to reflect the position of their city council, village board, or County Board.

The purpose of this exercise was to have the Workgroup consider the direction or future of the County and municipalities before focusing on hazard mitigation goals and objectives. The small groups discussed the possible priorities and narrowed the list to the top five choices of their group. Each small group reported to the whole group, and responses were tallied as follows:

Priorities given attention by most communities:

- Provide a safe place to live and work
- Improve/increase businesses
- Improve roads and highways
- Improve schools and educational programs
- Improve/increase housing
- Improve/increase public transportation opportunities
- Preserve historic and cultural resources

Priorities given attention by more than one community:

- Improve/increase recreation facilities
- Lower taxes
- Control/hold the rate of growth

Priorities given attention by at least one community:

- Improve air quality
- Improve habitat
- Improve water quality
- Improve employment opportunities

From the exercise, it is clear that the Workgroup sees community priorities as those activities that improve the quality of life of the people who live and work in DuPage County. The priorities are focused on serving and protecting people. This is not to say that protecting and enhancing the environment is not of importance to communities, but for purposes of this *Plan*, people are the priority.

During the 2012 *Plan* update, these priorities were reviewed and were found to be in alignment with the first responder/emergency management priorities of: Life safety, incident stabilization, property protection, and environmental conservation.

3.2 Plan Direction

The Workgroup conducted two more exercises to examine what the *Plan* should focus on, and how mitigation projects should be funded and implemented. Workgroup members were given a list of possible responses to each of these questions. After a process of discussing individual responses in the small groups and writing out each small group's top five responses, an overall vote was conducted to assess the mitigation priorities.

For the questions of "What to focus on?" the priorities were:

- Protect people's lives
- Protect public services (fire, police, etc.)
- Protect streets and utilities
- Protect public health
- Protect critical facilities

Additionally, the Workgroup gave importance to:

- Protecting existing buildings
- Protecting future development
- Preserve and protect historic and cultural resources

For the question of "How should mitigation projects be funded and implemented?" the responses were as follows:

Selected by most communities:

- Use county/municipal funds to pay for mitigation activities
- Help people/make people aware of how they can protect themselves
- Develop public/private partnerships

- Protect life/safety regardless of the cost

Selected by at least three communities:

- Protect critical facilities regardless of the cost
- Make people aware of the hazards they face
- Let state/federal agencies take the lead

Selected by at least one community:

- Limit projects to what state/federal agencies will help fund
- Only fund projects where it's proven that benefits exceed the cost
- New developments should pay the full cost of protection measures
- Seek user fees to fund measures

The exercises revealed important information to guide the planning effort, both in what was selected from the list and what was not selected. For example, the plan should focus on life, safety and health issues over the protection of buildings and property. Also, the Workgroup felt that the County and municipalities should fund mitigation projects that protect critical facilities and life/safety. However, state and federal agency support is important and should be sought. The Workgroup felt that people should be aware of how to help themselves, and the County and municipalities should take an active role in this effort.

3.3 Goals and Guidelines

At the October 2006 meeting the Workgroup established the goals for this DuPage *County Natural Hazards Mitigation Plan* as (shown in order of importance):

Goal 1. Protect the lives, health, and safety of the citizens of DuPage County from the impact and effects of natural hazards.

Goal 2. Protect public services and critical facilities from loss of use during, and potential damage from, natural hazards events.

Goal 3. Protect utilities and streets from the impact of natural hazards.

Goal 4. Mitigate potential damage to buildings and structures.

Goal 5. Ensure that new developments do not create new exposures to damage from natural hazards.

Goal 6. Protect historic, cultural, and natural resources from the effects of natural hazards.

The following guidelines were developed by the Workgroup for purpose of achieving the goals and to facilitate the development of hazard mitigation action items in Chapter 9 (shown in order of importance):

Guideline 1. Focus natural hazards mitigation efforts on floods, summer storms, winter storms, tornadoes, and extreme heat.

Guideline 2. Mitigation initiatives should focus on protecting citizens and public property.

Guideline 3. Make people aware of the hazards they face and encourage people to take steps to protect themselves and their property.

Guideline 4. Use available local funds, when necessary, in efforts that protect the lives, health, and safety of people from natural hazards.

Guideline 5. Use available local funds, when necessary, to protect the public services and critical facilities from natural hazards.

Guideline 6. Create and foster public-private partnerships to accomplish mitigation activities.

Guideline 7. Strive to develop cost-effective mitigation projects and seek state, and federal support for mitigation efforts.

Guideline 8. Strive to improve and expand business, infrastructure, education and housing opportunities in DuPage County in conjunction with planned mitigation efforts.

In summary, the goals and guidelines of this *Plan* focus on the life, health, and safety issues associated with natural hazards, and on the importance of people being able to protect themselves and their property from damage.

3.4 County and Municipal Planning Goals

A review of the goals and guidelines of this *Plan* were compared to the goals of other County and municipal plans. That review showed that this *Plan*'s focus is consistent and complementary to current County and municipal initiatives in other areas, such as comprehensive, economic development and stormwater plans. Shown on the following page are goals from the *DuPage County Stormwater Management Plan*, 1989, and the *2005 DuPage County Economic Development Plan*.

The goals in this *Plan* are also consistent with Countywide Stormwater and Flood Plain Ordinance, adopted by DuPage County and the municipalities. The Stormwater and Flood Plain Ordinance addresses stormwater, floodplain, wetland, and water quality management associated with new and re-development.

Goals of Other Countywide Plans

Objectives of the *DuPage County Stormwater Management Plan*, 1989:

- Reduce the existing potential for stormwater damage to public health, safety, life, and property
- Control future increase in stormwater damage within DuPage County and in areas of adjacent counties affected by DuPage County drainage
- Protect and enhance the quality, quantity, and availability of surface and groundwater resources
- Preserve and enhance existing aquatic and riparian environments and encourage restoration of degraded areas
- Control sediment and erosion in and from drainageways, developments, and construction sites
- Promote equitable, acceptable, and legal measures for stormwater management

Goals of the *2005 DuPage County Economic Development Plan*:

- Ø Retain and expand existing companies
- Ø Attract new companies to the area
- Ø Support local municipal economic development efforts
- Ø Maximize public and private resources through partnerships

Goals of the *2012 DuPage County Emergency Operations Plan (EOP)*:

- Ø Protect lives and property during an emergency within DuPage County
- Ø Identify roles and responsibilities of County Departments during emergency response, including during the mitigation phase of emergency management

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Chapter 4. Preventive Measures

The objective of preventive mitigation measures is to plan and regulate in order to protect new construction from hazards and see that future development does not increase potential losses for communities. Building, planning, zoning, and/or code enforcement offices administer preventive measures. Preventive measures include the following:

- Building Codes
- Planning and Zoning
- Subdivision Regulations
- Open Space Preservation
- Stormwater Management
- Wetland Protection
- Stream Restoration
- Hazard Mapping
- Urban forestry
- Dumping regulations
- Standards for Manufactured Homes

Stormwater management incorporates the management of stormwater runoff, floodplain management, water quality protection through best management practices, and soil and erosion control. Activities such as river restoration and wetland protection are resource protection activities aimed at preserving or restoring natural areas. In so doing, these activities enable the naturally beneficial functions of the land, such as, fields, floodplains or wetlands to be better realized.

4.1 Building Codes

Building codes provide one of the best methods of addressing natural hazard mitigation. They are an important measure to protecting new property from damage by earthquakes, tornadoes, high winds, and snow storms. When properly designed and constructed according to code, the average building can withstand the impacts of most of these forces.

Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. Provisions that should be included are:

- Making sure roofing systems will handle high winds and expected snow loads,

- Providing special standards for tying the roof, walls and foundation together to resist the effects of wind (see illustration),
- Requiring new buildings to have tornado "safe rooms,"
- Including insulation standards that ensure protection from extreme heat and cold as well as energy efficiency,
- Regulating overhanging masonry elements that can fall during an earthquake,
- Ensuring that foundations are strong enough for earth movement and that all structural elements are properly connected to the foundation, and
- Mandating overhead sewers for all new basements to prevent sewer backup.

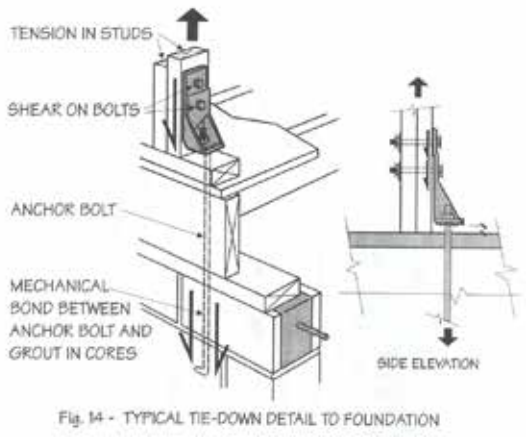
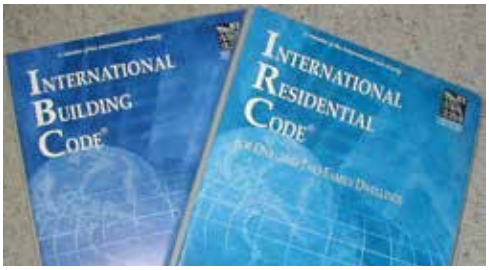


Fig. 14 - TYPICAL TIE-DOWN DETAIL TO FOUNDATION

Both builders and inspectors need to know the details of proper anchoring to protect new buildings from high winds.

Source: *Windstorm Mitigation Manual for Light Frame Construction*, page 95.

Model Building Codes: Many communities in Illinois are working with various versions of the National Building Code of the Building Officials and Code Administrators (BOCA) and/or the One and Two Family Dwelling Unit Code published by the Council of American Building Officials (CABO). These standard building codes provide the basis for good building safety programs, especially protection from fire and electrical hazards. However, the BOCA and CABO codes are not "state of the art" when it comes to addressing natural hazards. They are being replaced by the new International Code series (I-Codes). The primary I-Codes are the International Residential Code (IRC) and the International Building Code (IBC). The most recent version of these codes is 2006.



Tornado Standards: After a disaster, FEMA often sends a Building Performance Assistance Team to evaluate how well buildings built to code held up. A recent evaluation of wind and tornado damage concluded that the BOCA and CABO codes should be amended to incorporate wind load standards ASCE 7-95 and 7-98. The new I-Codes have incorporated these standards.

The Institute for Business and Home Safety (IBHS) has also reviewed the I-Codes with respect to hazards such as hurricanes, floods, hail, and tornadoes. The IBHS recommends that the International Residential Code should be amended to increase design for wind loads to meet hurricane resistant standards, SSTD-10-99.

New construction should also include the construction of an underground shelter or "safe room" at the first floor level to protect the lives of the occupants. A building code

could require them in new construction. Tornado safe rooms are discussed further in Section 5.2.2.

Flood Standards: The I-Codes have a section on flood protection that communities must adopt separately. These standards are in addition to requirements of the National Flood Insurance Program that are adopted in a community's floodplain ordinance.

Fortified Homes: IBHS has a set of recommendations to strengthen a building to better resist the impacts of natural hazards. The specific requirements for a "Fortified" home are available through the IBHS website at www.ibhs.com. A Fortified Tornado Windstorm Protection Checklist, provided on the website, defines nearly 20 standards, such as the size and depth of anchor bolts and materials of windows and skylights.

IBHS has researched the cost for implementing the Fortified program. The table to the right shows the increased cost of constructing a "Fortified" home. For less than 10 percent above the cost of the average home, a builder can incorporate all of the recommended criteria for a safer building.

	Standard Home	"Fortified" Home	Incremental Cost
Impact resistant windows and doors	$5,450	$15,500	$10,050
Garage doors	$650	$1,250	$600
Roof decking	$650	$1,750	$1,100
Sealing roof joints	$0	$650	$650
Roof covering	$2,350	$3,350	$1,000
Concrete/steel down pours	$0	$500	$500
Fortified inspection costs	$0	$1,000	$1,000
Total incremental cost			**$14,900**
Percentage of base cost			**9.8%**

Cost of a home meeting the "Fortified" code recommendations

Source: Institute for Business and Home Safety
Note that cost figures are for Florida, 2004

Thunderstorm Standards: The IBHS also supports stronger codes for roofing standards so they can better resist damage from hail. It recommends that communities adopt the Underwriters Laboratory Standard 2218, to increase the impact resistance of roofing.

Code Administration: Enforcement of code standards is very important. Adequate inspections are needed during the course of construction to ensure that the builder understands and implements the requirements. The Building Code Effectiveness Grading Schedule (BCEGS) is a national program used by the insurance industry to determine how well new construction is protected from wind, earthquake and other non-flood hazards. It is similar to the 10-year old Community Rating System and the century-old fire insurance rating scheme: building permit programs are reviewed and scored, a class 1 community is the best, and a class 10 communities has little or no program.

Code Official Training: Training of code officials is also very important for code enforcement. Training of code officials and inspectors is a large part of the BCEGS rating

for a community. Courses are offered through the building code associations to help local officials understand standards that apply to seismic, wind and flood hazards.

Local Implementation: Table 4-1 below lists the building codes in use in DuPage County.

Table 4-1
Building Codes Used in DuPage County and BCEGS Ratings

	Building Code Residential	BCEGS Residential	Building Code Commercial	BCEGS Commercial
Village of Addison	IRC 2000	5	IBC 2000	5
Village of Bartlett	IRC 2006	3	IBC 2006	2
Village of Bloomingdale	IRC 2003	3	IBC 2003	3
Village of Bensenville	CABO 1995	--	BOCA 1999	--
Village of Burr Ridge	IRC 2003	2	IBC 2003	2
Village of Carol Stream	IRC 2003	6	IBC 2003	6
Village of Clarendon Hills	SBOC 1996	5	BOCA 1999	5
City of Darien	BOCA 1999/IRC 1998	--	BOCA 1999	--
Village of Downers Grove	IRC 2000	8	IBC 2000	8
City of Elmhurst	IRC 2003	8*	IBC 2003	8*
Village of Glendale Heights	IRC 2000	5	IBC 2000	5
Village of Glen Ellyn	IRC 2003	--	IBC 2003	--
Village of Hanover Park	IRC 2003	4	IBC 2003	4
Village of Hinsdale	IRC 2000	4	IBC 2000	4
Village of Itasca	CABO 1995	5	BOCA 1999	5
Village of Lisle	BOCA 1996	5	BOCA 1996	5
Village of Lombard	IRC 2000	4	IBC 2000	4
City of Naperville	IRC 2006	4	IBC 2006	4
Village of Oak Brook	IRC 2000	--	IBC 2000	--
City of Oakbrook Terrace	IRC 2003	--	IBC 2000	--
Village of Roselle	CABO 1995	8	BOCA 1996	8
Village of Villa Park	IRC 2009	4	IBC 2009	4
City of Warrenville	IRC 2006	6	IBC 2006	6
Village of Wayne	IRC 2003	--	IBC 2003	--
City of West Chicago	IRC 2003	--	IBC 2003	--
Village of Westmont	IRC 2003	4	IBC 2003	5
City of Wheaton	IRC 2003	3	IBC 2003	3
Village of Willowbrook	CABO 1995/SBOC 1996	4	BOCA 1996	4
Village of Winfield	CABO 1995	--	BOCA 1999	--
City of Wood Dale	IRC 2003	4	IBC 2003	4
Village of Woodridge	IRC 2004	--	IBC 2004	--
DuPage County	IRC 2006	5	IBC 2006	5
College of DuPage	County	--	County	--

* Not in the program or no longer in the program.

Building Codes for State Property: Construction of state buildings and some other government buildings is exempt from municipal or county regulations. The Illinois Capital Development Board (CDB) is the construction management agency for state projects, such as prisons, college and university classroom buildings, mental health hospitals and state parks.

The CDB recognizes local building codes, but does not require a permit or inspection from the local building department. The agency will soon be adopting the International Codes for its use.

Overhead Sewers: Addison, Bartlett, Bloomingdale, Burr Ridge, Clarendon Hills, Hinsdale, Roselle, Villa Park, Wheaton, Willowbrook and Woodridge require overhead sewers to be installed with new construction.

CRS Credit: The Community Rating System provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved.

The Community Rating System encourages strong building codes. It provides credit in two ways: points are awarded based on the community's BCEGS classification and points are awarded for adopting the International Code series. Up to 120 points are possible.

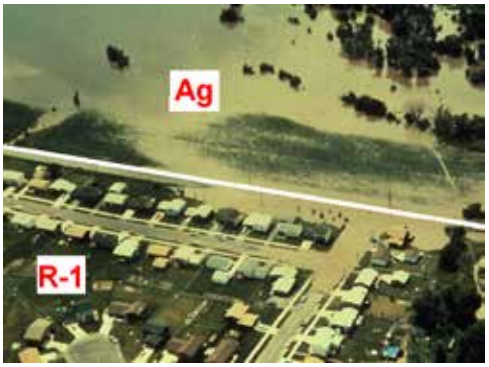
The CRS also has a prerequisite for a community to attain a CRS Class 8 or better: the community must have a BCEGS class of 6 or better. To attain a CRS Class 4 or better, the community must have a BCEGS class of 5 or better. In other words, a strong building code program is a must to do well in the Community Rating System.

4.2 Planning and Zoning

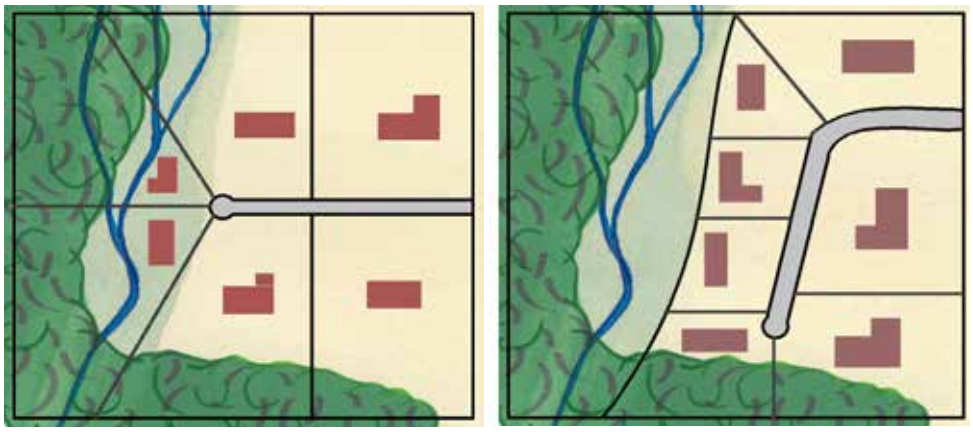
Planning and zoning activities direct development away from hazardous areas, especially floodplains and wetlands. They do this by designating land uses that are more compatible to the natural conditions of the land, such as open space or recreation. They can also benefit by simply allowing developers more flexibility in arranging improvements on a parcel of land through the planned development approach.

Comprehensive Plans: These plans are the primary tools used by communities to address future development. They can reduce future flood-related damages by indicating open space or low density development within floodplains and other hazardous areas. Natural hazards should be emphasized in specific land use recommendations.

Zoning Regulations: Zoning codes are the primary tool used to implement comprehensive plan guidelines for how land should be developed. Zoning ordinances usually set minimum lot sizes for each zoning district. Often, developers will produce a standard grid layout, such as that shown in the R-1 district to the right. The ordinance and the



A zoning ordinance should designate floodprone lands for agricultural, conservation, or other uses that suffer minimal damage from a flood.



In the standard zoning approach (left), the developer considers six equally-sized lots without regard for the flood hazard. Two properties are subject to flooding and the natural stream is disrupted. An alternative, flexible, approach is shown on the right. The floodplain is dedicated as public open space. There are seven smaller lots, but those abutting the floodplain have the advantage of a larger open area. Four lots have riverfront views instead of two. These amenities compensate for the smaller lot sizes, so the parcels are valued the same.

community can allow flexibility in lot sizes and location so developers can avoid hazardous areas.

One way to encourage such flexibility is to use the planned unit development (PUD) approach. The PUD approach allows the developer to easily incorporate flood hazard mitigation measures into the project. Open space and/or floodplain preservation can be facilitated and site design standards and land use densities can be adjusted, as in the example above.

Capital Improvement Plans: Capital improvement plans guide a community's major public expenditures for the next 5 to 20 years. Capital expenditures may include acquisition of open space within the hazardous areas, extension of public services into hazardous areas, or retrofitting existing public structures to withstand a hazard.

Local Implementation: Table 4-2 summarizes the findings of a review of comprehensive and land use plans adopted by the County and the municipalities.

NFIP/CRS

CRS Credit: Up to 100 points are provided for regulations that encourage developers to preserve floodplains or other hazardous areas from development. There is no credit for a plan, only for the enforceable regulations that are adopted pursuant to a plan.

Table 4-2
DuPage County Planning and Land Use Ordinances

Community	Comprehensive Plan	Flooding or other hazards included in Comprehensive Plan	Zoning Ordinance	Flood hazards or drainage provisions in Subdivision Ordinance	Requirement to bury utilities in Subdivision Ordinance
Village of Addison	1992	Yes	1973/2005	Yes	Yes
Village of Bartlett	1989		1978	County*	Yes
Village of Bensenville			2007	County*	
Village of Bloomingdale	1998		1969/2006	County*	Yes
Village of Burr Ridge	1999		1961/1997	County*	
Village of Carol Stream	2000		2006	Yes	Yes
Village of Clarendon Hills	1991/2006		1930/2006	County*	Yes
City of Darien	2002		2000	County*	
Village of Downers Grove	1965		1965/2006	County*	
City of Elmhurst	2007		2007	County*	
Village of Glendale Heights	1995	Yes	1999/2006	Yes	
Village of Hanover Park	1998		1991/2004	Yes	
Village of Hinsdale	1989		1989/2006	County*	Yes
Village of Itasca	1994	Yes	1959/2006	Yes	
Village of Lisle	2004		1970/2005	Yes	
Village of Lombard	1998	Yes	1924/1990	County*	
City of Naperville	2002		2006	Yes	Yes
Village of Oak Brook	1990		2002	Yes	Yes
City of Oakbrook Terrace	1986/2003		1990/2006	County*	
Village of Roselle	1995	Yes	1985 & amended	Yes	
Village of Villa Park	2009	Yes	1970	County*	
City of Warrenville	1984	Yes	1989/2012	Yes	Yes
Village of Wayne	2005		2007	County*	
City of West Chicago	2006		2005	County*	
Village of Westmont	1998		1979	County*	
City of Wheaton	1999	Yes	Yes	Yes	Yes
Village of Willowbrook	1993		1960	Yes	Yes
Village of Winfield	2001		1921/1999	Yes	
City of Wood Dale	1997	Yes	1948/2005	Yes	Yes
Village of Woodridge	1995	Yes	1986/2005	Yes	Yes
DuPage County			2005	County*	
College of DuPage	--		--		

* Rely on DuPage Countywide Stormwater and Flood Plain Ordinance

4.3 Subdivision Regulations

Subdivision regulations govern how land will be subdivided and sets construction standards. These standards generally address roads, sidewalks, utilities, storm sewers and drainageways. They can include the following hazard protection standards:

- Requiring that the final plat show all hazardous areas (as in the example on page 9-4).
- Road standards that allow passage of fire fighting equipment and snow plows
- Requiring power or phone lines to be buried
- Minimum water pressures adequate for fire fighting
- Requiring that each lot be provided with a building site above the flood level
- Requiring that all roadways be no more than one foot below the flood elevation.

Local Implementation: Table 4-2, on the previous page, shows the communities in DuPage County that have adopted subdivision regulations.

CRS Credit: Up to 25 points are provided for requiring that new streets in a floodplain be elevated to no more than one foot below the flood elevation. There are no CRS credits for requirements for hazards other than flooding.

4.4 Open Space Preservation

Keeping the floodplain and other hazardous areas open and free from development is the best approach to preventing damage to new developments. In urban areas, open space can serve as parks, greenway corridors and golf courses. Capital improvement plans and comprehensive land use plans can identify areas to be preserved through any or all of the following means:

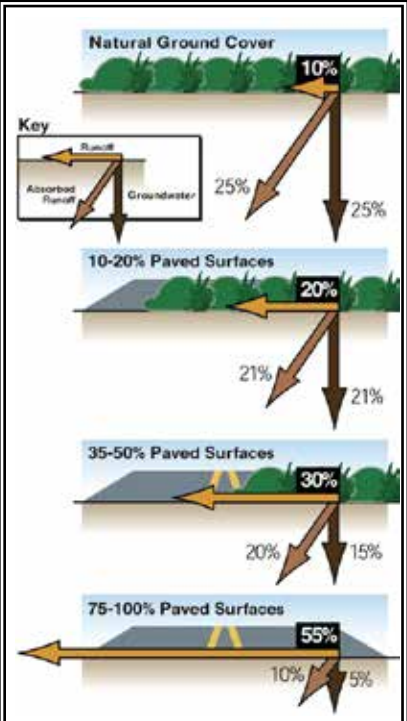
- Acquisition,
- Dedication by developers,
- Dedicating or purchasing an easement to keep the land open,
- Specifying setbacks or buffer zones where development is not allowed, and
- Subdivision regulations need to ensure that streets and other public facilities can handle emergency vehicles during an emergency.

Local Implementation: There are two kinds of open space land in DuPage County: lands that are currently open, such as vacant parcels or remaining farmland; and lands that are preserved as open space, such as parks and fish and wildlife areas. Community interest in maintaining and creating open space is growing throughout the County.

CRS Credit: Preserving floodprone areas as open space is one of the highest priorities of the Community Rating System. Up to 700 points can be given, based on how much of the floodplain is in parks, forest preserves, golf courses, undeveloped floodway or other uses that can be depended on to stay open. Additional credit is provided if there are deed restrictions on the parcels.

4.5 Stormwater Management

Development in floodplains is development in harm's way. New construction in the floodplain increases the amount of development exposed to damage and can aggravate flooding on neighboring properties. Development outside a floodplain can also contribute to flooding problems. Stormwater runoff is increased when natural ground cover is replaced by urban development (see graphic). Development in the watershed that drains to a river can aggravate downstream flooding, overload the community's drainage system, cause erosion, and impair water quality.



Increases in impervious surfaces increase watershed runoff. *Source: ASFPM*

Stormwater management encompasses two approaches to protecting new construction from damage by surface water:

- Regulating development in the floodplain to ensure that it will be protected from flooding and that it won't divert floodwaters onto other properties, and
- Regulating all development to ensure that the post-development peak runoff will not be greater than under pre-development conditions.

All DuPage County communities participate in the National Flood Insurance Program (NFIP). The NFIP and the Illinois Department of Natural Resources set minimum requirements for regulating development in the floodplain and in the floodway. All new buildings must be protected from the base or 100-year flood and no development can cause an increase in flood heights or velocities.

Stormwater runoff regulations require developers to build retention or detention basins to minimize the increases in the runoff rate caused by impervious surfaces and new drainage systems. Generally, each development must not let stormwater leave at a rate higher than that under pre-development conditions.

Local Implementation: DuPage County and all municipalities have adopted the DuPage County Countywide Stormwater and Flood Plain Ordinance (County Stormwater Ordinance). The Stormwater Ordinance established stormwater management and detention requirements, meets or exceed all of the state and NFIP floodplain regulatory requirements, provides for wetland management, and addresses soil erosion and sediment control.

The DuPage County Stormwater Management Division is responsible for administering and enforcing the ordinance. Communities, based on their regulatory resources, are granted partial or complete waiver of County review of permit application reviews.

Table 4-3
DuPage Countywide Stormwater and Flood Plain Ordinance Waiver Status

Community	County Stormwater Ordinance Waiver
Village of Addison	Complete
Village of Bartlett	Partial
Village of Bensenville	Partial
Village of Bloomingdale	Complete
Village of Burr Ridge	Partial
Village of Carol Stream	Complete
Village of Clarendon Hills	Partial
City of Darien	Partial
Village of Downers Grove	Complete
City of Elmhurst	Partial
Village of Glendale Heights	Partial
Village of Glen Ellyn	Complete
Village of Hanover Park	Partial
Village of Hinsdale	Partial
Village of Itasca	Partial
Village of Lemont	Partial
Village of Lisle	Partial
Village of Lombard	Partial
City of Naperville	Partial
Village of Oak Brook	Complete
City of Oakbrook Terrace	Partial
Village of Roselle	Partial
Village of Villa Park	Complete
City of Warrenville	Complete
Village of Wayne	Partial
City of West Chicago	Partial
Village of Westmont	Partial
City of Wheaton	Partial
Village of Willowbrook	Complete
Village of Winfield	Partial
City of Wood Dale	Complete
Village of Woodridge	Partial

CRS Credit: CRS credit is provided for both higher regulatory standards in the floodplain and runoff management standards for new developments. Credit is based on how those standards exceed the minimum NFIP requirements.

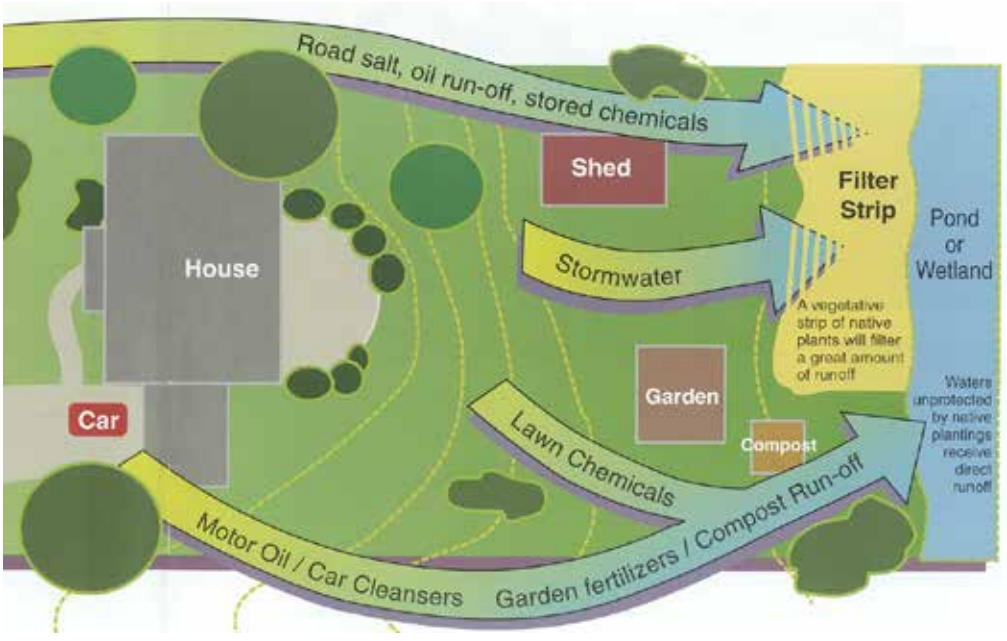
The County's Stormwater Ordinance has the following provisions that would be recognized by the CRS (in addition to the provisions discussed in other sections):

- Buildings must be elevated to a level two feet above the base (100-year) flood elevation (although attached garages can be lower, reducing the CRS score),
- Fill must meet certain standards to protect it from erosion and scour,
- Flood storage lost due to filling and construction must be compensated for by removal of an equal volume of storage,
- Only appropriate uses are allowed in the floodway. Buildings are not appropriate uses,
- Standards for retention and detention basins,
- Requirements for erosion and sedimentation control, and
- The requirement to incorporate best management practices into all plans.

The County and all municipalities should receive at least 300 points for these provisions of the DuPage County Stormwater Ordinance. They certainly exceed minimum State and Federal requirements. To attain a Class 4 or better in the CRS program, communities must have an adopted stormwater management plan that examines the impact of the 100-year event with future development conditions. Watershed plans being developed by the DuPage County Stormwater Division should fulfill this requirement.

Best Management Practices: *Point source* pollutants come from pipes such as the outfall of a municipal wastewater treatment plant. They are regulated by the U.S. and Illinois Environmental Protection Agencies. *Nonpoint source* pollutants come from non-specific locations and are harder to regulate.

Examples of nonpoint source pollutants are lawn fertilizers, pesticides, and other farm chemicals, animal wastes, oils from street surfaces and industrial areas and sediment from agriculture, construction, mining and forestry. These pollutants are washed off the ground's surface by stormwater and flushed into receiving storm sewers, ditches and streams.



BMPs slow stormwater runoff and improve water quality.

Source: Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois

The term "best management practices" (BMPs) refers to design, construction and maintenance practices and criteria that minimize the impact of stormwater runoff rates and volumes, prevent erosion, protect natural resources and capture nonpoint source pollutants (including sediment). They can prevent increases in downstream flooding by attenuating runoff and enhancing infiltration of stormwater. They also minimize water quality degradation, preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple uses of drainage and storage facilities.

Local Implementation: Best management practices have been incorporated throughout the County Stormwater Ordinance. The County and communities are also working to meet the requirements of the Clean Water Act, TMDL, and the NPDES Phase II (National Pollutant Discharge Elimination System) requirements.

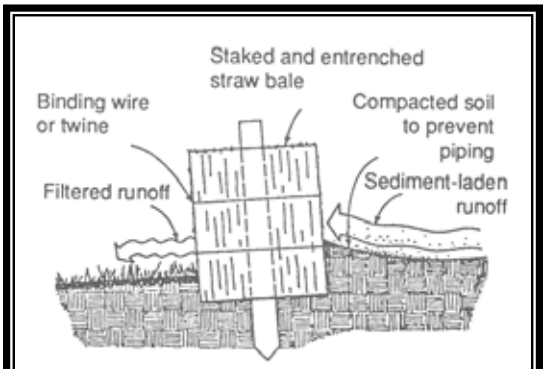
NFIP/CRS

CRS Credit: The DuPage County Stormwater Ordinance would receive up to 40 points for requirements that protect channel banks and lakeshores from development through setbacks or buffer zones and for requiring stormwater management facilities to incorporate BMPs.

Erosion and Sedimentation Control: Erosion also occurs along streambanks and shorelines as the volume and velocity of flow or wave action destabilize and wash away the soil. Sediment suspended will settle out where flowing water slows down. It can clog storm sewers, drain tiles, culverts and ditches, and reduce the water transport and storage capacity of river and stream channels, lakes and wetlands.

Additionally, the sediment often brings chemicals, heavy metals and other pollutants, and light and oxygen are reduced in the stream which impairs water quality. Sediment has been identified by the US EPA as the nation's number one nonpoint source pollutant for aquatic life.

Techniques to minimize erosion include phased construction, minimal land clearing, and stabilizing bare ground as soon as possible with vegetation and other soil stabilizing practices. If erosion occurs, other measures are used to capture sediment before it leaves the site. Silt fences, sediment traps and vegetated filter strips are commonly used to control sediment transport. Runoff from the site can be slowed down by terraces, contour strip farming, no-till farm practices, hay or straw bales, constructed wetlands, and impoundments (e.g., sediment basins and farm ponds). Slowing surface water runoff on the way to a drainage channel increases infiltration into the soil and reduces the volume of topsoil eroded from the site.



Straw bales catch sediment

Local Implementation: Standards for soil erosion and sediment control during and following project construction are components of the County Stormwater Ordinance. Erosion and sediment control planning is required in the initial site planning process.

CRS Credit: The County Stormwater Ordinance's erosion and sedimentation control provisions qualify for 35 points, the maximum credit for programs that do not address erosion from farmland.

4.6 Wetland Protection

4.6 Wetland and Riparian Buffer Protection

Wetlands are often found in floodplains and depressional areas of a watershed. Many wetlands receive and store floodwaters, thus slowing and reducing downstream flows. They also serve as a natural filter, which helps to improve water quality, and provide habitat for many species of fish, wildlife, and plants. Buffers with native vegetation and trees slow runoff and reduce downstream flows through infiltration and uptake of water by plants. In addition to reducing flood height and velocity of flows, buffers and wetlands reduce the sediment load in the runoff entering the waterway.


Chicago area wetland

DuPage County has been recognized for having a comprehensive stormwater management program. A component of this program is based on protecting the many benefits provided by wetlands and buffers, primarily by enforcing the DuPage County Countywide Stormwater and Flood Plain Ordinance. Since many wetland and buffer functions are difficult, expensive, and sometimes impossible to replace, the Ordinance requires that an applicant avoid or minimize impacts to wetland if possible. Wetland impacts are be replaced, or mitigated, in the same watershed. Impacted buffer functions are replaced in kind. Wetland replacement ratios and buffer widths are based on the quality of a wetland which is determined by analyses of habitat and vegetation quality, and the presence of Endangered or Threatened Species.

Some developers and government agencies have accomplished the required mitigation by buying into a wetland bank. The wetland banking program was adopted by the Stormwater Management Planning Committee and County Board in 1993 to give the development community the option of offsite wetland replacement while keeping the significant benefits of wetlands in the same watershed as the impact. The County has several wetland banks and wetland mitigation projects in various stages of development.

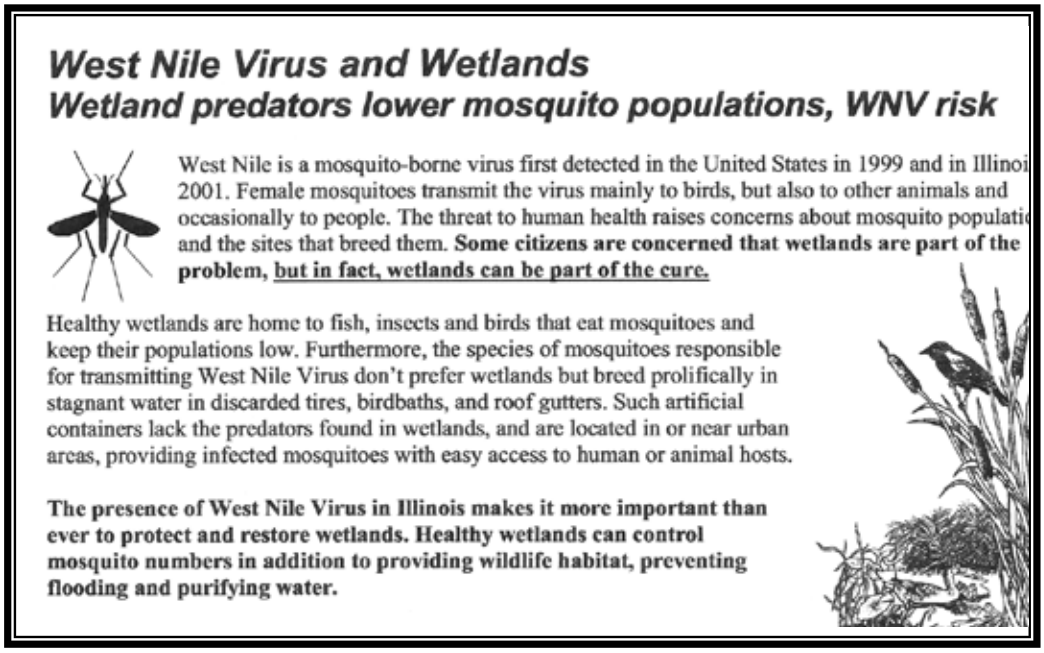
Wetlands that are determined to be part of the waters of the United States are also regulated by the U.S. Army Corps of Engineers (Corps') and the U.S. Environmental Protection Agency (USEPA) under Section 404 of the Clean Water Act. DuPage County has been granted a General Permit from the Army Corps of Engineers to reduce regulatory redundancy by regulating most Corps' jurisdictional wetlands. Permits involving impacts to Waters of the US and their associated wetlands are subject to review by several agencies including U.S. Fish and Wildlife Service, USEPA, and IEPA.

Wetland Maps

DuPage County developed wetland maps in the late 1990s. Since that time, development in the county has significantly changed the landscape. In 2013, the County will begin the process of modernizing these maps. This will allow the County to provide more accurate information to residents, developers, and businesses. The availability this type of information will reduce inadvertent impacts and encourage developers to consider the resource during the development planning process.

Education

DuPage County hosts training for environmental professionals on regulations, wetland soils, botany, water quality, and more. County staff regularly participates in professional seminars and community events as speakers, organizers, and facilitators. Information about wetlands, wetland and riparian buffers, and water quality is available on the county website.



West Nile Virus and Wetlands

Wetland predators lower mosquito populations, WNV risk

West Nile is a mosquito-borne virus first detected in the United States in 1999 and in Illinoi 2001. Female mosquitoes transmit the virus mainly to birds, but also to other animals and occasionally to people. The threat to human health raises concerns about mosquito populati and the sites that breed them. **Some citizens are concerned that wetlands are part of the problem, but in fact, wetlands can be part of the cure.**

Healthy wetlands are home to fish, insects and birds that eat mosquitoes and keep their populations low. Furthermore, the species of mosquitoes responsible for transmitting West Nile Virus don't prefer wetlands but breed prolifically in stagnant water in discarded tires, birdbaths, and roof gutters. Such artificial containers lack the predators found in wetlands, and are located in or near urban areas, providing infected mosquitoes with easy access to human or animal hosts.

The presence of West Nile Virus in Illinois makes it more important than ever to protect and restore wetlands. Healthy wetlands can control mosquito numbers in addition to providing wildlife habitat, preventing flooding and purifying water.

CRS Credit: The Community Rating System focuses on activities that directly affect flood damage to insurable buildings. While there is no credit for relying on the Corps of Engineers' 404 regulations, there is credit for preserving open space in its natural condition or restored to a state approximating its natural condition. The credit is based on the percentage of the floodplain that can be documented as wetlands protected from development by ownership or local regulations.

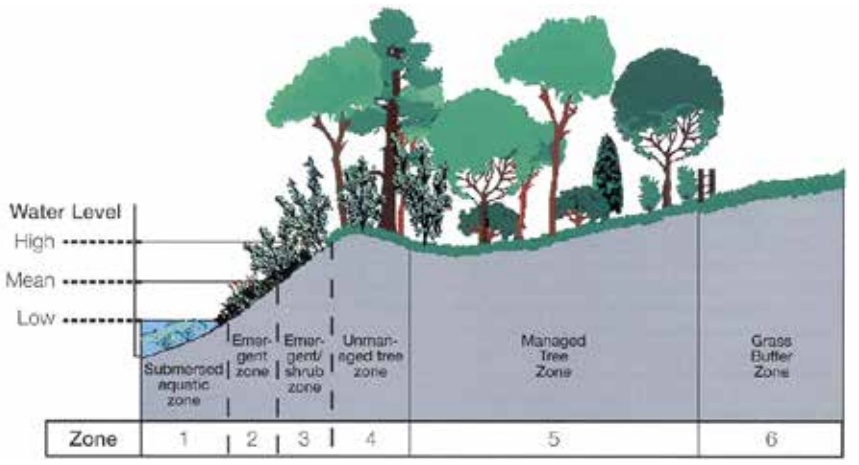
4.7 Stream Restoration

Stream restoration activities have several names, such as "stream conservation," "bioengineering" or "riparian corridor restoration." The objective of these approaches is to return streams, streambanks and adjacent land to a more natural condition, including the natural meanders. Another term is "ecological restoration" which restores native indigenous plants and animals to an area.

A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve retrofitting the shoreline with willow cuttings, wetland plants, and/or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized with plant roots.

In all, restoring the right vegetation to a stream has the following advantages:

- Reduces the amount of sediment and pollutants entering the water
- Enhances aquatic habitat by cooling water temperature
- Provides food and shelter for both aquatic and terrestrial wildlife
- Can reduce flood damage by slowing the velocity of water
- Prevents property loss due to erosion
- Provides recreational opportunities, such as hunting, fishing, and bird watching
- Reduces long-term maintenance costs



Aquatic and riparian buffer plant zones

Different types of plants are used in different buffer zones along a channel. Zone 1 plants are normally submerged while zone 2 plants are inundated during much of the growing season. Zone 3 plants are water tolerant, but are flooded only during high water. By using the proper plants in each zone, they stabilize streambanks, filter polluted runoff, and provide habitat. *Source: Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and Shorelines*, Tennessee Valley Authority

Studies have shown that after establishing the right vegetation, long-term maintenance costs are lower than if the banks were concrete. The Natural Resources Conservation Service estimates that over a ten year period, the combined costs of installation and maintenance of a natural landscape may be one-fifth of the cost for conventional landscape maintenance, e.g., mowing turf grass.

Local Implementation: A number of restoration projects are underway in DuPage County, particularly in the West Branch DuPage River watershed.

NFIP/CRS

CRS Credit: The Community Rating System focuses on activities that directly affect flood damage to insurable buildings. However, there are credits for preserving open space in its natural condition or restored to a state approximating its natural condition. There are also credits for channel setbacks, buffers and protecting shorelines.

4.8 Hazard Mapping

Mapping of hazards, both the areas impacted and the severity of the hazard is an important tool and resource for preventing damages from natural and manmade hazards. Communities in the NFIP have the riverine flood hazard mapped on their Flood Insurance Rate Map. However, additional maps of other areas that experience or can potentially flood are very useful.

With the availability of the internet and mapping software tools, both hazards and their potential impact to buildings and infrastructure can be mapped. As communities build GIS mapping capabilities, layers for hazard data can be added as information becomes available.

Local Implementation: DuPage County has significant mapping capabilities through the GIS Department. Currently, DuPage County is a Cooperating Technical Partner with FEMA for the development and maintenance of Flood Insurance Rate Maps (FIRMs). DuPage County will continue to work with FEMA to improve hazard mapping as funding becomes available.

Table 4-4
Tree Cities USA
In DuPage County

Addison
Bartlett
Bloomingdale
Burr Ridge
Clarendon Hills
Downers Grove
Elmhurst
Glendale Heights
Glen Ellyn
Hanover Park

4.9 Urban Forestry

The major damage caused by severe summer and winter storms is to trees. Downed trees and branches break utility lines and damage buildings and parked cars. An urban forestry program can reduce the damage potential of trees.

Urban foresters or arborists can select hardier trees which can better withstand high wind and ice accumulation. Only trees that attain a height less than the utility lines should be allowed along the power and

Trees are the first victims of ice storms

telephone line rights-of-way. Just as important as planting the right trees is correct pruning after a storm. If not done right, the damaged tree will not heal properly, decay over the next few years, and cause a hazard in the future. A trained person should review every damaged tree to determine if it should be pruned or removed.

By having stronger trees, programs of proper pruning, and on-going evaluation of the trees, communities can prevent serious damage to their tree population. A properly written and enforced urban forestry plan can reduce liability, alleviate the extent of fallen trees and limbs caused by wind and ice build-up, and provide guidance on repairs and pruning after a storm. Such a plan helps a community qualify to be a Tree City USA.

Local Implementation: Twenty-one DuPage County municipalities have the designation of "Tree City USA" (Table 4-4). As such, they have agreed to have a tree board or department, a tree care ordinance, and a community forestry program. Itasca and Wheaton have been in the Tree City USA program for over 20 years. Hinsdale, Roselle, Westmont, and Woodridge have been in the program between ten and 15 years. Other communities in DuPage County manage urban forestry through their public works departments. The DuPage County Highway Department does regular maintenance along County rights-of-way.

NFIP/CRS

CRS Credit: Being a part of the National Flood Insurance Program, the CRS recognizes only activities that affect flood damage. It does not provide credit for projects or programs that only affect damage from other types of hazards.

TREE CITY USA

Tree City USA is a program sponsored by The National Arbor Day Foundation in cooperation with the USDA Forest Service and the National Association of State Foresters. These standards were established to ensure that every qualifying community would have a viable tree management plan and program. They were also designed so that no community would be excluded because of size.

To qualify for Tree City USA, a town or city must meet four standards:

1. A tree board or department – Someone must be legally responsible for the care and management of the community's trees. This may be a professional forester or arborist, an entire forestry department, or a volunteer tree board.
2. A tree care ordinance – The ordinance must designate the establishment of a tree board or forestry department and give this body the responsibility for writing and implementing an annual community forestry work plan.
3. A community forestry program with an annual budget of at least $2 per capita – A little investigation usually reveals that more than this amount is already being spent by the municipality on its trees.
4. An Arbor Day observance and proclamation.

Source: www.arborday.org/programs/treecityusa.html

4.10 Dumping Regulations

BMPs usually address pollutants that are liquids or suspended in water that are washed into a lake or stream. Dumping regulations address solid matter, such as landscape waste, trash, shopping carts, and appliances that can be accidentally or intentionally thrown into channels or wetlands. Such materials may not pollute the water, but they can obstruct even low flows and reduce the channels' and wetlands' ability to convey or clean stormwater.

Many cities have nuisance ordinances that prohibit dumping garbage or other "objectionable waste" on public or private property. Waterway dumping regulations need to also apply to "non-objectionable" materials, such as grass clippings or tree branches which can kill ground cover or cause obstructions in channels. Regular inspections to catch violations should be scheduled.

Table 4-5
DuPage County Communities that Prohibit Dumping in Streams

Community	Dumping Prohibited	Community	Dumping Prohibited
Village of Addison	Yes	Village of Lombard	Yes
Village of Bartlett	Yes	City of Naperville	Yes
Village of Bensenville	Yes	Village of Oak Brook	Yes
Village of Bloomingdale	Yes	City of Oakbrook Terrace	Yes*
Village of Burr Ridge	Yes	Village of Roselle	Yes
Village of Carol Stream	Yes	Village of Villa Park	Yes**
Village of Clarendon Hills	Yes	City of Warrenville	Yes
City of Darien	Yes	City of West Chicago	
Village of Downers Grove	Yes*	Village of Westmont	County
City of Elmhurst	Yes	City of Wheaton	Yes
Village of Glendale Heights	Yes	Village of Willowbrook	Yes
Village of Glen Ellyn	Yes*	Village of Winfield	No
Village of Hanover Park	Yes	City of Wood Dale	Yes
Village of Hinsdale	Yes	Village of Woodridge	Yes
Village of Itasca	Yes	DuPage County	
Village of Lisle	Yes		

* Not Specific to waterways

** Harmful waste only

Local Implementation: The DuPage County Stormwater Ordinance prohibits the temporary or permanent storage of landscape waste in floodplains. Though it does not address dumping directly, it does regulate "the storage of materials and the deposit of solid or liquid waste." All such projects are prohibited if they cause an increase in flood heights or flood damage. A permit, however, may not be required, or enforcement action taken, unless the waste exceeds 5,000 square feet. Most communities have ordinances

that prohibit dumping, as shown in Table 4-5. Many do not say that dumping in floodplains is expressly prohibited, since dumping is not allowed anywhere.

CRS Credit: The CRS provides up to 30 points for enforcing and publicizing a regulation that prohibits dumping in the drainage system. As currently written, the DuPage County Stormwater Ordinance would not receive this credit.

4.11 Manufactured Homes

Manufactured or "mobile" homes are usually not regulated by local building codes. They are built in a factory in another state and are shipped to a site. They do have to meet construction standards set by the US Department of Housing and Urban Development (HUD). All mobile type homes constructed after June 15, 1976 must comply with HUD's National Manufactured Home Construction and Safety Standards. These standards apply uniformly across the country and it is illegal for a local unit of government to require additional construction requirements. Local jurisdictions may regulate the location to these structures and their on-site installation.

The greatest mitigation concern with manufactured housing is protection from damage by wind. The key to local mitigation of wind damage to mobile homes is proper installation. The Illinois Mobile Home Act and Manufactured Home Tiedown Code are enforced by the Illinois Department of Public Health (IDPH). The State code includes equipment and installation standards. Installation must be done in accordance with manufacturers' specifications. There is a voluntary program for installers to be trained and certified.

Following the installation of a manufactured home, installers must send the state a certification that they have complied with the State's tiedown code. Inspections are only done if complaints are made regarding an installation.

In addition to code standards to protect the mobile home from high winds is the need to protect the occupants. There is no state or federal requirements for shelters in mobile home parks.

Local Implementation: As discussed in Chapter 2, there are five manufactured home communities in DuPage County, located near or in Bartlett, Elmhurst, West Chicago, Winfield and Wood Dale. Also in DuPage County, manufactured structures are sometimes used for temporary classroom or sales offices at development sites. The floodplain ordinance portion of the County Stormwater Ordinance applies to mobile homes and manufactured buildings. Also, zoning ordinances have mobile home standards incorporated into them.

Mobile school classrooms are regulated by the IDPH, and school districts must provide the State with an architect's seal of compliance. Each year, there must be an inspection of the anchoring and a renewed evacuation plan signed by the superintendent of the school district. These provisions provide a higher level of protection than current procedures do for residential mobile homes.

CRS Credit: Up to 50 points are provided for enforcing the floodplain management requirements in mobile home parks. Because the DuPage County Stormwater Ordinance has these provisions, communities with mobile home parks could receive this credit. Additional points are possible for other special regulations, such as prohibiting manufactured housing in the floodway. There are no CRS credits for manufactured housing standards for hazards other than flooding.

4.12 Conclusions

1. Building codes are the prime preventive measure for tornadoes, high winds, snow storms, and earthquakes. Rigorous enforcement of the latest available building codes, with an adequately trained staff provides a more sustainable community.

2. The County and many communities have adopted the International Code series, which provides better protection from natural hazards. However, according to the Institute for Building and Home Safety, the International Residential and Building Codes do not adequately protect new construction from damage by tornadoes (wind) and hail.

3. Based on the national Building Code Effectiveness Grading Schedule (BCEGS), administration of building codes in DuPage County is generally good. BCEGS Class 5 is recognized by CRS as a minimum requirement for better CRS classes. Most communities have residential and commercial ratings of 5 and better.

4. The majority of the comprehensive and land use plans address floodplains and the need to preserve these hazardous areas from intensive development. However, many zoning ordinances do not designate floodprone areas for any special type of land use.

5. It is unknown what percent of the county's floodplains are open space and/or in public ownership.

6. The County Stormwater Ordinance's provisions for floodplain development and stormwater management regulations exceed minimum national and State standards and will be helpful in preventing flood problems from increasing.

7. State administration of installation of mobile or manufactured homes does not guarantee that they will be adequately tied down or protected from flooding and other hazards.

8. A hazard mitigation program can utilize resource protection programs to support protecting areas and natural features that can mitigate the impacts of natural hazards.

9. The current DuPage County regulations on wetland protection, erosion and sediment control, and best management practices, that are in accordance with state and federal requirements, are effective standards. For implementation of the regulations, differing requirements by state and federal agencies (e.g., assurities) can cause problems.

10. There are excellent examples of wetland protection and river and shoreline restoration projects being cooperatively implemented by the County, the Forest Preserve District, municipalities, and other agencies that demonstrate the benefits of these measures.

11. There is not a countywide ordinance that prohibits dumping of yard waste and other debris in streams or other parts of the drainage system. "Fill" in floodways and wetlands are prohibited by regulations during development or construction. There are not effective mechanisms for reporting, action and remediation for dumping violations that occur outside development and outside existing ordinance applicability.

12. Most communities have urban forestry programs in place that can be effective against damage and power losses from wind and ice storms.

4.13 Recommendations

1. All communities should adopt the latest International series of codes, the new national standard that is being adopted throughout the country. Current efforts by multi-community organizations of building departments to develop local amendments for regional consistency should be pursued, provided they produce equivalent natural hazard protection features.
2. Communities should work to improve their BCEGS rating, with a target of reaching or maintaining at least a Class of 5 or better in time for their next cycle visit by the Insurance Services Office.
3. On a regional basis, municipal and County code enforcement staffs should work together to:
    a. Develop building code language to strengthen new buildings against damage by high winds, tornadoes and hail,
    b. Adequately regulate mobile/manufactured structure installation for all uses, including residential, commercial and schools, and
4. On a regional basis, municipal and county planning and engineering staff should develop example subdivision ordinance language that requires new infrastructure to have hazard mitigation provisions, such as secondary access to subdivisions.
5. Municipal comprehensive plans, land use plans and zoning ordinances should incorporate open space provisions that will protect properties from flooding and preserve wetlands and farmland.
6. Offices responsible for design, construction or permitting critical facilities should ensure that the design accounts for natural hazards and adjacent land uses.

7. The public, developers, builders, and decision makers should be informed about the hazard mitigation benefits of these preventive measures and the procedures that should be followed to ensure that new developments do not create new problems.
8. Communities need to understand and consistently enforce the County Stormwater Ordinance provisions. All communities should enforce the wetland protection, erosion and sediment control and best management practices provisions of the County Stormwater Ordinance. The DuPage County municipal engineers group should continue their efforts in these areas.
9. The public and decision makers should be informed about the hazard mitigation benefits of restoring rivers, wetlands and other natural areas. Myths about mosquitoes should be dispelled and restoration and protection techniques should be explained.
10. Each community should ensure that it has enforceable stream and wetland dumping regulations.
11. The public should be informed about the need to protect streams and wetlands from dumping and inappropriate development and the relevant codes and regulations.
12. Every community should develop or continue to implement an urban forestry program that qualifies them to become a Tree City, USA.
13. DuPage County and municipalities should consider joining the NFIP's CRS program. For the municipalities already involved in CRS, they should work to improve their CRS class.

4.12 References

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2. *Guidelines for Installing Manufactured Homes in Illinois*, Illinois Department of Public Health, 2000.
3. *Multi-Hazard Identification and Risk Assessment*, Federal Emergency Management Agency, 1997.
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7. *Windstorm Mitigation Manual for Light Frame Construction*, Illinois Emergency Management Agency, 1997.
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12. *Environmental Consideration in Comprehensive Planning,* Northeastern Illinois Planning Commission, 1994.

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Chapter 5. Property Protection

Property protection mitigation measures are used to modify a building or a property that is subject to a hazard in order to reduce potential damage. Property protection measures fall under three approaches:

- Modify the site to keep the hazard from reaching the building,
- Modify the building so it can withstand the impacts of the hazard, and
- Insure the property to provide financial relief after the damage occurs.

The word "building" can refer to residential, commercial or industrial structures, or it can mean infrastructure facilities (treatment plants, electrical substations, roads) or other public structures. Property protection measures are normally implemented by the property owner (public or private); although in many cases technical and financial assistance can be provided by a government agency. These are discussed later in this chapter.

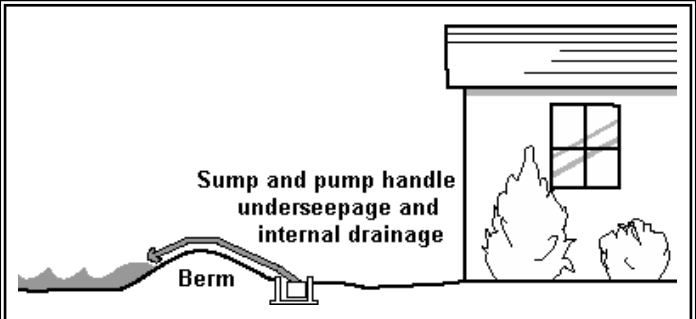
5.1 Barriers, Elevation, Relocation, and Acquisition

For the hazards considered in this plan, flooding is the one hazard that can be kept away from a building. There are four common methods to do this:

- Erect a barrier between the building and the source of flooding,
- Move the building out of the flood prone area
- Elevate the building above the flood level
- Demolish the building.

The advantages and disadvantages to these four methods will be discussed below. Generally, floods do not damage vacant areas. The major impact of hazards is to people and improved property. In some cases, properties can be modified so the hazard does not reach the damage-prone improvements. A fire break is an example of this approach - brush and other fuel are cleared away from the building so a fire may not reach it.

Barriers: A flood protection barrier can be built of dirt or soil ("berm") or concrete or steel ("floodwall"). Berms take up more space than floodwalls, but floodwalls are more expensive than berms.



Small barriers can be effective against shallow flooding.

Careful design is needed so as not to create flooding or drainage problems on neighboring properties. If the ground is

porous and if floodwaters will stay up for more than an hour or two, the design needs to account for leaks, seepage of water underneath, and rainwater that falls inside the perimeter.

Barriers can only be built so high. They can be overtopped by a flood higher than expected. Barriers made of earth are susceptible to erosion from rain and floodwaters if not properly sloped, covered with grass, and maintained. A berm can settle over time, lowering its protection level. A floodwall can crack, weaken, and lose its watertight seal. Therefore, barriers need careful design and maintenance (and insurance on the building, in case of failure).

Relocation: Moving a building to higher ground is the surest and safest way to protect it from flooding. Relocation of a building can be to a new property outside of the floodplain, or, for large lots, to a higher location (outside of the floodplain) on the existing property. Any building can be moved; however the cost goes up for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings.

Small, wood frame buildings are the easiest to relocate

Building Elevation: Raising a building above the flood level can be almost as effective as moving it out of the floodplain. Water flows under the building, causing little or no damage to the structure or its contents.

Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with floodplain regulations that require new, substantially improved, and substantially damaged buildings to be elevated above the base flood elevation.

Elevating a building will change its appearance. If the required amount of elevation is low, the result is similar to putting a building on a 2- or 3-foot-high crawlspace (see example to the left). If the building needs to be raised more than four feet, owners are concerned that it will stick out like a sore thumb, and they may decline to implement an elevation project. Yet, many owners have successfully and attractively (with stairs and landscaping) elevated their homes more than eight feet.

Home elevated one foot above the base flood elevation.

Another problem with this approach is with basements. Only the first floor and higher are elevated. The basement remains as the foundation. All utilities are elevated and the basement is filled in to protect the walls from water pressure. The owner loses the use of the basement, which may deter him or her from trying this approach.

A third problem with elevation is that it may expose the structure to greater impacts from other hazards. If not braced and anchored properly, an elevated building may have less resistance to the shaking of an earthquake and the pressures of high winds. Careful design and construction, however, should prevent these secondary problems.

Demolition: If a home has been heavily damaged and susceptible to future damage, it is safest for owners to relocate. Acquisition, followed by demolition, is most appropriate for buildings that are dilapidated and are not worth protecting, but acquisition and demolition should also be considered for structures that would be difficult to move—such as larger, slab foundation, or masonry structures. Generally, demolition projects are undertaken by a government agency, so the cost is not borne by the property owner, and the land is converted to public use, such as a park.

One problem that sometimes results from an acquisition and demolition project is a "checkerboard" pattern in which nonadjacent properties are acquired. Creating such an acquisition pattern in a community adds to the maintenance costs that taxpayers must support.

Local Implementation: In DuPage County, floodproofing devices, such as, barriers to protect structures must function without human intervention. They must be located within 10 feet of the structure. If they are beyond 10 feet then compensatory storage (1.5:1) is required.

Table 5-1 lists the flood prone property acquisitions throughout the County since the 1980s. Carol Stream has a number of homes in the Klein Creek floodplain that have experienced repetitive damage over the last 20 years where acquisition should be considered.

NFIP/CRS

CRS Credit: The Community Rating System provides the most credit points for acquisition and relocation because this measure permanently removes insurable buildings from the floodplain. The score is based on the number of buildings removed compared to the number remaining in the floodplain (Activity 520 - Acquisition and Relocation).

The CRS also credits barriers and elevating existing buildings (Activity 530 - Flood Protection). Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building. Because barriers are less secure than elevation, not as many points are provided.

Table 5-1
DuPage County Flood Prone Property Acquisitions

Community	Watershed	Location	Number of Acquisitions	Participating Agencies
Village of Addison	Salt Creek	Salt Creek	4	IDNR, FEMA
City of Darien	Sawmill Creek	Crest Road	4	DCSM
Village of Downers Grove	East Branch DuPage River		2	
City of Elmhurst	Salt Creek	Monterey Avenue	3	IDNR
Village of Lisle	East Branch DuPage River	Garfield/Lincoln River/Dumoulin	28	Village, DCSM
Village of Roselle	Salt Creek/Spring Brook	Roselle Road	1	
Village of Villa Park	Salt Creek	Riverside Court	1	
City of Wheaton	East Branch DuPage River	Main Street & Dorchester	3	DCSM, City
Village of Winfield	West Branch DuPage River			DCSM
City of Wood Dale	Salt Creek		10	FEMA, IDNR, DCFPD, City, Park District
DuPage County	East Branch DuPage River	Valley View (Uninc. DuPage)	47	DCSM, FEMA

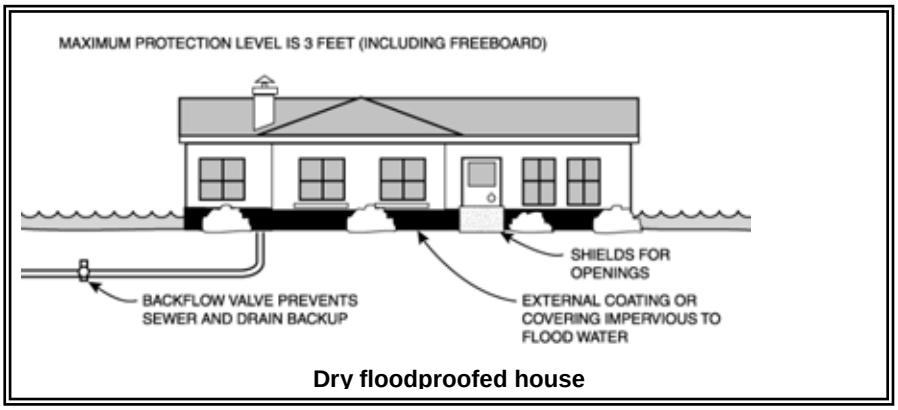
DuPage County Stormwater Management (DCSM)
DuPage County Forest Preserve District (DCFPD)
Illinois Department of Natural Resources, Office of Water Resources (IDNR)
Federal Emergency Management Agency (FEMA)

5.2 Retrofitting – Modify the Building

Section 5.1 focused on keeping the hazard from reaching a building or damage-prone part of a property. An alternative is to modify or "retrofit" the site or building to minimize or even prevent damage. There are a variety of techniques to do this. This section looks at the measures that can be implemented to protect existing buildings from damage by floods, sewer backup, earthquakes, tornadoes, summer and winter storms.

5.2.1 Flood Retrofitting - Buildings

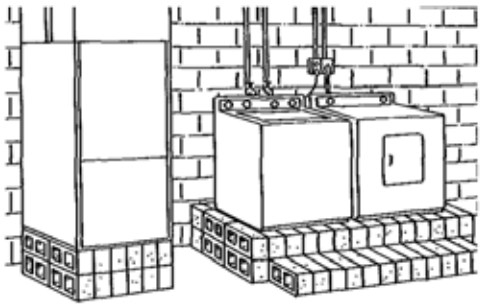
Flood retrofitting measures include **dry floodproofing** where all areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or



Dry floodproofed house

plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags.

Dry floodproofing of new and existing nonresidential buildings in the regulatory floodplain is permitted under State, FEMA and County regulations. Dry floodproofing of existing residential buildings in the floodplain is also permitted as long as the building is not substantially damaged or being substantially improved. Owners of buildings located outside the regulatory floodplain can always use dry floodproofing techniques.



Wet floodproofed basement

The alternative to dry floodproofing is **wet floodproofing:** water is let in and everything that could be damaged by a flood is removed or elevated above the flood level. Structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater, and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

Wet floodproofing has one advantage over the other approaches: no matter how little is done, flood damage is reduced. Thousands of dollars in damage can be prevented by simply moving furniture and electrical appliances out of a basement.

A third flood protection modification addresses flooding caused by overloaded sanitary or combined sewers. Four approaches may be used to protect a structure against **sewer backup**: floor drain plugs, floor drain stand-pipes, overhead sewers, and backflow protection valves.

The first two devices keep water from flowing out of the lowest opening in the building, the floor drain. They cost less than $25. However, if water becomes deep enough in the sewer system, it can flow out of the next lowest opening, such as a toilet or tub, or it can overwhelm a drain plug by hydrostatic pressure and flow into the building through the floor drain. The other two measures, overhead sewers and backflow protection valves keep water in the sewer line during a backup. These are more secure, but more expensive ($3,000-$4,000).

For dry floodproofing, wet floodproofing, and sewer backup prevention, it is important to consider what contents of a building are suitable for keeping in basements or crawl spaces. Valuable and invaluable items, such as, photographs, should be kept elsewhere in the event that the seepage or flooding occurs even with the retrofitting measures in place.

Local Implementation: Most floodproofing activity in the County has been the installation of overhead sewers (see Table 5-2).

CRS Credit: Credit for dry and wet floodproofing and sewer backup protection is provided under Activity 530 (Retrofitting). Because these property protection measures are less secure than barriers and elevation, not as many points are provided.

5.2.2 Tornado Retrofitting

Tornado retrofitting measures include constructing an underground shelter or "safe room" at the first floor level to protect the lives of the occupants. Their worth has been proven by recent tornadoes in Oklahoma, as shown in the photo to the right. They can be installed for approximately $3,000.

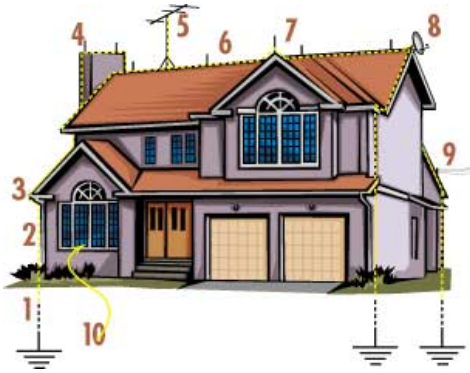
Tornado shelter

Safe rooms are built by connecting all parts of the shelter together (walls, roof and foundation) using adequate fasteners or tie downs. These help hold the safe room together when the combination of high wind and pressure differences work to pull the walls and ceiling apart. The walls of the safe room are constructed out of plywood and metal sheeting to protect people from windborne missiles (flying debris) with the strong winds of a tornado. More information on safe rooms can be found in FEMA Publication 320.

Interior rooms can be reinforced and retrofitted to be tornado "safe rooms"

Another retrofitting approach for tornadoes and **high winds** is to secure the roof, walls and foundation with adequate fasteners or tie downs. These help hold the building together when the combination of high wind and pressure differences work to pull the building apart. This measure also applies to manufactured homes.

A third tornado and high wind protection modification is to strengthen garage doors, windows and other large openings. If winds break the building's "envelope," the pressures on the structure are greatly increased. Impact-resistant glass is also recommended for high wind or tornado protection.



Lightning protection measures

Source: State Farm Insurance

5.2.3 Summer Storm Retrofitting

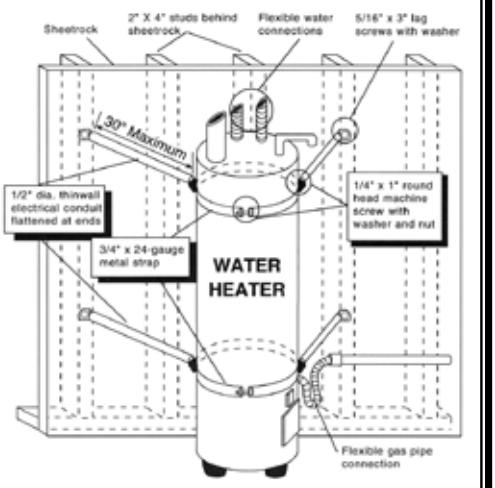
Retrofitting approaches to protect private or public buildings from the effects of **thunderstorms** include:

- storm shutters
- lightning rods (illustrated on the previous page)
- strengthening connections and tie-downs (similar to tornado retrofitting)
- impact-resistant glass in window panes
- surge protectors at electrical outlets

Roofs could be replaced with materials less susceptible to damage by **hail**, such as modified asphalt or formed steel shingles.

5.2.4 Winter Storm Retrofitting

Winter storm retrofitting measures include improving insulation on older buildings and relocating water lines from outside walls to interior spaces. Windows can be sealed or covered with an extra layer of glass (storm windows) or plastic sheeting. Roofs can be retrofitted to shed heavy loads of snow and prevent ice dams that form when snow melts.



Source: The Homeowners Guide to Earthquake Safety

5.2.5 Earthquake Retrofitting - Buildings

Earthquakes, or seismic events, present two hazards for buildings and people – a hazard for the structure itself and a hazard for the building's contents (non-structural hazard). Earthquake retrofitting measures for the **structure** include:

- removing masonry overhangs that will fall onto the street during shaking
- bracing the walls of the building provides structural stability
- bolting sill plates to the foundation

These measures can be very expensive and should be considered for buildings on a case by case basis.

Measures that protect against non-structural seismic hazards typically involve small modifications. Retrofitting activities for non-structural hazards include:

- tying down appliances, water heaters, bookcases, and fragile furniture so they won't fall over during a quake
- installing latches on drawers and cabinet doors
- mounting picture frames and mirrors securely
- installing flexible utility connections for water and gas lines
- anchoring and bracing propane tanks and gas cylinders

These approaches can be very cost effective and have little or no impact on the appearance of a building, yet they are important measures for keeping buildings safer and protecting lives during earthquake events.

While these simple and inexpensive measures may be cost effective for a home or business, they may not be sufficient for protection of **critical facilities**. Fire stations need to be sure that they can open their doors and hospitals must be strong enough to continue operating during the shocks and aftershocks. Again, critical facilities should be evaluated on a case by case basis.

5.2.6 Earthquake Retrofitting – Infrastructure and Lifelines

Infrastructure hardening, attention to lifelines and bridge strengthening are important elements of earthquake mitigation. From FEMA Publication Number 271, *Seismic Design Guidelines and Standards for Lifelines* (1996):

> Lifelines are the public works and utility systems that support most human activities: individual, family, economic, political, and cultural. The various lifelines can be classified under the following five systems: electric power, gas and liquid fuels, telecommunications, transportation, and water supply and sewers.

The first step in protecting lifeline systems is the prioritization of critical facilities, utility systems, and other infrastructure. The involvement of state agencies, such as the Illinois Department of Transportation, is important. The involvement of private owners of utility systems is also important. FEMA, through the National Earthquake Hazard Reduction Program (NEHRP) and the Central United States Earthquake Consortium offer technical guidance on retrofitting approaches.

CRS Credit: Retrofitting to protect a building for hazards other than flooding is not credited under the CRS.

5.3 Insurance

Technically speaking, insurance does not mitigate damage caused by a natural hazard. However, it does help the owner repair, rebuild and (hopefully) afford to incorporate some of the other mitigation measures in the process.

Insurance has the advantage that, as long as the policy is in force, the property is protected and no human intervention is needed for the measure to work. A standard **homeowner's insurance** policy will cover a property for the hazards of tornado, wind, hail, and winter storms. Separate endorsements are usually needed for earth movement (e.g., earthquake) coverage.

Although most homeowner's insurance policies do not cover a property for flood damage, an owner can insure a building for damage by surface flooding through the National Flood Insurance Program. **Flood insurance** coverage is provided for buildings and their contents damaged by a "general condition of surface flooding" in the area.

Some people have purchased flood insurance because it was required by the bank when they got a mortgage or home improvement loan. Usually these policies just cover the building's structure and not the contents. Renters can buy contents coverage, even if the owner does not buy structural coverage on the building. There is limited coverage for basements and the below grade floors of bi-levels and tri-levels.

Several insurance companies have **sump pump failure** or **sewer backup coverage** that can be added to a homeowner's insurance policy. Each company has different amounts of coverage, exclusions, deductibles, and arrangements. Most are riders that cost extra. Most exclude damage from surface flooding that would be covered by a National Flood Insurance policy.

Larger local governments can self-insure and absorb the cost of damage to one facility, but if many properties are exposed to damage, self-insurance can be a major drain on the treasury. Communities cannot expect Federal disaster assistance to make up the difference. Under Section 406(d) of the Stafford Act.

> If an eligible insurable facility damaged by flooding is located in a [mapped floodplain] … and the facility is not covered (or is underinsured) by flood insurance on the date of such flooding, FEMA is required to reduce Federal disaster assistance by the *maximum* amount of insurance proceeds that would have been received had the buildings and contents been fully covered under a National Flood Insurance Program (NFIP) standard flood insurance policy. [Generally, the maximum amount of proceeds for a non-residential property is $500,000.]
> [Communities] Need to:
> - Identify all insurable facilities, and the type and amount of coverage (including deductibles and policy limits) for each. The anticipated insurance proceeds will be deducted from the total eligible damages to the facilities.
> - Identify all facilities that have previously received Federal disaster assistance for which insurance was required. Determine if insurance has been maintained. *A failure to maintain the required insurance for the hazard that caused the disaster will render the facility ineligible for Public Assistance funding….*
> - [Communities] *must* obtain and maintain insurance to cover [their] facility - buildings, equipment, contents, and vehicles - for the hazard that caused the damage in order to receive Public Assistance funding. Such coverage must, at a minimum, be in the amount of the eligible project costs. FEMA will not provide assistance for that facility in future disasters if the requirement to purchase insurance is not met. – FEMA Response and Recovery Directorate Policy No. 9580.3, August 23, 2000

In other words, the law expects public agencies to be fully insured as a condition of receiving Federal disaster assistance.

Earthquake Insurance: Earthquakes are not covered under standard homeowners or business insurance policies, but coverage is usually available for earthquake damage in the form of an endorsement to a home or business insurance policy. Cars and other vehicles are covered for earthquake damage under the comprehensive part of the auto insurance policy. In DuPage County, property owners can obtain earthquake insurance.

Earthquake insurance provides coverage for your dwelling, for your personal property, and for any additional living expense (ALE). ALE coverage can include costs for the following:

- Temporary rental home, apartment, or hotel room
- Restaurant meals
- Telephone or utility installation in a temporary residence
- Relocation and storage
- Furniture Rental
- Laundry

Premiums for both of these are very low, but deductibles, especially for earthquake, are very high.

Local Implementation: Flood insurance has been available in DuPage County communities since the 1970's. Current flood insurance coverage is 2,214 policies

Most communities in DuPage County are enrolled in either the Illinois Municipal League Risk Management Association (IML). IML provides risk management advice and coverage for all of the hazards covered in this *Plan*, including flood and earthquake. DuPage County has an insurance policy through the ICI.

CRS Credit: There is no credit for purchasing flood or basement insurance, but the Community Rating System does provide credit for local public information programs that explain flood insurance to property owners. The CRS also reduces the premiums for those people who do buy NFIP coverage.

5.4 The Government's Role

Property protection measures are usually considered the responsibility of the property owner. However, local governments should be involved in all strategies that can reduce flood losses, especially acquisition and conversion of a site to public open space. There are various roles the County or a municipality can play in encouraging and supporting implementation of these measures.

Government Facilities: One of the first duties of a local government is to protect its own facilities. Fire stations, water treatment plants and other critical facilities should be a high priority for retrofitting projects and insurance coverage.

Often public agencies discover after the disaster that their "all-hazard" insurance policies do not cover the property for the type of damage incurred. Flood insurance is even more important as a mitigation measure because of the Stafford Act provisions discussed above.

Public Information: Providing basic information to property owners is the first step in supporting property protection measures. Owners need general information on what can be done. They need to see examples, preferably from nearby. Public information activities that can promote and support property protection are covered in Chapter 9.

Financial Assistance: Communities can help owners by helping to pay for a retrofitting project. Financial assistance can range from full funding of a project to helping residents find money from other programs. Some communities assume responsibility for sewer

backups, street flooding, and other problems that arise from an inadequate public sewer or public drainage system.

Less expensive community programs include low interest loans, forgivable low interest loans and rebates. A forgivable loan is one that does not need to be repaid if the owner does not sell the house for a specified period, such as five years. These approaches don't fully fund the project but they cost the community treasury less and they increase the owner's commitment to the flood protection project. Often, small amounts of money act as a catalyst to pique the owner's interest to get a self-protection project moving.

The City of Guthrie, Oklahoma has a rebate program for installation of tornado shelters and safe rooms. The City provides up to $1,500 per house, which can cover the majority of the cost.

The more common outside funding sources are listed below. Unfortunately, the last three are only available after a disaster, not before, when damage could be prevented. Following past disaster declarations, FEMA, the Illinois Emergency Management Agency (IEMA) and the Illinois Department of Natural Resources have provided advice on how to qualify and apply for these funds.

Pre-disaster funding sources
- FEMA's Pre-Disaster Mitigation (PDM) grants (administered by IEMA)
- FEMA's Flood Mitigation Assistance (FMA) grants (administered by IEMA)
- Community Development Block Grant (administered by the Department of Commerce and Economic Opportunity
- Illinois Department of Natural Resources
- Conservation organizations, such as the Conservation Foundation and CorLands, although generally these organizations prefer to purchase vacant land in natural areas, not properties with buildings on them.

Post-disaster funding sources
- Insurance claims
- The National Flood Insurance Program's Increased Cost of Compliance provision (which increases the claim payment to cover a flood protection project required by code as a condition to rebuild the flooded building)

Post-disaster funding sources, Federal disaster declaration needed
- FEMA's disaster assistance (for public properties, however, after a flood, the amount of assistance will be reduced by the amount of flood insurance that the public agency should be carrying on the property) (administered by IEMA)
- Small Business Administration disaster loans (for non-governmental properties)
- FEMA's Hazard Mitigation Grant Program (administered by IEMA)

Acquisition Agent: The community can be the focal point in an acquisition project. Most funding programs require a local public agency to sponsor the project. The County or a municipality could process the funding application, work with the owners, and provide some, or all, of the local share.

Table 5-2
DuPage County Floodproofing Assistance Efforts

Community	Overhead Sewers or Floodproofing	Financial Assistance	Technical Assistance	Other Efforts
Village of Addison	Yes	Yes	Yes	Overhead sewer required with new construction
Village of Bartlett	Yes	Yes (100%)	Yes	Overhead sewer required with new construction
Village of Bensenville				
Village of Bloomingdale		Yes	Yes	Overhead sewer required with new construction
Village of Burr Ridge				Overhead sewer required with new construction
Village of Carol Stream				
Village of Clarendon Hills			Yes	Overhead sewer required with new construction
City of Darien	No			
Village of Downers Grove			Yes	
City of Elmhurst	Some			
Village of Glendale Heights			NFIP	New sewer system and WTP has reduced problems
Village of Glen Ellyn	Yes	Yes (50/50)	Yes	Overhead sewer required with new construction
Village of Hanover Park				
Village of Hinsdale				Overheads required by sanitary district
Village of Itasca				
Village of Lisle	Yes, a few	Yes	Yes	
Village of Lombard	Yes	Yes	Yes	Backyard program
City of Naperville	Yes			Overhead sewer required with new construction
Village of Oak Brook				
City of Oakbrook Terrace				
Village of Roselle				Overhead sewer required with new construction
Village of Villa Park				Overhead sewer required with new construction
City of Warrenville	No	No	Yes	Overhead sewer required with new construction
Village of Wayne	No	No		Site visits to determine if sanitary sewer problems
City of West Chicago				
Village of Westmont				Ejectors required
City of Wheaton		Yes	Yes	Overhead sewer required with new construction
Village of Willowbrook			Yes	Overhead sewer required with new construction
Village of Winfield	Yes			
City of Wood Dale	No		Yes	
Village of Woodridge		Village $1,000 reimb.,and County 50% or $2,500		In village code and through program
DuPage County				
College of DuPage	--	--	--	

Mandates: Mandates are considered a last resort if information and incentives aren't enough to convince a property owner to take protective actions. An example of a retrofitting mandate is the requirement that many communities have that downspouts be disconnected from the sanitary sewer line.

There is a mandate for improvements or repairs made to a building in the mapped floodplain. If the project equals or exceeds 50 percent of the value of the original building it is considered a "substantial improvement." The building must then be elevated or otherwise brought up to current flood protection codes.

Another possible mandate is to require less expensive hazard protection steps as a condition of a building permit. For example, many communities require upgraded electrical service as a condition of a home improvement project. If a person were to apply for a permit for electrical work, the community could require that the service box be moved above the base flood elevation or the installation of separate ground fault interrupter circuits in the basement.

Local Implementation: As discussed in Chapter 1, there are several identified critical facilities. Most of these have no special measures to protect them from flooding, tornadoes, and other natural hazards.

CRS Credit: Except for public information programs, the Community Rating System does not provide credit for efforts to fund, provide incentives or mandate property protection measures. The CRS credits are provided for the actual projects, after they are completed (regardless of how they were funded or who instigated them). On the other hand, in order to participate in the CRS, a community must certify that it has adequate flood insurance on all properties that have been *required* to be insured. The minimum requirement is to insure those properties in the mapped floodplain that have received Federal aid, as specified by the Flood Disaster Protection Act of 1973.

5.5 Repetitive Flood Loss Properties

Chapter 2 explains the criteria for designation of the County's repetitive loss properties. Repetitive loss properties deserve special attention because they are more prone to damage by natural hazards than any other properties in the County. Further, protecting repetitive loss buildings is a priority with FEMA and IEMA mitigation funding programs.

When repetitive loss properties are reviewed, the key factors listed below should be used to determine appropriate property protection measures. The criteria used are based on several studies that have identified appropriate measures based on flood and building conditions. While a cost/benefit study was not conducted on each property, these guidelines show which measures are cost-effective.

- "High hazard areas" are areas in the floodway or where the 100-year flood is two or more feet over the first floor.
- Buildings in high hazard areas or in less than good condition should be acquired and demolished.
- Buildings with basements and split-level foundations in high hazard areas should be acquired and demolished. They are too difficult to elevate and the hydrostatic pressures on the walls from deeper flooding make them too risky to protect in place.

- Buildings subject to shallow flooding from local drainage should be protected through area-wide flood control or sewer improvement projects.
- Buildings in good condition on crawlspaces should be elevated or relocated.
- Buildings in good condition on slab, basement or split-level foundations subject to shallow flooding (less than 2 feet) can be protected by barriers and dry floodproofing.
- Recent flood claims. Some properties have not had a flood insurance claim for 20 years, indicating that some measure has probably been put in place to protect the property from repetitive flooding.

These criteria are general, and recommendations for individual structures should be made only after a site inspection. Other extenuating circumstances may also alter the recommendations.

Local Implementation:
Table 2-13 summarizes FEMA repetitive loss properties in DuPage County. DuPage County maintains a list of all flood prone properties that qualify for acquisition, and the list includes repetitive loss properties. Properties have been identified for acquisition throughout DuPage County based on watershed modeling done by the County. The properties are identified by watershed (or subwatershed) rather than "repetitive loss areas." Funding of acquisitions, or matching funds, is/are provided through County stormwater management program. The acquisition list also includes all properties that have been acquired by local, state and federal agencies (see Table 5-1).

The effort of the countywide stormwater management program has greatly reduced the number of repetitive loss properties in DuPage County. Municipalities and DuPage County are continuing repetitive loss acquisition efforts as grant dollars and matching funds become available.

5.6 Conclusions

1. Property protection measures for natural hazards are important for DuPage County given the number of hazards and the number of buildings for which the County is at risk.

2. There are several ways to protect individual properties from damage by natural hazards. The advantages and disadvantages of each should be examined for each situation.

3. Property owners can implement some property protection measures at little cost, especially for sites in areas of low hazards (e.g., shallow flooding, sewer backup, summer, and winter storms).

4. For other measures, such as relocation, elevation and safe rooms, the owners may need financial assistance.

5. Limited and inaccurate data from FEMA makes it difficult to assess repetitive flood loss properties.

6. Government agencies can promote and support property protection measures through activities ranging from financial incentives to public information.

7. The County is unable to determine if government properties, including critical facilities, have measures to protect them from flooding, tornadoes, and other natural hazards.

8. About 2,200 of the buildings in the County's floodplains are covered by flood insurance.

5.7 Recommendations

1. Available property protection public education materials should be consolidated and tailored for DuPage County. Materials should address measures that can help owners reduce their exposure to damage by natural hazards and the various types of insurance coverage that are available.

2. The County and municipalities should provide information and technical advice to floodplain property owners for reading floodplain maps.

3. The County and municipalities should consider the feasibility of providing information and technical advice to floodplain property owners for protecting their property.

4. Repetitive flood loss areas should be investigated and mitigated.

5. Most property protection projects should be voluntary.

6. Structural elevation or acquisition alternatives should be investigated for flood prone properties when a regional project is not feasible.

7. Feasible structural elevation or acquisitions should be funded through grants or through capital funding.

8. Positive incentives should be maintained and created by the County and municipalities to encourage property protection by property owners.

9. Communities should consider cost-sharing programs, such as rebates, to encourage low cost property protection.

10. All property owners should be encouraged to determine if they are adequately insured for natural hazards.

11. DuPage County should seek property protection financial assistance for flood and tornado mitigation projects for properties at risk.

12. A standard checklist should be developed to evaluate a property's exposure to damage from the hazards most prevalent in DuPage County. The checklist should be

provided to each agency participating in this planning process and made available to the general public.

13. Each public entity should evaluate its own properties using the standard checklist. A priority should be placed on determining critical facilities' vulnerability to damage and whether public properties are adequately insured.

14. Each public entity should protect its own publicly-owned facilities with appropriate mitigation measure(s), except where efficiencies allow for joint funding and joint projects.

15. All critical facilities in the floodplain, with priority given to facilities in the floodway, should be mitigated, to the extent that the measures are cost effective and feasible.

5.6 References

1. *Disaster Mitigation Guide for Business and Industry*, Federal Emergency Management Agency, FEMA-190, 1990.
2. *Engineering Principles and Practices for Retrofitting Flood Prone Residential Buildings,* Federal Emergency Management Agency, FEMA-259, 1995.
3. *Flood Insurance Agent's Manual*, FEMA, 2000.
4. *Flood Proofing Techniques, Programs and References*, U.S. Army Corps of Engineers National Flood Proofing Workgroup, 1991.
5. Mitigation Ideas: Possible Mitigation Measures by Hazard Type, FEMA Region 5, 2002.
6. *Floodproofed Sites in Illinois*, French & Associates, 1992.
7. *Guide to Flood Protection in Northeastern Illinois*, Illinois Association for Floodplain and Stormwater Management, 1997.
8. *The Homeowners Guide to Earthquake Safety*, California Seismic Safety Commission, 2000.
9. *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding.* Federal Emergency Management Agency, FEMA-312, 1998.
10. *Ice Storm Mitigation*, FEMA –860-DR-Illinois, Illinois Emergency Management Agency, 1990.
11. *Local Flood Proofing Programs*, U.S. Army Corps of Engineers, 1994.
12. Materials supplied by County offices and municipalities, 2004 and 2005.
13. State Farm Insurance website, www.statefarm.com.
14. *Taking Shelter from the Storm: Building a Safe Room Inside Your House*, Federal Emergency Management Agency, FEMA-320, 1998.
15. *Windstorm Mitigation Manual for Light Frame Construction*, Illinois Emergency Management Agency, 1997.
16. Insurance Information Institute website: www.iii.org.

Chapter 6. Structural Projects

Structural projects are projects that are constructed to protect people and infrastructure from damage due to natural hazards. Structural projects are usually funded by public agencies. Preventing damage due to flooding is the primary focus of structural projects. Structural projects keep flood waters away from an area by constructing barriers, by storing floodwater elsewhere, or by redirecting flood flows. Large structural flood control projects are most often planned, funded and implemented at a regional level by agencies, such as the DuPage County Stormwater Division, the Illinois Department of Natural Resources, Office of Water Resources, the U.S. Army Corps of Engineers, the USDA Natural Resources Conservation Service. Many projects are jointly planned and funded between these agencies in cooperation with the municipalities or the DuPage County Forest Preserve District.

The DuPage County Stormwater Management Plan was adopted in 1989. In consolidated the existing stormwater effort throughout the county into a "unified, countywide structure." The Plan was adopted in accordance with Illinois Public Act 85-905 which gives DuPage County to authority to conduct planning, adopt regulations and implement projects, including structural projects, relating to stormwater management.

Six approaches are reviewed in this chapter:

- Reservoirs and detention
- Levees and barriers
- Channel improvements and diversions
- Crossings and roadways
- Drainage and storm sewer improvements
- Drainage system maintenance

Structural projects offer advantages not provided by other measures, as shown in the table below, but they also have shortcomings. The appropriateness of using structural flood control depends on individual project area circumstances.

Pros and Cons of Structural Flood Control Projects

Advantages	Shortcomings
May provide the greatest amount of protection for land area used.	They disturb the land and disrupt natural water flows, often destroying wildlife habitat.
Because of land limitations, may be the only practical solution in some circumstances.	They require regular maintenance, which if neglected, can have disastrous consequences.
Can incorporate other benefits into structural project design such as water supply and recreational uses.	They are built to a certain flood protection level that can be exceeded by larger floods, causing extensive damage.
Regional detention may be more cost-efficient and effective than requiring numerous small detention basins.	They can create a false sense of security as people protected by a project often believe that no flood can ever reach them.
	Although it may be unintended, in many circumstances they promote more intensive land use and development in the floodplain.

The planning of structural flood control projects usually involves an alternative assessment, and that assessment is typically part of, or a product of, a watershed plan.

The following watershed plans, flood control studies or reports have been published for DuPage County communities:

Table 6-1
DuPage County Watershed Plans

1988	Adopted Willow Way Brook Watershed Plan
1991	Adopted Ginger Creek Watershed Plan
1991	Adopted Salt Creek Watershed Plan
1991	Adopted Willow Creek Watershed Plan
1992	Adopted Salt Creek Watershed Capitol Improvement Plan
1992	Adopted Tributary #4 Watershed Plan
1994	Adopted Black Partridge Watershed Plan
1994	Adopted Winfield Creek Watershed Plan
1994	Adopted Westwood Creek Watershed Plan
1994	Adopted Klein Creek Watershed Plan
1996	Adopted Valley View Flood Control Plan
1996	Adopted Sawmill Creek Watershed Plan
1996	Adopted Tributary #2 Watershed Plan
1997	Adopted Flagg Creek Watershed Plan
1997	Adopted Steeple Run Watershed Plan
1998	Adopted the Sawmill Creek Watershed Plan Addendum
1999	Amended the Salt Creek Watershed Plan
1999	Adopted Ferry Creek Watershed Plan
2002	Adopted West Branch Tributary #1 Watershed Plan (Keeneyville)
2003	Adopted Addison Creek Watershed Plan
2004	Adopted the River-Dumoulin Flood Control Plan for inclusion in the East Branch DuPage River Watershed Plan
2004	Adoption of Route 53 North Flood Control Plan for inclusion in the East Branch DuPage River Watershed Plan
2004	Adopted the Upper Des Plaines River Tributaries Watershed Plan
2006	Adopted West Branch DuPage River Watershed Plan
2006	Adopted Spring Brook Tributary to Salt Creek Watershed Plan

Along with the survey of DuPage County communities, these plans and project implemented by the DuPage County Stormwater Division form the basis of this chapter.

CRS Credit: The Community Rating System provides flood insurance discounts to those communities that implement various floodplain management activities that meet certain criteria. Comparing local activities to those national criteria helps determine if local activities should be improved. Structural flood control projects that provide 100-year flood protection and result in revisions to the Flood Insurance Rate Map are not credited by the CRS in order to not duplicate the larger premium reduction provided by removing properties from the mapped floodplain.

In 2002, the CRS began crediting structural flood control projects that meet the following criteria:

- They must provide protection to at least the 25-year flood
- The design and construction must be certified by a licensed professional engineer
- They must meet certain environmental protection criteria
- They must meet Federal, State and local regulations, such as Corps of Engineers' 404 permit and State dam safety rules requirements
- They must meet certain maintenance requirements

These criteria ensure that credited projects are well-planned and permitted. Any of the first five measures reviewed in this chapter would be recognized under Section 531 of the *CRS Coordinator's Manual*. Credit points are based on the type of project, how many buildings are protected, and to what flood protection level.

6.1 Reservoirs and Detention

Reservoirs reduce flooding by temporarily storing flood waters behind dams or in storage or detention basins. Reservoirs lower the flood height by holding back, or detaining, runoff before it can flow downstream. Flood waters are detained until the flooding has subsided, then the water in the reservoir or detention basin is released or pumped out slowly at a rate that the river can accommodate downstream. Reservoirs can be dry and remain idle until a large rain event occurs. Or they may be designed so that a lake or pond is created.

Reservoirs are most commonly built for one of two purposes. Large reservoirs are constructed to protect property from existing flood problems. Smaller reservoirs or detention basins are built to protect property from the impacts of new development (i.e., more runoff).

Regardless of size, reservoirs protect the development that is downstream from the reservoir site. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected.

There are several considerations when evaluating use of reservoirs and detention:

- The expense for management and maintenance of the facility.
- Flooding can still occur if their design level is exceeded.
- Sediment deposition may occur and reduce the storage capacity over time.
- They can impact water quality as they are known to affect temperature, dissolved oxygen and nitrogen, and nutrients.

Local Implementation: In urban areas, such as DuPage County, reservoirs are an important part of floodwater management. Table 6-2 shows reservoirs that have been constructed. Significant detention has been provided in the Salt Creek watershed to address the damage that occurred from the 1987 flood.

Examination of detention opportunities is a part of watershed planning for DuPage County. Also, the DuPage County Countywide Stormwater and Flood Plain Ordinance require stormwater detention with most new developments.

Table 6-2
DuPage County Detention Projects – Constructed

Watershed	Project	Storage (Acre-Feet)	Year Completed	Maintenance
Salt Creek	Elmhurst Quarry Reservoir	8,300	1996*	DuPage County
Salt Creek	Wood Dale - Itasca Reservoir	1,775	2003*	DuPage County
Salt Creek	Meacham Grove Reservoir	600	1997*	DuPage County
Salt Creek	Lake-Villa Reservoir (Louis Reservoir)	210	1994*	Addison
	Wayne Oaks Dam	70	1995*	
East Branch DuPage River	Willoway Brook Reservoir	345	1990*	DuPage FPD
West Branch DuPage River	Upper DuPage Reservoir	230	1977	
West Branch DuPage River	Winfield Creek	110	1997*	
West Branch DuPage River	Gary/Kehoe Reservoir	140	1999*	Carol Stream
	Cricket Creek Wetland Bank	1	1996*	
	Steeple Run Drainage Improvement.	30	2000*	
Sawmill Creek	Marion Hills Dale Basin	14	2002*	
Sawmill Creek	Marion Hills Crest Road Basin	34	2004*	
	Eldridge Park Reservoir Modification	120	2002*	
	Huffman Street Flood Control Project – Phase I	13.5	2006*	
	Kress Creek Regional Flood Control facility	200	2006*	
	Total Storage:	12,192.5 ac-ft		

*Constructed since the adoption of the countywide stormwater management plan in DuPage County in 1989

Other detention projects that have been sponsored by DuPage County municipalities include:

- Lufkin Reservoirs/Jackson Detention Area in Villa Park in the Sugar Creek watershed (100-year design)
- Reservoir at Prospect and Coolidge in Wheaton (built in 1976) with pump station
- Prospect/Norfolk detention basin in Clarendon Hills (10-year design), built in 1989
- Schiller Street Basin in the Salt Creek watershed, built in 1987 in Itasca
- Meacham Creek Tributary 3 reservoir constructed in 2004 in Roselle, in the Salt Creek watershed
- Lake Manor Pond in Addison (100-year design) in the Salt Creek watershed
- Plamondon-Mulloy Pond in Addison (100-year design) in the Salt Creek watershed
- Steeple Run watershed projects in Naperville (Old Plank Park and Huffman Street)
- Carol Stream Venture subdivision

6.2 Levees and Barriers

This flood control measure is a barrier of earth (levee) or concrete (floodwall) erected between the watercourse and the property to be protected. Levees and floodwalls confine water to the stream channel by raising its banks. They must be well designed to account

for large floods, underground seepage, pumping of internal drainage, and erosion and scour.
Key considerations when evaluating use of a levee include:

- Removal of fill to compensate for the floodwater storage that will be displaced by the levee
- Internal drainage of surface flow from the area inside the levee.
- Cost of construction and maintenance
- Design limitations (while levees may reduce flood damage for smaller more frequent rain events, they may also overtop or breach in extreme flood events and subsequently create more flood damage than would have occurred without the levee).

Levees can push floodwater onto other properties upstream or downstream and need to be designed with this in mind. To reduce environmental impacts and provide multiple use benefits, a setback levee (set back from the floodway) is the best project design. The area inside a setback levee can provide open space for recreational purposes and provide access sites to the river or stream.

Floodwalls perform like levees except they are vertical-sided structures that require less surface area for construction. Floodwalls are constructed of reinforced concrete, which makes the expense of installation cost prohibitive in many circumstances. Floodwalls also degrade adjacent habitat and can displace erosive energy to unprotected areas of shoreline downstream.

Levees and floodwalls are appropriate when the cost of relocating structures out of the flood prone area exceeds that cost of the levee or floodwall construction and maintenance, and when upstream and downstream impacts can be mitigated.

Local Implementation: Constructed levees in DuPage County are shown in Table 6-3.

Table 6-3
DuPage County Levee and Barrier Projects – Constructed

Watershed	Project	Year Completed	Maintenance
Salt Creek	Addison Dam and Pump (Westwood Creek backflow prevention)	1995*	Addison
Salt Creek	Kingery West Levee (east side of Salt Creek)	1982	DuPage County
Salt Creek	Elmhurst Levee	1991	DuPage County
East Branch DuPage River	East Branch DuPage River and St. Joseph Creek in Lisle	1968	DuPage County
West Branch DuPage River	Winfield Creek in Wheaton	1977	

In 1977, a levee was constructed to protect homes in the Winfield Creek watershed in Wheaton (100-year design). A portion of the levee eroded during the 1987 flood. The levee was repaired. The Elmhurst levee was constructed in 1991 to protect homes from Salt Creek flooding (100-year design). The levee was constructed as the Elmhurst Quarry reservoir was being designed to provide storage of floodwaters. In Villa Park a berm was constructed at Rotary Park in the Salt Creek watershed (50-year design). In 2003 an earth berm was constructed in the Salt Creek watershed near the East Side Links and Tees Golf Course in Villa Park. In the 1960s, channel improvements were made and levees constructed along the East Branch of the DuPage River (from Middleton Avenue to Maple Avenue) and St. Joseph Creek (from confluence with the East Branch DuPage River to Illinois State Route 53) in Lisle. As part of the River Dumoulin Flood Control Study, the County has proposed repair of the Lisle levees.

6.3 Channel Improvements and Diversions

By improving channel's conveyance, more water is carried away at a faster rate. Three types of channel improvements are reviewed here: projects that make the channel wider, straighter or smoother; dredging the channel bottom; and diversion of high flows to another channel or body of water.

Straightening, deepening and/or widening a stream or river channel, commonly referred to as "channelization," which is commonly used for local drainage or flooding problems. Considerations for channel improvement are:

- Channelized streams can create or worsen flooding problems downstream as larger volumes of water are transported at a faster rate.
- Channelized streams rise and fall faster. During dry periods the water level in the channel is lower than it should be, which creates water quality problems and degrades habitat.
- Channelized waterways tend to be unstable and experience more streambank erosion. The need for periodic reconstruction and silt removal becomes cyclic, making channel maintenance very expensive.

However, properly designed, properly sloped and planted channel banks are more aesthetically and environmentally appealing, and can prove to be cost-effective approaches. In DuPage County, detention projects are usually considered with channel improvements.

Dredging for the purpose of floodwater management is often viewed as a form of conveyance improvement. However, it has the following limitations:

- Dredging is often cost prohibitive because the dredged material must be disposed of somewhere else (out of the floodplain).

Dredging

- Unless instream and/or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years.
- If the channel has not been disturbed for many years, dredging will destroy the habitat that has developed.
- To protect the natural values of the stream, federal law requires a Corps of Engineers permit before dredging can proceed. This can be a lengthy process that requires much advance planning and many safeguards to protect habitat.

A **diversion** is a new channel that sends floodwaters to a different location, thereby reducing flooding along an existing watercourse. Diversions can be surface channels, overflow weirs, or tunnels. During normal flows, the water stays in the old channel. During flood flows, the floodwaters spill over to the diversion channel or tunnel, which carries the excess water to a receiving lake or river. Diversions are limited by topography; they will not work in some areas. Unless the receiving water body is relatively close to the floodprone stream and the land in between is low and vacant, the cost of creating a diversion can be prohibitive.

Local Implementation: DuPage County channel improvement projects are included in Table 6-4.

Table 6-4
DuPage County Channel Improvement Projects – Constructed

Watershed	Project	Year Completed	Maintenance
Salt Creek	Salt Creek Channel Improvement	1992	Oak Brook, Elmhurst
Salt Creek	Bensenville Ditch	1998	Bensenville
East Branch DuPage River	St. Joseph Creek Channel Improvement	1990	Downers Grove
East Branch DuPage River	Willoway Brook	1990	Wheaton
West Branch DuPage River	West Branch DuPage River Channel Improvement	1992	Hanover Park
West Branch DuPage River	Long Meadow Road Channel Improvement	1981	Hanover Park

The channel enlargement on Willoway Brook in the East Branch DuPage River watershed (100-year design) constructed in 1990 in Wheaton performed well during the 1996 flood.

6.4 Crossings and Roadways

In some cases buildings may be elevated above floodwaters but access to the building is lost when floodwaters overtop local roadways, driveways, and culverts or ditches. Depending on the recurrence interval between floods, the availability of alternative

access, and the level of need for access, it may be economically justifiable to elevate some roadways and improve crossing points.

For example, if there is sufficient downstream channel capacity, a small culvert that constricts flow and causes localized backwater flooding may be replaced with a larger culvert to eliminate flooding at the waterway crossing point. The potential for worsening adjacent or downstream flooding needs to be considered before implementing any crossing or roadway drainage improvements.

Local Implementation: The bridges shown in the table below had been identified by DuPage County communities as those which impede or obstruct flow. The roadways included in the table are those that could be elevated to provide continued access during flooding.

Table 6-5
DuPage County Bridges and Roadways
That Potentially Impede Flood Flows

Community	Bridge or Roadway
Village of Itasca	Maple Street Bridge
Village of Itasca	Irving Park Road Bridge
Village of Itasca	Elm Street (private bridge to Itasca Country Club)
Village of Itasca	North Prospect Avenue
Village of Lisle	Burlington Northern railroad culvert at south end of Elm Street
Village of Roselle	Foster Avenue Bridge (Improvement proposed)
Village of Villa Park	Possibly St. Charles Road at Salt Creek
Village of Villa Park	Possibly Villa Avenue at Sugar Creek
City of Wheaton	1700 Block of North Main Street
City of Wheaton	Bridge at Marionjoy Rehabilitation Hospital
Village of Winfield	Winfield Road at Winfield Creek (aka Spring Brook)
Village of Winfield	Park Street at Winfield Creek
Village of Winfield	Church Street at Winfield Creek
Village of Winfield	Summit Drive at Winfield Creek
Village of Winfield	East Street at Winfield Creek
Village of Winfield	Manchester Road at Winfield Creek
Village of Winfield	Roosevelt & Shaffner Roads at Winfield Creek
City of Wood Dale	Irving Park Road at Salt Creek (in design)

6.5 Drainage and Storm Sewer Improvements

Manmade ditches and storm sewers help drain areas where the surface drainage system is inadequate, or where underground drainageways may be safer or more practical. Storm sewer improvements include installing new sewers, enlarging small pipes, and preventing back flows. Particularly appropriate for depressions and low spots that will not drain naturally, drainage and storm sewer improvements usually are designed to carry the runoff from smaller, more frequent storms.

Because drainage ditches and storm sewers convey water faster to other locations, improvements are only recommended for small local problems where the receiving stream or river has sufficient capacity to handle the additional volume and flow of water. To reduce the cumulative downstream flood impacts of numerous small drainage projects, additional detention or run-off reduction practices should be provided in conjunction with the drainage system improvements.

A combination of restored wetland detention, vegetated swales, infiltration trenches and other best management practices that increase infiltration (reducing runoff), and improve water quality can be implemented in conjunction with stormwater system improvements.

Local Implementation: Most all DuPage County communities include storm sewer and drainage improvements annually in their capital budgets. Many communities also had implemented projects to address areas with combined sewers.

CRS Credit: The Community Rating System credits capital improvement plans that fund drainage improvements that reduce the need for maintenance or that eliminate bottlenecks, logjams and other maintenance problems. Up to 50 points are provided.

6.6 Drainage System Maintenance

The drainage system may include detention ponds, stream channels, swales, ditches and culverts. Drainage system maintenance is an ongoing program to clean out blockages caused by an accumulation of sediment or overgrowth of weedy, non-native vegetation or debris, and remediation of streambank erosion sites.

“Debris” refers to a wide range of blockage materials that may include tree limbs and branches that accumulate naturally, or large items of trash or lawn waste accidentally or intentionally dumped into channels, drainage swales or detention basins. Maintenance of detention ponds may also require revegetation or repairs of the restrictor pipe, berm or overflow structure.

Maintenance activities normally do not alter the shape of the channel or pond, but they do affect how well the drainage system can do its job. Sometimes it is a very fine line that separates debris that should be removed from natural material that helps form habitat. Therefore, written procedures that are consistent with state laws and environmental concerns are usually needed.

Government agencies usually accept responsibility for maintaining facilities on public property. However, in Illinois, the responsibility for drainageway maintenance on private property, when no easements have been granted, is with the individual private property owner. This often results in very little maintenance being accomplished.

Local Implementation: Table 6-6 shows drainage system maintenance activity in DuPage County.

Table 6-6
DuPage County Drainage System Maintenance

Community	Regular Drainage System Maintenance	Written Procedures
Village of Addison	Yes	
Village of Bartlett	Yes	
Village of Bloomingdale	Yes	
Village of Burr Ridge	Will respond to complaints	
Village of Carol Stream	Yes	Yes
Village of Clarendon Hills	Yes	
City of Darien		
Village of Downers Grove	Yes	
City of Elmhurst	Yes	
Village of Glendale Heights	Yes	Yes
Village of Glen Ellyn	Yes, as needed	No
Village of Hanover Park	--	--
Village of Hinsdale	Yes	
Village of Itasca	Yes	
Village of Lisle	Yes	Yes
Village of Lombard	No	
City of Naperville	Yes	No
Village of Oak Brook	Yes	No
City of Oakbrook Terrace	After large rain	
Village of Roselle	Yes	
Village of Villa Park	Some	
City of Warrenville	Yes, as needed	No
City of West Chicago		
Village of Westmont	Yes	--
City of Wheaton	Yes	--
Village of Willowbrook	Yes	Yes
Village of Winfield	Will respond to complaints	
City of Wood Dale	Yes	
Village of Woodridge	Yes	Yes
DuPage County	Yes	
College of DuPage	No	

CRS Credit: Community Rating System credit is provided for a formal drainage system inspection and maintenance program with published procedures that clearly identify what can be removed and what "debris" should be allowed to stay in natural channels. Up to 250 points are possible, but communities (like the County) that do not have formal written procedures and/or only respond on an as needed basis will not receive the credit.

6.7 DuPage County Planned Structural Projects

The following two tables list the structural projects identified by the DuPage County Stormwater Division through the developed watershed plans. Table 6-7 shows budgeted projects, and Table 6-8 shows projects not yet funded.

Table 6-7
DuPage County Planned Stormwater Management Projects
With Identified Funding Source
Year 2007 - 2018

Planned Project	Estimated Cost	Estimated Completion Date
Kress Road – Union Pacific RR Culvert	$1,850,000	Completed - 2008
Kress Creek – Prairie Path, Western Drive, and Downs Dr Culvert Replacements	$800,000	Completed - 2008
Kress Creek – Airport Diversion	$650,000	Completed - 2012
Springbrook Creek Watershed Plan Implementation	$450,000	2014
Brewster Creek Flood Mitigation	$5,200,000	2013
Klein Creek/Armstrong Park Flood Control	$5,000,000	2014
River Dumoulin Levee Maintenance	$70,000	2018
Keeneyville East	$1,500,000	Cancelled
Keeneyville West	$700,000	Cancelled
Sawmill Creek – Marion Hills 75th St Basin	$1,000,000	Cancelled
Winfield Creek – Main Street Improvement	$400,000	2013
West Branch/Warrenville Flood Mitigation	$5,500,000	2015
Voluntary Buyouts	$3,000,000	On-going
Total from continued projects:	$19,620,000	

Table 6-8
DuPage County Planned Stormwater Management Projects Without Funding

Planned Project	Estimated Cost
Willow Creek Plan	$6,800,000
Ferry Creek Main Stem	$1,200,000
Ferry Creek Tollway Tributary	$800,000
Spring Brook No.1 Watershed Plan	$600,000
Ginger Creek WSP Implementation	$1,500,000
Sawmill Creek – Marion Hills Community Park Basin	$300,000
Flagg Creek 63rd & Bentley Improvements	$1,000,000
East Branch DuPage - Valley View	$2,000,000
Westwood Creek Plan	$8,000,000
Ferry Creek EJ&E/North Aurora Road Underpass	$250,000
Busse Woods Dam Modification	$1,100,000
Total:	$23,550,000

Other projects have been identified by the DuPage County municipalities. These include:

- A reservoir to alleviate flooding on Sugar Creek (Villa Park)
- North Main Street at Winfield Creek is being studied by the City of Wheaton for potential culvert and channel enlargements
- Detention and floodplain improvements in the Town Center area in Winfield
- Levee repair and restoration in Lisle; part of the River Dumoulin Flood Control Study
- Klein Creek stream bank rehabilitation, which is a tributary to the West Branch of the DuPage River.
- Stormwater detention pond shoreline stabilization efforts, with the consideration of bio-engineering techniques and native, erosion-resistant, plant material in Carol Stream and other communities.

6.8 Conclusions

1. The DuPage County Stormwater Management Program is important to DuPage County and its municipalities. Proper funding of the program is necessary.

2. Structural projects, including reservoirs, channel improvements and levees, have been effective in reducing flood damage in DuPage County, to the extent that they have been tested.

3. It is understood that structural projects can have adverse impacts on downstream properties and on the environment.

4. Structural measures should continue to be used in DuPage County to address flood problems. It is understood new flood problem areas can be identified at any time; after any flood event.

5. Structural projects can be effective in protecting critical facilities from natural hazards.

6. There are a number of locations where bridge or culvert replacement or enlargement should be investigated.

7. Local drainage and stormwater flooding (both in and outside the floodplain) could be reduced through drainage system improvements.

8. Drainage maintenance programs in communities are important throughout the County.

6.9 Recommendations

1. Structural flood control projects, including drainage and bridge and culvert improvements, should be pursued and funded, provided they meet the following criteria:

- Each project's study looks beyond the immediate project site to ensure that no other properties will be adversely impacted.
- Each project should be based on a watershed master plan or, at a minimum, coordinated with other projects in the same watershed.
- Each project's study considers protecting the natural functions of the stream and floodplain, in addition to flood protection.
- Each project's study considers alternative non-structural approaches to protect the affected properties from flood damage.
- The design and construction is certified by a licensed professional engineer.
- Opportunities for stream and natural areas restoration are incorporated wherever feasible.
- Communities and property owners that may be affected by the project are notified.
- All relevant federal, state and local permits are obtained, including Corps of Engineer's 404 permits and IDNR floodway permits.

2. The DuPage County Stormwater Management program should continue to be funded through appropriate funding mechanisms.

3. The DuPage County Stormwater Management program and municipalities should continue to identify, plan and implement structural flood control projects both before and following flood events.

4. Funding for municipal or regional structural measures in DuPage County should be sought as it is made available through FEMA hazard mitigation programs.

5. Flood problem areas in DuPage County that should be considered for structural mitigation are not limited to those identified in this Plan. Flood problems should be addressed as they are identified.

6. Each municipality and the County should implement a formal and regular drainage system maintenance program.

6.10 References

1. DuPage County Stormwater Management Program information and studies listed on page 6-2 of this chapter.

2. *Our Community and Flooding*, 1998, Resource Coordination Policy Committee.

3. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2002.

4. *CRS Credit for Drainage System Maintenance*, FEMA, 2002.

5. Survey of municipalities and County offices, 2006.

Chapter 7. Emergency Services

Emergency service measures protect lives and property. Emergency services have been traditionally framed around the cycle of emergency preparedness, warning, response, and recovery. Mitigation has been added to this cycle for the purpose of reducing the impact of natural hazards and the recovery needs. The importance of preparedness, warning and response are emphasized through mitigation.

The DuPage County Office of Homeland Security and Emergency Management (OHSEM) coordinates emergency management services in DuPage County. The County and the City of Naperville have full-time emergency managers. All other communities have part-time emergency managers. Most work full-time for their municipalities with other duties and responsibilities. The Illinois Emergency Management Agency (IEMA) coordinates the state response to emergencies. OEM coordinates the efforts of the Local Emergency Managers Coordinators (LEMC). All DuPage County communities are represented on the LEMC. LEMC members include emergency managers from the County, municipalities and fire protection districts.

DuPage County citizen corps

"Citizen Corps Councils helps drive local citizen participation by coordinating Citizen Corps programs, developing community action plans, assessing possible threats and identifying local resources."

Source: DuPage County Website

A good emergency management program addresses natural hazards, and it involves all municipal and/or county departments. This chapter reviews emergency services measures, following their chronological order of identifying an oncoming problem (threat recognition), responding to an emergency, through post-disaster activities.

7.1 Preparedness – Planning

An emergency operations plan (EOP) ensures that all response needs are addressed and that all response activities are appropriate for the expected threat.

EOPs should be reviewed annually to keep contact names and telephone numbers current and to make sure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and changing conditions. The end result is a coordinated effort implemented by people who have experience working together so that available resources will be used in the most efficient manner.

Local Implementation: The County has an adopted Emergency Operations Plan (EOP). DuPage County municipalities have adopted EOPs that were developed in cooperation with the County's EOP. DuPage County and the municipalities are in the process of updating County Plan and undergoing National Integrated Management System (NIMS)

compliance for the EOP development and training. The County and all municipalities have emergency operation centers (EOCs). Most communities have rooms that are converted into EOCs. The County and some communities have a dedicated EOC.

The OEM is responsible for the EOP for the County and for the review of EOPs developed by the municipalities. The LEMC meets quarterly to coordinate planning efforts. OEM also facilities emergency manage exercises with the municipal emergency management agencies (EMAs).

DuPage County has established a "Citizen Corps" to expand the County's capability to respond to emergencies through volunteers who have joined the Citizen Corps. The Citizen Corps program is a component of the USA Freedom Corps, and is sponsored by the federal government. A local council coordinates federal, state and local volunteer program efforts. Nationally, programs that are coordinated under the Citizen Corps council are the Community Emergency Management Teams (CERT), the Neighborhood Watch, Volunteers in Police Service (VIPs), and the Medical Reserve Corps.

Operation Helping Hand - Special Needs Registration

Operation Helping Hand is a cooperative public safety program in DuPage County. It is designed to ensure the safety of those residents of DuPage County that are most vulnerable to emergencies and disasters, the elderly and infirmed and those with various disabilities. Information provided on health and medical condition is shared with police, fire and other emergency workers to assist them in responding to a disaster or emergency.

In DuPage County, OEM has four tiers to their Citizen Corps program: awareness, formation of CERTs, development of emergency operations cadre for shelter management or community relations, and pairing of volunteers with local EMAs.

Mutual aid agreements are in place throughout the county for fire, police, emergency management, public health, and public work. These agreements (MABAS, ILEAS, IEMMAS, and PHMAS) can be utilized in any phase of an emergency or disaster.

OEM has also developed Operation Helping Hand for DuPage County (see box above), which allows the County to be aware of the location and needs of the County's special needs populations.

7.2 Preparedness - Threat Recognition

Planning, resources and personnel are all important elements of preparedness. Threat recognition is also important. The first step in responding to a flood, tornado, storm or other natural hazard is knowing when weather conditions are such that an event could occur. With a proper and timely threat recognition system, adequate warnings can be disseminated.

Floods: A flood threat recognition system predicts the time and height of the flood crest. This can be done by measuring rainfall, soil moisture, and stream flows upstream of the community and calculating the subsequent flood levels.

On rivers and streams, including Salt Creek and the DuPage River, the measuring and calculating of flood events is done by the National Weather Service (NWS) which is in the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Support of NOAA's efforts is provided by the United States Geological Service (USGS), the Illinois Department of Natural Resources (IDNR), and DuPage County.

Forecasts of expected river stages are made through the Advanced Hydrologic Prediction Service (AHPS) of the National Weather Service. Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government to be the official source for weather information.

When weather conditions are right for potential flooding, the NWS is able to issue a specific *prediction* of when and how high the major streams in DuPage County will peak. NWS can also issue more general flood statements on smaller streams throughout the County. The National Weather Service may issue a "flash flood watch." This means the amount of rain expected will cause standing water and flooding on small streams and depressional area. However, these events are can be very localized and rapid that a "flash flood warning" may not be issued.

One of the best tools for understanding flood predictions is a flood stage forecast map. Staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, etc. for a given prediction. With this information, an advance plan can be prepared that shows problem sites and determines what resources will be needed to respond to the predicted flood level.

Local Implementation: Real-time stream gage readings for sites on Salt Creek and the DuPage River can be accessed on the internet at websites shown in Table 7-1. DuPage County cooperates with the USGS and IDNR to maintain a network of rainfall and river gages are needed for flood threat recognition. Gage locations and identification are shown in Exhibit 7-1 and Table 7-2. The DuPage County web site offers a link to rainfall data and stream levels. Supervisory Control and Data Acquisition (SCADA) telemetry system information can also be accessed at the DuPage County web site for those with established user names and passwords. The IDNR web site provides links to numerous sites including the NWS, USGS and the Corps of Engineers.

Table 7-1
Flood Forecast and
Rain and Stream Gage Links

Illinois Department of Natural Resources (IDNR)

http://dnr.state.il.us/owr/surveilance.htm

DuPage County

http://ec.dupageco.org/dec/stormwater/watershed/index.html

National Weather Service (NWS)

http://www.crh.noaa.gov/crh/

United States Geological Service (USGS)

http://waterdata.usgs.gov/il/nwis/rt

Tornadoes and Thunderstorms: The National Weather Service is the prime agency for detecting meteorological threats, such as tornadoes and thunderstorms. Severe weather warnings are transmitted through the Illinois State Police's Law Enforcement Agencies Data

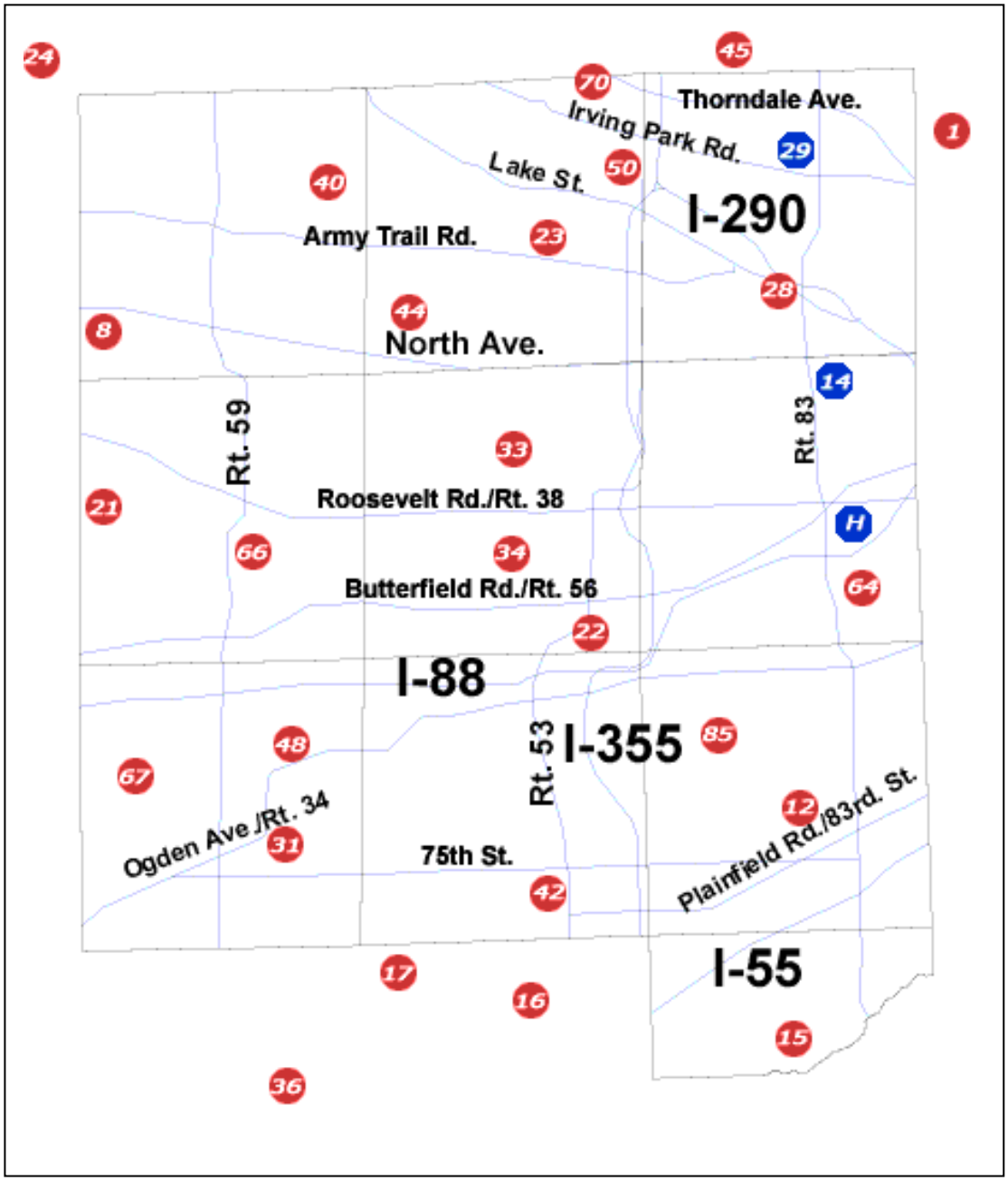


Exhibit 7-1
DuPage County Rain and Stream Gage Locations

BLUE dots with numbers are Rain gage & Stream gage locations
RED dots with numbers are Rain gages ONLY

Table 7-2
DuPage County Rain and Stream Gages

Gage	Gage Name
01	O'Hare International Airport
08	DuPage County Airport near St. Charles
12	Marionbrook WWTP
14	Elmhurst Quarry | Diversion Structure Stream Level
15	Argonne (Sawmill Creek)
16	Bolingbrook WWTP in Bolingbrook (Royce Rd.)
17	West Branch at Washington in Naperville
21	Fermi near West Chicago
22	Morton Arboretum
23	Bloomingdale lift Station in Bloomingdale
24	Elgin WWTP
28	Addison WWTP
29	Wood Dale WWTP | Irving Park Road Stream Level
31	Naperville Municipal Building
33	Countryside Drive in Wheaton 1 (North)
34	Loraine Street in Wheaton 2 (South)
36	Springbrook WWTP near Naperville (Sanitary District)
40	Bartlett WWTP (Sanitary District)
42	Woodridge WWTP (WGV)
44	Carol Stream WWTP
45	Busse Woods FP near Elk Grove Village (Dam)
48B	Naperville North Operations Center on Ogden
50	Spring Creek Reservoir (Lake Street, structure 5)
64	Oak Brook pump station
66	Blackwell FP near Warrenville (REMOVED)
67	Naperville Township Highway Garage
70	Schaumburg Public Works
85	Westmont
H	Harger Road Stream Level

System (LEADS) and through the NOAA Weather Radio System. As with floods, the NWS can only look at the large scale (whether conditions are appropriate for formation of a tornado).

For tornadoes and thunderstorms, local emergency managers can provide more site-specific and timely recognition by sending out National Weather Service trained spotters to watch the skies when the Weather Service issues a watch or warning.

Winter Storms: The National Weather Service is again the prime agency for predicting winter storms. Severe snow storms can often be forecasted days in advance of the expected event, which allows time for warning and preparation. Though more difficult, the National Weather Service can also forecast ice storms.

Other Weather Hazards: DuPage County dispatch centers receive other severe weather alerts from the LEADS system. These alerts are issued by the Illinois State Police who monitor the NOAA Weather Wire, or through their monitoring of NOAA weather radios. Police and fire stations, schools, county and municipal buildings, and some private facilities have been issued Weather Radios, or they are notified over the EAS from DuPage County emergency management.

NFIP/CRS

CRS Credit: Credit can be received for utilizing the gages listed on the previous page. The actual points are based on how much of the community's floodplain is subject to flooding by the gauged stream.

7.3 Warning

After the threat recognition system tells the County and municipalities that a flood, tornado, thunderstorm, winter storm or other hazard is coming, the next step is to notify the public and staff of other agencies and critical facilities. The earlier and the more specific the warning, the greater the number of people who can implement protection measures.

The NWS issues notices to the public using two levels of notification:

Watch: conditions are right for flooding, thunderstorms, tornadoes or winter storms.

Warning: a flood, tornado, etc. has started or has been observed.

A more specific warning may be disseminated by the community in a variety of ways. The following are the more common methods:

- Outdoor warning sirens
- Sirens on public safety vehicles

- Commercial or public radio or TV stations
- The Weather Channel
- Cable TV emergency news inserts
- Reverse 911
- Telephone trees/mass telephone notification
- NOAA Weather Radio
- Tone-activated receivers in key facilities
- Door-to-door contact
- Mobile public address systems
- E-mail notifications

REVERSE 911® INTERACTIVE COMMUNITY NOTIFICATION

REVERSE 911® is a communications solution that uses a patented combination of database and GIS mapping technologies to deliver outbound notifications.

Multiple or redundant systems are most effective - if people do not hear one warning, they may still get the message from another part of the system. Each has advantages and disadvantages:

- Radio and television provide a lot of information, but people have to know when to turn them on.
- NOAA Weather Radio can provide short messages of any impending weather hazard or emergency and advise people to turn on their radios or televisions, but not everyone has a Weather Radio.
- Outdoor warning sirens can reach many people quickly as long as they are outdoors. They do not reach people in tightly-insulated buildings or those around loud noise, such as in a factory, during a thunderstorm, or in air-conditioned homes. They do not explain what hazard is coming, but people should know to turn on a radio or television.
- Automated telephone notification services are also fast, but can be expensive and do not work when phone lines are down. Nor do they work for unlisted numbers and calling screener services, although individuals can sign up for notifications.
- Where a threat has a longer lead time, going door-to-door and manual telephone trees can be effective.

StormReady

DuPage County StormReady Designations
City of Aurora
City of Batavia
Village of Bartlett
Village of Bolingbrook
Village of Burr Ridge
Village of Carol Stream
Village of Downers Grove
City of Elmhurst
Village of Lemont
Village of Lombard
City of Naperville
Village of Westmont
City of Wood Dale
Village of Woodridge
DuPage County
College of DuPage
Benedictine University

Just as important as issuing a warning is telling people what to do. A warning program should have a public information aspect. People need to know the difference between a tornado warning (when they should seek shelter in a basement) and a flood warning (when they should stay out of basements).

StormReady: The National Weather Service established the StormReady program to help local governments improve the timeliness and effectiveness of hazardous weather-related

warnings for the public. To be officially StormReady, a community must:

- Establish a 24-hour warning point and emergency operations center (EOC)
- Have more than one way to receive severe weather warnings and forecasts and to alert the public
- Create a system that monitors weather conditions locally
- Promote the importance of public readiness through community seminars
- Develop a formal hazardous weather plan, which includes training severe weather spotters and holding emergency exercises.

Being designated as a StormReady community by the Weather Service is a good measure of a community's emergency warning program for weather hazards.

Local Implementation: DuPage County and municipal emergency services, including fire protection districts are responsible for disseminating warning information to the public and notifying response personnel during an emergency. Once a threat is perceived, the County's 911 dispatch center then transmits the warnings to all first responders, and, in conjunction with the DuPage County emergency management, the warnings are transmitted to schools, hospitals, government offices, business, and the general public through the following systems:

- The Emergency Alert Radio System (EARS) is a tone alert system designed to provide weather watch and warning information to schools, hospitals, government offices, businesses, and the general public.
- The Illinois Emergency Alert System (ILEAS) is a national warning system that utilizes broadcast radio, television stations, and local cable television systems.
- The Emergency Alert System Emergency Management Network (EM*net*) is a satellite based digital state-wide messaging system that allows users to send secure messages to all municipalities.

Communities are responsible for notification to their citizens and activation of their warning systems. Fire chiefs, police chiefs, and mayors may be authorized to activate the warning system according to their emergency plans. The hospitals, nursing homes, special needs homes in the county have weather radios to monitor weather conditions.

Since 2007, DuPage County first response agencies (Police, Fire, Public Works, Emergency Management, etc…) implemented the STARCOM21 system, allowing for interoperable communications between disciplines and jurisdictions. The DuPage County Emergency Telephone System Board (ETSB) has oversight of the Enhanced 9-1-1 systems for citizens of the County of DuPage and portions of Cook, Kane and Will counties. The ETSB meets on the first Thursday of each month.

Within the last five years, the DuPage County Office of Homeland Security and Emergency Management has also increased interoperable communications capacity throughout the County through several methods:

- Obtained and maintained a cache of deployable tactical radios, available for first responder agencies throughout the County
- Enhanced the County's Illinois Transportable Emergency Communications System (ITECS) unit
- Conduct monthly radio tests of the STARCOM and DCERN radio networks
- Serve as Subject Matter Experts for overall strategic interoperable communications planning committees:
    - Emergency Telephone Safety Board (ETSB)
    - Public Safety Answering Points (PSAP) supervisor committees
    - Police and Fire Chief Associations

CRS Credit: Community Rating System points are based on the number and types of warning media that can reach the community's floodprone population. Depending on the location, communities can receive up to 25 points for the sirens and the County's Emergency Alert Radio System and more points if there are additional measures, such as telephone trees. Being designated as a StormReady community can provide 25 more points.

7.4 Response

The protection of life and property is the foremost important task of emergency responders. Concurrent with threat recognition and issuing warnings, a community should respond with actions that can prevent or reduce damage and injuries. Typical actions and responding parties include the following:

- Activating the emergency operations center (emergency management)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Passing out sand and sandbags (public works)
- Ordering an evacuation (chief elected official)
- Holding children at school/releasing children from school (school district)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (engineering)

- Security and other protection measures (police)

Local Implementation: Municipalities are responsible for warnings in their incorporated areas, and fire protection districts for their areas of service, until all of their resources are exhausted. If the severity or extent of an emergency were to exceed any municipality's capability, the County emergency management will be able to provide additional resources and assistance. Table 7-2 shows which communities have EOPs with specific flood response procedures.

As discussed in Section 7.1, mutual aid agreements have been developed and will be utilized to the extent needed. Also, OEM will assemble CERTs to assist with small emergency initial response.

Community Emergency Response Team (CERT)

"CERT is about readiness, people helping people, rescuer safety, and doing the greatest good for the greatest number. CERT is a positive and realistic approach to emergency and disaster situations where citizens will be initially on their own and their actions can make a difference. Through training, citizens can manage utilities and put out small fires; treat the three killers by opening airways, controlling bleeding, and treating for shock; provide basic medical aid; search for and rescue victims safely; and organize themselves and spontaneous volunteers to be effective."

Source: DuPage County Website

CRS Credit: Since the County and communities maintain their own plans, it is difficult to determine CRS credit. CRS credits are added, however, to the effective use of GIS mapping in the development of response plans. Given the County's GIS capabilities, CRS credit should be available.

7.5 Critical Facilities Protection

Critical facilities are discussed in Chapter 1. Protecting critical facilities during a disaster is the responsibility of the facility owner or operator. However, if they are not prepared for an emergency, the rest of the community could be impacted. If a critical facility is damaged, workers and resources may be unnecessarily drawn away from other disaster response efforts. If such a facility is adequately prepared by the owner or operator, it will be better able to support the community's emergency response efforts.

Many critical facilities have full-time professional managers or staff who are responsible for the facility during a disaster. Some have their own emergency response plans. Illinois state law requires hospitals, nursing homes, and other public health facilities to develop such plans. Many facilities would benefit from early warning, response planning, and coordination with community response efforts.

Backup Generation

Some critical facilities such as hospitals and nursing homes are required by state statute to establish and maintain backup generators to ensure electrical power can be maintained at minimal levels. DuPage County has several critical facilities on its County Campus such as the Jail, Convalescent Center, and Emergency Operations Center. Most municipalities throughout the County have critical facilities such as Police and Departments, City/Village Halls, and several others that should invest in backup generators.

Local Implementation: Critical facilities in the County and each municipality are included in the Critical Infrastructure Location Manager (CILM), a web-based program that interfaces with the County's GIS. The Critical (Facility) Analysis Module (CAM) allows emergency event parameters to be inputted into the CILM and a regional database of all critical facilities it provided. Large scale maps and detailed information is readily available to the County and municipal staff, at any time. This *Plan* identifies all local government-owned buildings, schools, hospitals, nursing homes, and other public and private health facilities.

The County is working on the development of mapping to determine if critical facilities are located in flood prone areas. Table 7-3 shows communities that have procedures in their EOPs for critical facilities. Chapter 5 discusses the importance of protecting critical facilities from damage.

DuPage County has invested in backup generation for all county campus buildings. This system is anticipated to be fully activated in Spring of 2013. Most police and fire stations throughout the County currently have backup generators. Municipalities should continue to identify key facilities and establish backup systems as budgets allow.

CRS Credit: The Community Rating System gives the same weight to critical facility protection as it does to the rest of the community's flood response plan. CRS credit focuses on coordinating the community's efforts with the facilities' managers and helping them develop their own flood-specific emergency plans.

7.6 Recovery and Mitigation

After a disaster, communities should undertake activities to protect public health and safety, facilitate recovery, and help prepare people and property for the next disaster. Throughout the recovery phase, everyone wants to get "back to normal." The problem is, "normal" means the way they were before the disaster, exposed to repeated damage from future disasters.

Appropriate measures include the following:

Recovery actions
- Patrolling evacuated areas to prevent looting
- Providing safe drinking water
- Monitoring for diseases
- Vaccinating residents for tetanus
- Clearing streets
- Cleaning up debris and garbage
- Regulating reconstruction to ensure that it meets all code requirements

Mitigation actions
- Conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work

- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long-term mitigation activities
- Applying for post-disaster mitigation funds

Table 7-3
Community Emergency Flood Procedures and Mitigation Actions

	Flood procedures?	Critical facility procedures?	Damage inspection procedures?	Mitigation opportunities?
Village of Addison	Yes			
Village of Bartlett			Yes	Yes
Village of Bensenville				
Village of Bloomingdale			Yes	
Village of Burr Ridge		Yes	Yes	Yes
Village of Carol Stream			Yes	Yes Several Land Acquisitions
Village of Clarendon Hills			Permits	
City of Darien			Yes	
Village of Downers Grove	Yes		Yes	
City of Elmhurst	Yes	Yes	Yes	Yes
Village of Glendale Heights			Permits	
Village of Glen Ellyn			Yes	
Village of Hanover Park		w/ MWRD		
Village of Hinsdale			Permits	
Village of Itasca	Yes	Yes	Yes	
Village of Lisle	Yes	Yes	Yes	
Village of Lombard			Permits	
City of Naperville		Yes	Permits	
Village of Oak Brook	Quarry Gages		Yes	
City of Oakbrook Terrace			Annex D-4	
Village of Roselle				
Village of Villa Park			Annex	
City of Warrenville	Yes	Yes	Yes	Yes
Village of Wayne				
City of West Chicago				
Village of Westmont	Yes		Yes	Yes
City of Wheaton	Yes		Permits	
Village of Willowbrook	Yes	Yes	Yes	Yes
Village of Winfield	Yes		Permits	
City of Wood Dale	Yes	Yes	Yes	
Village of Woodridge	Yes	Yes	Inspection	
DuPage County	Appendix	CILM-CAM	CILM-AM System	
College of DuPage			Yes	

Local Implementation: Table 7-2 shows which communities currently require permits for building repairs and re-occupancy. This is to ensure that damaged structures are safe for people to re-enter and repair. The table also shows that Burr Ridge, Carol Stream, Elmhurst, Warrenville, Westmont and Willowbrook have an established system for identifying mitigation opportunities.

Special requirements apply to buildings in the floodplain and the floodway, regardless of the type of disaster or cause of damage. The National Flood Insurance Program (and the County's Stormwater Ordinance) requires that local officials enforce the substantial damage regulations. These rules require that if the cost to repair a building in the mapped floodplain equals or exceeds 50% of the building's market value, the building must be retrofitted to meet the standards of a new building in the floodplain. In most cases, this means that a substantially damaged building in the floodplain must be elevated above the base flood elevation. State law prohibits the re-building of substantially damaged buildings in the floodway. Floodway rules established by IDNR are included in the County's Stormwater Ordinance.

These requirements can be very difficult for understaffed and overworked offices after a disaster. If these activities are not carried out properly, the community can miss an opportunity to address a hazardous area, but it may be violating its obligations under the NFIP.

DuPage County Stormwater Management Division is responsible for the implementation of the floodplain regulations in the Countywide Storm Water and Floodplain Ordinance. Municipalities are responsible for floodplain regulations as a condition of their good standing in the NFIP.

7.7 Conclusions

1. Emergency management planning in the County is ongoing and generally comprehensive.
2. Numerous mutual aid agreements are in place throughout the County, including those for public works resources.
3. The DuPage County emergency operations center was build in 1959 when the population of DuPage County was substantially lower. Equipment has been upgraded since 1959 as funds and the facility's physical features have allowed.
4. The flood threat recognition system is best on Salt Creek. For other streams, the flood threat recognition system should be improved. Local officials have to augment the National Weather Service's general statements of possible flooding.
5. "Flood stage" and other threat and hazard-related terminology can be hard to understand.
6. The rain gage network in the County is generally very good.
7. The threat recognition system for severe weather hazards (tornadoes, thunderstorms, and winter storms) for the County is relatively good.

8. Warning systems exist in all parts of the County, however the adequacy of the warning systems is not fully known.
9. Mobile home parks (discussed in Chapter 5) are without warning systems.
10. Schools, hospitals, nursing homes, and government buildings have NOAA weather radios.
11. The procedures and media that the County and municipalities use to disseminate warnings are generally comprehensive.
12. Some emergency response plans do not cover critical facilities that will be affected by various types of hazards.
13. Many plans are without specific plans or guidance documents on post-disaster inspections and capitalizing on post-disaster mitigation opportunities.

7.8 Recommendations

1. Continue to update Emergency Operations Plans for the County and municipalities every two years with a NIMS compliant template.
2. Response procedures for floods and other hazards should be incorporated in all emergency operations planning and response where appropriate. For example, public works department pre-identify sandbag staging locations for residents.
3. Develop a disaster recovery strategy for the County and municipalities that includes the identification of mitigation efforts.
4. Emergency operations centers at the County and in municipalities should be evaluated for effectiveness and functionality, and modified appropriately. The County and all municipalities should have a fully operational emergency operations center and a secondary location.
5. Develop emergency transportation plans that allow for emergency coordination and evacuation (routing).
6. The LEMC should continue to work with the Mitigation Workgroup to implement mitigation strategies and projects.
7. Continue work for NIMS compliance for the County and all municipalities.
8. Conduct annual emergency response training exercises. Look for multi-jurisdiction training opportunities.
9. Provide training on NIMS and ICS for all first responders and other identified personnel for compliance.
10. Investigate adequacy and research funding opportunities for emergency warning and response equipment, including outdoor weather warning sirens, generators for critical facilities, and other warning systems.

11. Research funding for additional rainfall and river gages. Also the County and community should look to expand the National Weather Service observer's network.
12. All parcels in the floodplain should be identified using the County's GIS mapping for planning, warning and response purposes.
13. All identified critical facilities in the County should be mapped using the County's GIS mapping for planning, warning and response purposes. The County should continue their efforts to determine critical facilities located in flood prone areas.
14. Continue use and funding of the County's Reverse-911 system and utilize other applications of that system for natural hazard warning and response.
15. Develop flood stage maps for the County's major streams to make use of gaging networks, warning systems and GIS mapping capabilities.
16. All communities should strive to obtain a StormReady designation.

7.9 References

1. *CRS Coordinator's Manual*, Community Rating System, FEMA, 2002.

2. *CRS Credit for Flood Warning Programs*, FEMA, 1999.

3. *Flood Fighting*, Illinois Department of Transportation, Division of Water Resources, 1985.

4. *Guidelines on Community Local Flood Warning and Response Systems*, Federal Interagency Advisory Workgroup on Water Data, 1985.

5. Information on StormReady communities can be found on the National Weather Service website, www.nws.noaa.gov/stormready/.

6. DuPage County website.

7. IDNR, NWS, and USGS websites.

8. Survey of DuPage County and municipalities, 2006.

9. Illinois Emergency Management Agency

10. FEMA

11. Citizen Corps web site: www.citizencorps.gov.

12. Reverse 911 web site www.reverse911.com.

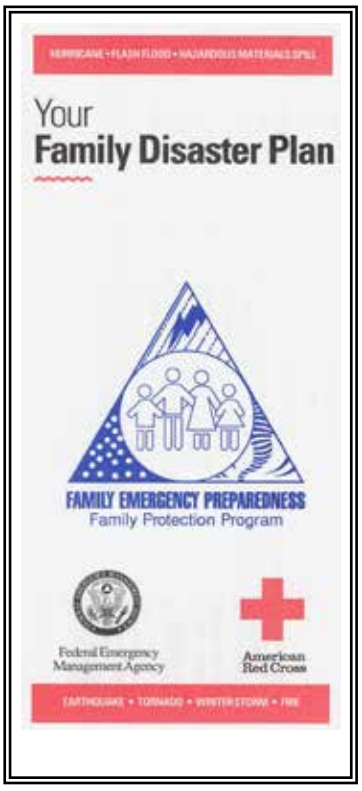
Chapter 8. Public Information

Hazard mitigation public information activities advise property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards. These activities can motivate people to take the steps necessary to protect themselves and others. A successful hazard mitigation program involves a public information strategy and involves both the public and private sectors.

8.1 Outreach Projects

Outreach projects are the first step in the process of orienting property owners to property protection and assisting them in taking appropriate steps or designing and implementing a project. They are designed to encourage people to seek out more information in order to take steps to protect themselves and their properties. Sending notices to property owners can help introduce the idea of property protection and identify sources of assistance.

Numerous government agencies and non-profit organizations publish public information and guidance regarding hazards and hazard mitigation for outreach purposes. Providing technical assistance and library resources are other forms of outreach. The challenge is to have these efforts effectively reach their intended audience.



Community newsletters/direct mailings: One of the most effective types of outreach projects are mailed or distributed to everyone in the community or, in the case of floods, to floodplain property owners.

Research has proven that outreach projects work. However, awareness of the hazard is not enough; people need to be told what they can do about the hazard, so projects should include information on safety, health and property protection measures. Research has also shown that a properly run local information program is more effective than national advertising or publicity campaigns. Therefore, outreach projects should be locally designed and tailored to meet local conditions.

News media: Local newspapers can be strong allies in efforts to inform the public. Press releases and story ideas may be all that's needed to whet their interest. After a tornado in another community, people and the media become interested in their tornado hazard and how to protect themselves and their property. Local radio stations and cable TV channels can also help. These media offer interview formats and cable may be willing to broadcast videos on the hazards.

Other approaches: Examples of other outreach project approaches include:

- School programs,
- Presentations at meetings of neighborhood, civic or business groups,
- Displays in public buildings or shopping malls,
- Signs in parks, along trails and on waterfronts that explain the natural features (such as the river) and their relation to hazards (such as floods),
- Brochures available in municipal buildings and libraries, and
- Special meetings such as floodproofing open houses.

Local implementation: Table 8-1 provides a list of DuPage County community newsletters. The table also shows if a community provides technical assistance for flood issues, which will be discussed in the next section.

National publications: The American Red Cross has a variety of brochures and publications on safety measures to take for fires, floods, winter storms, heat, etc. Their publications are tailored for different age groups. The Red Cross also conducts specialized programs on topics such as "home alone safety," first aid and CPR, and what to do during a disaster. American Red Cross publications can be obtained at www.redcross.org/pubs or www.chicagoredcross.org

FEMA and IEMA provide a wealth of publications that can be obtained via their websites: www.fema.gov/help/publications.shtm, and www.state.il.us/iema/.

DuPage County publications and outreach: The DuPage County Office of Homeland Security working with the DuPage County Health Department has developed outreach materials for all ages, which can be requested or viewed through the County's web site: www.dupageco.org .

OEM also has outreach projects on the internet, including the "Protect DuPage" program (www.dupageco.org/oem/protectdupage). Also, Citizen Corps efforts in DuPage County can be accessed at www.citizencorpsdupage.org

Table 8-1 DuPage Community Newsletters

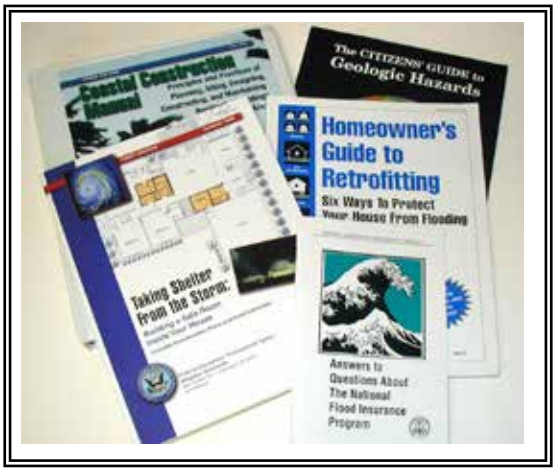
Community	Newsletter	Hazards in newsletter or other?	Assistance for reading flood maps?	Property visits?
Village of Addison	*Spotlight on Addison*	Yes	Yes	Upon request
Village of Bartlett	*Barletter*	Yes	Yes	Yes
Village of Bensenville				
Village of Bloomingdale	(Bi-monthly)	Yes	Yes	Upon request
Village of Burr Ridge	(Yes)	Yes	Yes	Yes
Village of Carol Stream	*Correspondent*	Yes	Yes	Upon request
Village of Clarendon Hills	*Trustee Topics*	Yes	Yes	Upon request
City of Darien				
Village of Downers Grove	*Hometown Times*	Yes	Yes	Yes
City of Elmhurst	*The Front Porch*	Yes	Yes	Yes
Village of Glendale Heights	*Glendale Heights News*	Yes	Yes	Yes
Village of Hanover Park	*HiLighter*	Yes		
Village of Hinsdale	(Yes)			
Village of Itasca	*The Village News*	Yes	Yes	Yes
Village of Lisle	*Village of Lisle Newsletter*	Yes	Yes	
Village of Lombard	*The Pride*	Yes	Yes	Yes
City of Naperville	*Bridges*	Yes	Yes	Upon request
Village of Oak Brook	*The Village of Oak Brook Newsletter*	Yes	Yes	Upon request
City of Oakbrook Terrace	*The Terrace Leaves*	Yes	Yes	Upon request
Village of Roselle	*Roselle Reporter*		Yes	
Village of Villa Park	*Our Village Matters*	Yes	Yes	
City of Warrenville	*Home Town Happenings*	Yes	Yes	Yes
Village of Wayne				
City of West Chicago	*Window to West Chicago*			Yes
Village of Westmont		Yes	Yes	Yes
City of Wheaton	*The City of Wheaton Newsletter*		Yes	Yes
Village of Willowbrook	*Community Connection*	Yes	Yes	Yes
Village of Winfield	*Winfield Focus*			
City of Wood Dale	*Wood Dale Community Newsletter*	Yes	Yes	Yes
Village of Woodridge	*Focus On Woodridge*	Yes		Upon request
DuPage County	(Townships)	--	Yes	Upon request
College of DuPage				

The DuPage County Stormwater Management Division has also worked with the School and Community Assistance for Recycling and Composting Education (SCARCE) in Wheaton on physical models of watershed runoff and groundwater flow that are brought into schools to education children.

CRS credit: The Community Rating System provides up to 290 points for outreach projects on flood topics. 100 of those points are for having a public information program strategy. This *Plan* qualifies for the strategy credit (see Section 8.6).

8.2 Library and Web Sites

The community library and local web sites are obvious places for residents to seek information on hazards, hazard protection, and protecting natural resources. Books and pamphlets on hazard mitigation can be given to libraries, many of them obtained free from state and federal agencies. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.



Today, web sites are becoming more popular as research tools. They provide quick access to a wealth of public and private sites and sources of information. Through links to other web sites, there is almost no limit to the amount of up-to-date information that can be accessed by the user.

In addition to on-line floodplain maps, websites can link to information for homeowners on how to retrofit for tornadoes, earthquakes and floods and a "FEMA for Kids" site. This website teaches children how to protect their home and what to have in a family disaster kit.

Local implementation: Table 8-2 indicated whether the community library provides information on hazards and hazard mitigation. The table also shows if website links to hazard information and hazard mitigation are provided. Website links vary from links to the community library to FEMA, State or County websites. Table 8-2 provides a list of DuPage County community websites.

Table 8-2 DuPage Community Library Information and Web Sites

Community	Hazard and Mitigation Resources in Library	Website Links to Hazard and Mitigation Information	Website
Village of Addison	Yes	Link to library	addisonadvantage.org
Village of Bartlett	Yes	Yes	vbartlett.org
Village of Bensenville			bensenville.il.us
Village of Bloomingdale			bloomingdale.il.us
Village of Burr Ridge	N/A	Yes	burr-ridge.gov
Village of Carol Stream	Yes	Yes	carolstream.org
Village of Clarendon Hills	Yes	Yes	clarendon-hills.il.us
City of Darien			darien.il.us
Village of Downers Grove	Yes	Yes	downers.us
City of Elmhurst	Yes		elmhurst.org
Village of Glendale Heights	Yes	Yes	glendaleheights.org
Village of Hanover Park		Yes	hanoverparkillinois.org
Village of Hinsdale	Yes		villageofhinsdale.org
Village of Itasca	Yes	Yes	itasca.com
Village of Lisle	Yes	Yes	villageoflisle.org
Village of Lombard	Yes	Yes	villageoflombard.org
City of Naperville	Yes		naperville.il.us
Village of Oak Brook	Yes	Yes	oak-brook.org
City of Oakbrook Terrace	N/A	Yes	oakbrookterrace.net
Village of Roselle	Yes	Yes	roselle.il.us
Village of Villa Park			invillapark.com
City of Warrenville	Yes	Yes	warrenville.il.us
City of West Chicago			westchicago.org
Village of Westmont	Yes	Yes	westmont.il.gov
City of Wheaton	Yes	Yes	wheaton.il.us
Village of Willowbrook	Yes	Yes	willowbrookil.org
Village of Winfield	Yes	Yes	villageofwinfield.com
City of Wood Dale	N/A	Yes	wooddale.com
Village of Woodridge	Yes	Yes	woodridge.il.us
DuPage County	--	Yes	dupageco.org
College of DuPage			cod.edu

CRS credit: The Community Rating System provides up to 30 points for having a variety of flood references in the local public library and up to 36 more for similar material on municipal web sites.

8.3 Technical Assistance

Hazard information: Many benefits stem from providing map information to inquirers. Residents and business owners that are aware of the potential hazards can take steps to avoid problems and/or reduce their exposure to flooding. Real estate agents and house hunters can find out if a property is floodprone and whether flood insurance may be required.

Communities can easily provide map information from FEMA's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Studies. They may also assist residents in submitting requests for map amendments and revisions when they are needed to show that a building is outside the mapped floodplain.

Communities often supplement what is shown on the FIRM with maps that complement and clarify the FIRM and information on additional hazards, flooding outside mapped areas and zoning. When the map information is provided, community staff can explain insurance, property protection measures and mitigation options that are available to property owners. They should also remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get wet.

Property protection assistance: While general information provided by outreach projects or the library helps, most property owners do not feel ready to retrofit their buildings without more specific guidance. Local building department staffs are experts in construction. They can provide free advice, not necessarily to design a protection measure, but to steer the owner onto the right track.

Building or public works department staff can provide the following types of assistance:

- Visit properties and offer protection suggestions
- Recommend or identify qualified or licensed contractors
- Inspect homes for anchoring of roofing and the home to the foundation
- Provide advice on protecting windows and garage doors from high winds
- Explain when building permits are needed for home improvements

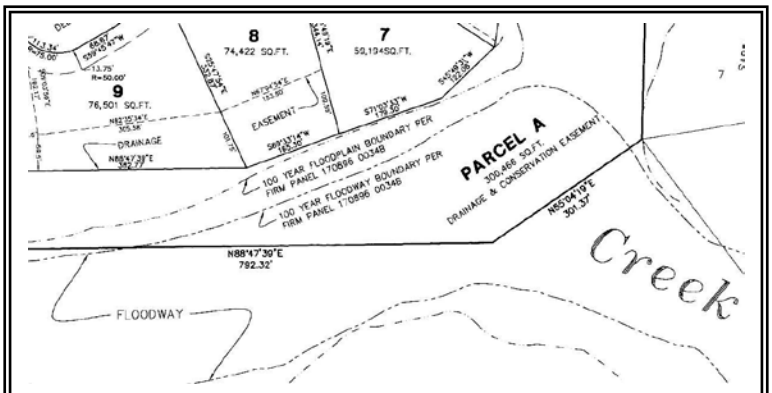
Local implementation: Table 8-1 shows communities that provide link to technical assistance for floodplain management issues or addressing wind or snow hazards.

CRS credit: The Community Rating System provides 140 points for providing map information to inquirers. The community must keep the maps up to date. Up to 71 points are available for providing one-on-one flood protection assistance to residents and businesses and making site visits. Both services must be publicized.

8.4 Real Estate Disclosure

Many times after a flood or other natural disaster, people say they would have taken steps to protect themselves if only they had known they had purchased a property

exposed to a hazard. Three regulations, one federal and two state, require that a potential buyer of a parcel be told of their exposure to a hazard.



Subdivision plat with flood hazard disclosure

Federal law: Federally regulated lending institutions must advise applicants for a mortgage, or other loan that is to be secured by an insurable building, that the property is in a floodplain as shown on the Flood Insurance Rate Map.

Flood insurance is required for buildings located within the base floodplain if the mortgage or loan is federally insured. However, because this requirement has to be met only 10 days before closing, often the applicant is already committed to purchasing the property when he or she first learns of the flood hazard.

Illinois Residential Real Property Disclosure Act: This law requires a seller to tell a potential buyer:

- If the seller is aware of any flooding or basement leakage problem
- If the property is located in a floodplain or if the seller has flood insurance
- If the seller is aware of a radon problem
- If the seller is aware of any mine subsidence or earth stability defects on the premises
- If the seller is aware of any structural defects

This State law is not wholly reliable because the seller must be aware of a problem and willing to state it on the disclosure form. Due to the sporadic occurrence of flood events, a property owner may legitimately not be aware of potential flooding problems with a property being sold or purchased. Practices by local real estate boards can overcome the deficiencies of these laws and advise newcomers about the hazard earlier. They may also encourage disclosure of past flooding or sewer problems, regardless of whether the property is in a mapped floodplain.

The shortcoming of this approach is that it is dependent on the seller, not on an independent check of the flood map. Multiple Listing Service (MLS) entries read “Flood insurance may be required.” This does not provide any help in disclosing the flood hazard.

Illinois Compiled Statutes: Chapter 55, Section 5/3-5029 requires that all subdivision plats must show whether any part of the subdivision is located in the 100-year floodplain (see example).

CRS credit: Communities would receive 10 points for the two state laws. Up to 46 more points are available if real estate agents implemented a program that checked the FIRMs before a property was listed and provided the flood hazard information to house hunters. Ten points would be provided if local real estate agents gave out brochures that advised people to check out a property's hazards before they commit to a purchase.

8.5 Public Information Program Strategy

The development of a public information program strategy is an approach to improve the effectiveness of the community's public information efforts. A public information program strategy involves the review of local conditions, local public information needs, and a recommended action plan of activities. A strategy should consist of the following parts, which are incorporated into this plan.

- The local hazards – discussed in Chapter 2 of the *Plan*.
- The property protection measures appropriate for a specific hazard – discussed in Chapters 2 and 5.
- Hazard safety measures appropriate for the local situation. An example for an earthquake hazard is shown on page 8-12.
- Flood safety measures appropriate for the local situation – discussed in the box on page 8-12.
- The public information activities currently being implemented within the communities, including those by non-government agencies – discussed in sections 8.1 through 8.4.
- Goals for the community public information programs are covered in Chapter 3.
- The outreach projects that will be done each year to reach the goals are section 8-7's recommendations and Chapter 9's Action Plan.
- The process that will be followed to monitor and evaluate the projects is in Chapter 9's Action Plan.

Much of the above items are taken from FEMA's Community Rating System for the National Flood Insurance Program, but the strategy is useful and applicable for any hazard or mitigation outreach effort.

Public information topics: The Mitigation Workgroup worked through a list of potential public information topics and selected ten topics to focus initial efforts on. These selected topics are shown in Section 8.7 – Recommendations.

Ways to disseminate public information: The Workgroup also evaluated ways or methods of distributing the public information messages and materials. The top ten approaches are also presented in Section 8.7 – Recommendations.

CRS credit: The Community Rating System provides 100 points for a public information program strategy. Although not discussed before the exercises, the CRS provides the most credit for direct mailings to floodplain residents. Credit also favors newsletters, website and libraries. Fewer points are given for other media, such as presentations at meetings and booths at shopping malls because they reach fewer people.

8.6 Conclusions

1. There are many ways that public information programs can be used so that people and businesses will be more aware of the hazards they face and how they can protect themselves. Many of them are currently being implemented by the County, municipalities, FEMA, and American Red Cross.
2. Community outreach projects, libraries and websites can reach a lot of people, but only a moderate amount of information is provided on natural hazards.
3. Mitigation efforts are being made by communities, but little information is provided to property owners to describe their current activities.
4. The Workgroup assessed a variety of topics and determined that for DuPage County the most important topics to cover in public information activities are:
   a. Safety and protection measures
   b. Protecting your property
   c. Understanding floods
   d. Protecting our watersheds
5. The most appropriate ways to get the messages out are:
   a. Community newsletters
   b. Mailings to residents
   c. Websites and links to other sources
   d. Newspaper articles
   e. Cable television access
6. All communities in DuPage County implement public information activities. By making a few changes and formalizing its activities, a community can earn nearly 500 points under the Community Rating System.

8.7 Recommendations

1. The following topics should be covered in public information activities.
   a. Safety
      - During thunderstorms and lightning
      - During winter storms
      - Tornado safety precautions
      - Emergency protection measures
   b. Protecting your property
      - Sewer backup protection measures
      - Yard drainage issues
      - Sources of assistance
   c. Understanding floods
      - Why there are floods

- Why we regulate the floodplain
- Flood insurance

d. Protecting our watersheds

- Benefits of open space
- Protecting wetlands
- Protecting water quality
- Stream and wetland dumping issues

2. Each County office and municipality should review their current public information activities and incorporate the messages in them, where appropriate.
3. Publications developed by other agencies should be reviewed, consolidated, and tailored for distribution to DuPage County property owners. A set of countywide publications should be developed that can be used by communities as is, but developed in a format that allows communities to customize the materials.
4. Sample articles, with illustrations, on these topics should be prepared and distributed to all interested parties, such as public information offices, webmasters, permit offices, reception desks, and neighborhood organizations.
5. The community newsletters, mailings, websites, newspapers, and cable television access should be used to convey these messages. They are listed in priority order as recommended by the Mitigation Workgroup.
6. The County should provide an order form for local libraries to order free state and federal hazard mitigation publications.
7. Community websites should include information and links to other sites to cover as many topics as possible. It should also include a system for users to determine the flood hazard for their properties.
8. Communities in the National Flood Insurance Program should provide floodplain information for property owners.

8.8 References

1. Community surveys, 2006.
2. *Are You Ready? A Guide to Citizen Preparedness*, FEMA 2002.
3. CRS Credit for Outreach Projects, FEMA, 2002.
4. *CRS Coordinator's Manual*, FEMA 2002.
5. Floodproof Retrofitting: Homeowner Self-Protection Behavior, Shirley Bradway Laska, University of Colorado, 1991.
6. Municipal web sites.
7. Protecting Nature in Your Community, Chicago Wilderness and the Northeastern Illinois Planning Commission, 2000.

8. Stormwater Management Public Information Resource Guide, South Suburban Mayors and Managers Association, 1999.

9. Illinois Emergency Management Agency web site.

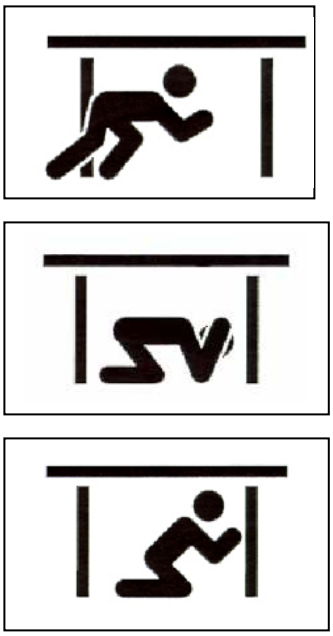
Duck, Cover and Hold

Whether you are in your home, a school classroom, a high-rise or other type of building, it is important to know how to protect yourself during an earthquake. Practice what to do during an earthquake with your family members so you can react automatically when the shaking starts. If you are outdoors when the shaking starts, get into an open area away from trees, buildings, walls and power lines. If you are indoors follow these steps.

Duck
Duck or drop down to the floor.

Cover
Take cover under a sturdy desk, table or other furniture. If that is not possible, seek cover against an interior wall and protect your head and neck with your arms. Avoid danger spots near windows, hanging objects, mirrors or tall furniture.

Hold
If you take cover under a sturdy piece of furniture, hold on to it and be prepared to move with it. HOLD the position until the ground stops shaking and it is safe to move.



Flood Safety

- Do not walk through flowing water. Drowning is the number one cause of flood deaths. Currents can be deceptive; six inches of moving water can knock you off your feet. Use a pole or stick to ensure that the ground is still there before you go through an area where the water is not flowing.
- Do not drive through a flooded area. More people drown in their cars than anywhere else. Don't drive around road barriers; the road or bridge may be washed out.
- Stay away from power lines and electrical wires. The number two flood killer after drowning is electrocution. Electrical current can travel through water. Report downed power lines to the Police or Sheriff by calling 911.
- Look out for animals that have been flooded out of their homes and who may seek shelter in yours. Use a pole or stick to poke and turn things over and scare away small animals.
- Look before you step. After a flood, the ground and floors are covered with debris including broken bottles and nails. Floors and stairs that have been covered with mud can be very slippery.
- Be alert for gas leaks. Use a flashlight to inspect for damage. Don't smoke or use candles, lanterns, or open flames unless you know the gas has been turned off and the area has been ventilated.
- Carbon monoxide exhaust kills. Use a generator or other gasoline-powered machine outdoors. The same goes for camping stoves. Charcoal fumes are especially deadly -- cook with charcoal outdoors.
- Clean everything that got wet. Flood waters have picked up sewage and chemicals from roads, farms, factories, and storage buildings. Spoiled food, flooded cosmetics, and medicine can be health hazards. When in doubt, throw them out.
- Take good care of yourself. Recovering from a flood is a big job. It is tough on both the body and the spirit and the effects a disaster has on you and your family may last a long time.

Chapter 9 – Action Plan

9.1 Action Plan Overview

The findings, conclusions and recommendations presented in Chapters 1 through 8 of the *DuPage County Natural Hazards Mitigation Plan* have been aggregated into this Action Plan. The Action Plan presented in this chapter establishes the overall direction of the DuPage County natural hazards mitigation program. Specific mitigation activities pursuant to the general direction are detailed in Section 9.2. A table summarizing all of the action items is provided in Section 9.3. Section 9.4 addresses plan maintenance. This action plan has been reviewed and updated by the Natural Hazard Mitigation Workgroup in 2012.

Recommendations for this *DuPage County Natural Hazards Mitigation Plan* appear at the end of Chapters 4 – 8 for each of the five mitigation strategies (preventive, property protections, structural measures, emergency services, and public information). This chapter converts those recommendations to specific action items. Action items have been developed for recommendations that are both a priority and feasible in the next few years. Feasibility has to do with current County and municipal resources and the likelihood of grant funding from state and federal agencies. Recommendations not included in the Action Plan are no less important. Some recommendations act as "building blocks" to other recommendations. Some recommendations may not be fundable until mitigation funds are made available following a disaster declaration.

Goals and guidelines for this *DuPage County Natural Hazards Mitigation Plan* from Chapter 3 are provided on the following page. In development of the Action Plan the Mitigation Workgroup worked to ensure that action items lend themselves to the fostering of the goals and guidelines.

The action items in Section 9.2 assign recommended projects and deadlines to the appropriate agencies. Each action item contains a short description and a section for the responsible agency, the deadline for accomplishing the action item, the costs, and the benefits. The discussions in earlier chapters provide more background and direction on these action items. The action items are summarized in Table 9-1 (page 9-13). The relationship between the goals and guidelines are shown in Table 9-2 (page 9-14).

Action items are grouped into administrative items, program activities, and public information items.

The overall direction of this *Plan* can be summarized under the six goals established in Chapter 3:

Goal 1. Protect the lives, health, and safety of the citizens of DuPage County from the impact and effects of natural hazards.

Goal 2. Protect public services and critical facilities from loss of use during, and potential damage from, natural hazards events.

Goal 3. Protect utilities and streets from the impact of natural hazards.

Goal 4. Mitigate potential damage to buildings and structures.

Goal 5. Ensure that new developments do not create new exposures to damage from natural hazards.

Goal 6. Protect historic, cultural, and natural resources from the effects of natural hazards.

The eight guidelines from Chapter 3 set the direction or the strategy for the mitigation activities developed or recommended in Chapters 4 through 8. The guidelines also set the direction for the action items in this Chapter.

Guideline 1. Focus natural hazards mitigation efforts on floods, summer storms, winter storms, tornadoes, extreme heat, and power outages.

Guideline 2. Mitigation initiatives should focus on protecting citizens and public property.

Guideline 3. Make people aware of the hazards they face and encourage people to take steps to protect themselves and their property.

Guideline 4. Use available local funds, when necessary, in efforts that protect the lives, health, and safety of people from natural hazards.

Guideline 5. Use available local funds, when necessary, to protect the public services and critical facilities from natural hazards.

Guideline 6. Create and foster public-private partnerships to accomplish mitigation activities.

Guideline 7. Strive to develop cost-effective mitigation projects and seek state, and federal support for mitigation efforts.

Guideline 8. Strive to improve and expand business, infrastructure, education and housing opportunities in DuPage County in conjunction with planned mitigation efforts.

9.1.1 DuPage Watershed Plans

There are several watersheds that affect DuPage County jurisdictions. Action Items specific to each municipality are located in these watershed plans.

Watershed Plan	Year Developed	DuPage Communities listed in the Watershed Plan	Preferred Action Item(s) Location in Plan
Upper Salt Creek Watershed: Volume 1 (Cook County Plan)	November 2009	· Itasca	pages 2-1 to 2-3
		· Wood Dale	
Klein Creek Watershed	September 2010	· Carol Stream	page 5-1
		· Bloomingdale	
		· Glendale Heights	
		· Winfield	
		· Unincorporated DuPage County	
West Branch DuPage Watershed	February 2006	· Bartlett	pages 19-22
		· Hanover Park	
		· Carol Stream	
		· Wheaton	
		· West Chicago	
		· Warrenville	
		· Naperville	
		· Schaumburg	
		· Unincorporated DuPage County	
West Branch DuPage Watershed (Addendum)	December 2010	· Naperville	pages 3-5
		· Warrenville	
		· West Chicago	
		· Unincorporated DuPage County	
Kress Creek Watershed	January 2005	· West Chicago	pages 5-1 & 5-2
		· Unincorporated DuPage County	
Steeple Run Watershed	September 1997	· Naperville	pages 32-33
		· Unincorporated DuPage County	
East Branch DuPage River Watershed	May 1996	· Glen Ellyn	page 25
		· Glendale Heights	
		· Unincorporated DuPage County	
Willoway Brook Watershed	November 1985	· Glen Ellyn	page 5
		· Lisle	
		· Wheaton	
		· Unincorporated DuPage County	

Spring Brook Tributary to Salt Creek Watershed (addendum)	May 2011	· Itasca · Bloomingdale · Addison · Roselle · Elk Grove Village · Schaumburg · Unincorporated DuPage County	pages ES-7 & 8, 2-1 to 2-5
Brewster Creek Headwaters Watershed	December 2009	· Bartlett · Wayne · Unincorporated DuPage County	pages 5-1 & 5-2
Upper Des Plaines River Watershed	September 2004	· Bensenville · Wood Dale · Elk Grove Village · Unincorporated DuPage County	pages 2-1 to 2-3
Flagg Creek Watershed	June 1997	· Burr Ridge · Clarendon Hills · Hinsdale · Willowbrook · Unincorporated DuPage County	pages ES-2 & ES-3
Addison Creek Watershed	May 2002	· Bensenville · Unincorporated DuPage County	pages 3-4
Willow Creek Watershed	March 1991	· Bensenville · Unincorporated DuPage County	pages 3-5, Appendix 1
Lower Salt Creek Watershed	2006	· Addison · Wood Dale · Itasca · Elmhurst · Villa Park · Oakbrook Terrace · Oak Brook · Hinsdale	page 38
Ginger Creek Watershed	June 1991	· Oak Brook	page 4-14
West Branch Tributary No. 4	February 1993	· Carol Stream · Unincorporated DuPage County	page 57
Black Partridge Creek Watershed	March 1994	· Woodridge · Unincorporated DuPage County	page 68
Winfield Creek Watershed	April 1994	· Winfield · Carol Stream	page ES6

		· Glendale Heights	
		· Wheaton	
		· Glen Ellyn	
		· Unincorporated DuPage County	
Westwood Creek Watershed	1994	· Lombard	page 9-1
		· Addison	
		· Unincorporated DuPage County	
Sawmill Creek Watershed Addendum	December 1998	· Burr Ridge	page 22
		· Westmont	
		· Darien	
		· Downers Grove	
		· Woodridge	
		· Willowbrook	
		· Unincorporated DuPage County	
East Branch Tributary No. 2 Watershed	May 1996	· Glen Ellyn	page 46
		· Glendale Heights	
		· Unincorporated DuPage County	
Ferry Creek Watershed	February 1999	· Naperville	Section 8
		· Warrenville	
		· Aurora	
		· Unincorporated DuPage County	
West Branch Tributary No. 1 Watershed	2002	· Bloomingdale	Section 8
		· Hanover Park	
		· Roselle	
		· Unincorporated DuPage County	
River-Dumoulin (East Branch) Flood Control Plan	April 2004	· Lisle	page 27
Route 53 North (East Branch) Flood Control Plan	2004	· Glen Ellyn	page 29
Valley View Flood Control Plan	November 1996	· Unincorporated DuPage County	page ES-18

A complete list of all watershed plans can be found on the DuPage County Stormwater Management website: http://www.dupageco.org/EDP/Stormwater_Management/6597/

The preferred actions identified in the DuPage Watershed Plans are part of the flood mitigation strategies for both the county and the municipalities and these strategies are made part of the hazard mitigation plan by reference.

9.1.2 Action Items by Jurisdiction

Each jurisdiction has self-identified the action items their jurisdiction may pursue over the next five years. The results were obtained through a survey collected between October and December of 2012.

The online survey asked if each jurisdiction is "currently participating or may potentially participate in some or all of the specific action items". Each action item has been selected based the jurisdictions individual demographics, geography, risk, vulnerability, existing assets, and current mitigation strategies.

Action items selected below may or may not be implemented by the jurisdiction based on funding, staffing, equipment, subject matter expertise, available grant funding, and other previsions. *(see table 9.3 for details)*

DuPage County

- Action Item 1: *Plan* Adoption
- Action Item 2: Continuation of Mitigation Workgroup
- Action Item 3: Plan Monitoring and Maintenance
- Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
- Action Item 5: Urban Forestry - Participation in Tree City USA
- Action Item 6: Community Rating System Participation
- Action Item 9: Property Protection Projects
- Action Item 10: Continued Watershed Management
- Action Item 11: Structural Flood Control Projects
- Action Item 12: Stream Maintenance Programs
- Action Item 13: Participation in StormReady
- Action Item 14: Identification of Floodplain Structures
- Action Item 15: Review of Critical Facilities
- Action Item 16: Development of Flood Stage Maps
- Action Item 17: Seek Mitigation Grant Funding for Additional Mitigation Planning Cost Beneficial Projects
- Action Item 18: Development of a Public Information Strategy
- Action Item 19: Property Protection References
- Action Item 20: Backup Generation for Critical Facilities
- Action Item 21: Construction of Safe Rooms
- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Addison

- Action Item 1: *Plan* Adoption
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- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Bartlett

- Action Item 1: *Plan* Adoption
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Bensenville

- Action Item 1: *Plan* Adoption
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- Action Item 3: Plan Monitoring and Maintenance

- Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
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Bloomingdale

- Action Item 1: Plan Adoption
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Burr Ridge

- Action Item 1: Plan Adoption
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- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Carol Stream

- Action Item 1: *Plan* Adoption
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- Action Item 9: Property Protection Projects
- Action Item 10: Continued Watershed Management
- Action Item 11: Structural Flood Control Projects
- Action Item 12: Stream Maintenance Programs
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- Action Item 19: Property Protection References
- Action Item 20: Backup Generation for Critical Facilities
- Action Item 21: Construction of Safe Rooms
- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Clarendon Hills

- Action Item 1: *Plan* Adoption
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- Action Item 19: Property Protection References
- Action Item 20: Backup Generation for Critical Facilities
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- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Darien

- Action Item 1: Plan Adoption
- Action Item 2: Continuation of Mitigation Workgroup
- Action Item 3: Plan Monitoring and Maintenance
- Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
- Action Item 5: Urban Forestry - Participation in Tree City USA
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- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Downers Grove

- Action Item 1: Plan Adoption
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Elmhurst

- Action Item 1: Plan Adoption
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- Action Item 20: Backup Generation for Critical Facilities
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Glen Ellyn

- Action Item 1: Plan Adoption
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- Action Item 3: Plan Monitoring and Maintenance
- Action Item 5: Urban Forestry - Participation in Tree City USA
- Action Item 6: Community Rating System Participation
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Glendale Heights

- Action Item 1: *Plan* Adoption
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Hanover Park

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Hinsdale

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Itasca

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Lisle

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Lombard

- Action Item 1: *Plan* Adoption
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- Action Item 3: Plan Monitoring and Maintenance
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Naperville

- Action Item 1: Plan Adoption
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Oakbrook

- Action Item 1: Plan Adoption
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Oak Brook Terrace

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Roselle

- Action Item 1: Plan Adoption
- Action Item 5: Urban Forestry - Participation in Tree City USA
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- Action Item 9: Property Protection Projects
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Villa Park

- Action Item 1: Plan Adoption
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Warrenville

- Action Item 1: Plan Adoption
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Wayne

- Action Item 1: *Plan* Adoption
- Action Item 2: Continuation of Mitigation Workgroup
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West Chicago

- Action Item 1: Plan Adoption
- Action Item 2: Continuation of Mitigation Workgroup
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- Action Item 6: Community Rating System Participation
- Action Item 9: Property Protection Projects
- Action Item 10: Continued Watershed Management
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Westmont

- Action Item 1: Plan Adoption
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- Action Item 3: Plan Monitoring and Maintenance
- Action Item 5: Urban Forestry - Participation in Tree City USA
- Action Item 9: Property Protection Projects
- Action Item 10: Continued Watershed Management
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- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Wheaton

- Action Item 1: Plan Adoption
- Action Item 2: Continuation of Mitigation Workgroup
- Action Item 3: Plan Monitoring and Maintenance

- Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
- Action Item 5: Urban Forestry - Participation in Tree City USA
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Willowbrook

- Action Item 1: Plan Adoption
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- Action Item 19: Property Protection References
- Action Item 20: Backup Generation for Critical Facilities
- Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

Winfield

- Action Item 1: Plan Adoption
- Action Item 2: Continuation of Mitigation Workgroup
- Action Item 3: Plan Monitoring and Maintenance
- Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating

- Action Item 5: Urban Forestry - Participation in Tree City USA
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Wood Dale

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Woodridge

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It should be noted that this list reflects action items that municipalities may pursue depending upon several factors such as funding, equipment, staffing, etc... In no way is this list intended to commit a jurisdiction to conduct these action items.

9.2 Mitigation Action Items

The following is an update and description of each action item defined in the DuPage County Natural Hazard Mitigation Plan.

9.2.1 Administrative Action Items

Action Item 1: *Plan* Adoption

Adopt this *DuPage County Natural Hazards Mitigation Plan* by resolution of the County Board, City Councils, Boards of Trustees, and other governing boards, as appropriate. The municipal, fire protection districts, colleges, and other agencies resolutions should adopt each action item that is pertinent to the community and assign a person responsible for it.

Responsible Agency: County Board, City Councils, Boards of Trustees, and other agencies.

Progress: As of 2007, every jurisdiction in DuPage County has adopted the 2007 Natural Hazard Mitigation Plan

***Next 5 years**: Every jurisdiction is expected to adopt the 2012 Natural hazard Mitigation Plan*

Cost: Staff time.

Benefits: Adoption of the *Plan* ensures that County, municipalities, other agencies, and colleges are authorized to implement the action items with available resources. Adoption is also a requirement for recognition of the *Plan* by mitigation funding programs, including the Disaster Mitigation Act of 2000, the FEMA Flood Mitigation Assistance Program and the National Flood Insurance Program's Community Rating System.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 2: Continuation of Mitigation Workgroup

The County's resolution to adopt this *Plan* should convert the DuPage County Natural Hazards Mitigation Workgroup to a permanent advisory. It would:

- Act as a forum for hazard mitigation issues,
- Disseminate hazard mitigation ideas and activities to all participants,
- Allow for continued public participation in the implementation and future revisions,
- Ensure incorporation of this *Plan*'s goals and guidelines into other planning documents,
- Monitor implementation of this Action Plan, and

– Report on progress and recommended changes to the County Board and each municipality.

Responsible Agency: The DuPage County Board.

Progress: The Mitigation Workgroup met to develop the Plan in 2007, and every year since to develop the required Annual Reports

Next 5 years: The Mitigation Workgroup is met in 2012 to develop an update to the *Plan*, and will continue to meet annually to produce the Annual Reports

Cost: Staff time.

Benefits: The benefit is better implementation of this *Plan*, plus a more comprehensive mitigation program in DuPage County. This approach also provides a mechanism for continued public involvement (e.g., Mitigation Workgroup activities posted on the County website).

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook , Oakbrook Terrace, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 3: *Plan* Monitoring and Maintenance

A Natural Hazard Mitigation Workgroup meeting will be held *at least* once a year to evaluate and monitor progress on implementation The public will be welcome to attend and/or comment. An annual evaluation report will be submitted to the County Board by the DuPage County Stormwater Chair or the current chair of the Mitigation Workgroup.

At the annual meeting, along with an assessment of the implementation efforts, the Mitigation Workgroup will determine if other mitigation issues or efforts, based on any natural hazard occurrences or input from communities or the public, should be added to the *Plan*.

The *Plan* is required by FEMA to be updated every five years. Every five years, or if any substantial revisions to the *Plan* are recommended to the Action Plan in any year, the *Plan* must be adopted by the County Board and the participating communities.

Responsible Agency: DuPage County Office of Homeland Security and Emergency Management and the Mitigation Workgroup.

Progress: As of 2010, the DuPage County OHSEM took responsibility of coordinating Workgroup meetings. The Plan will be updated to reflect this change

Next 5 years:

- DuPage County OHSEM intends to continue coordinating meetings.
- A new hazard “Power Outage” has been added to the plan

Cost: Staff time.

Benefits: A monitoring system helps ensure that responsible agencies don't forget their assignments or fall behind in working on them. The *Plan* should be evaluated in light of progress, changed conditions, and new opportunities.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

9.2.2 Mitigation Program Action Items

Action Item 4: Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating

The County and most municipalities participate in BCEGS and maintain at least a BCEGS rating of 5. Communities should strive to improve their rating to a 4, if not already attained.

Responsible Agency: County and municipal building code departments.

Progress:

- Most communities participate and maintain a BCEGS rating of 5
- DuPage County received a BCEGS rating of 5 (2011)
- Since 2011, DuPage County has adopted the following building codes:
  - 2009 DuPage County Building Code (our residential code)
  - 2009 International Building Code
  - 2009 International Energy Conservation Code
  - 2009 International Fire Code
  - 2009 International Fuel Gas Code
  - 2009 International Mechanical Code
  - 2008 National Electrical Code
  - 2004 State of Illinois Plumbing code (most current edition)
  - 1997 Illinois Accessibility Code (most current edition)

Next 5 years: Municipalities are encouraged to improve their BCEGS ratings and adopt the county building codes as a minimum standard.

Cost: Staff time and cost of training.

Benefits: The County and all DuPage County municipalities have adopted and enforce building codes, with most communities implementing the International Code series. Effective implementation and enforcement of building codes provides mitigation for severe summer and winter storms, including wind events, and earthquakes. The BCEGS program is designed to evaluate the code adoption and enforcement efforts of a community, with particular emphasis on natural hazard mitigation. Through rigorous enforcement of the latest available codes, utilizing

adequately staffed and trained code enforcement professionals; these efforts will be reflected through more favorable BCEGS classifications.

Plan Reference: Chapter 4 – Program description provided in Section 4.1 (page 4-3). Also see recommendation 2 in Section 4.13.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Darien, Downers Grove, DuPage County, Glendale Heights, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Villa Park, Warrenville, Wheaton, Willowbrook, Winfield, Wood Dale.

Action Item 5: Urban Forestry - Participation in Tree City USA

DuPage municipalities that are Tree City USA communities will maintain their status in the nationwide program, and communities and colleges that are not in the program will consider joining the program. It is understood that each municipality will make these considerations based on available staffing and financial resources.

Responsible Agency: Public works department or other appropriate municipal or institutional departments.

Progress: Since 2007, 26/32 (81%) communities participate in the Tree City USA program.

Next 5 years: DuPage County Mitigation Workgroup will continue to encourage municipal participation in Tree City USA.

Cost: $2 per capita, staff time.

Benefits: Urban forestry programs provide mitigation against severe winter and summer storms, including high wind events. The loss of trees is prevented along with the protection of power, telephone and cable services. Damage to vehicles and buildings from falling limbs is also prevented.

Plan Reference: Chapter 4 – Participation in Tree City USA is described in Section 4.9 (page 4-16). Also see recommendation 12 in Section 4.13.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 6: Community Rating System Participation

DuPage County municipalities that participate in the National Flood Insurance Program's Community Rating System (CRS) will continue their participation and strive to improve their class rating. The County and municipalities not currently involved in CRS will consider joining the program, though it is understood that some communities have determined that the program is not warranted at this time.

Responsible Agency: Community CRS coordinators and community NFIP coordinators.

Progress: Since 2007, 3 communities have improved their CRS rating

Next 5 years: DuPage County should investigate the feasibility of participating in the CRS. Communities should continue to take steps to improve their CRS rating.

Deadline: Ongoing.

Cost: Staff time.

Benefits: The CRS program saves property owners money on flood insurance premiums and it has been shown to be effective for the implementation of stormwater and floodplain management. DuPage County and the municipalities enforce higher regulatory standards than FEMA and participate in many creditable CRS activities.

Plan Reference: Chapter 1, and throughout the *Plan* (see CRS icons and comments). Also see recommendation 13 in Section 4.13.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Oakbrook , Oakbrook Terrace, Roselle, West Chicago, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 7: Community Rating System Information Workshop - REMOVED

DuPage County should invite FEMA, the Illinois Department of Natural Resources (IDNR), and the Insurance Services Office, Inc. (ISO) to present a workshop to the County, municipal stormwater administrators and other interested parties on CRS. The workshop should include an explanation of the program, annual requirements associated with participation, and an idea of minimum credits available to DuPage County municipalities based on ongoing, countywide efforts, such as the DuPage County Countywide Stormwater and Flood Plain Ordinance.

Responsible Agency: DuPage County and municipal stormwater administrators and/or NFIP coordinators.

Progress: This action item has been accomplished and has been removed from the 2012 plan update

Rationale: This action item was intended to be a one-time occurrence to educate potential CRS communities

Cost: Sponsored by IDNR; staff time.

Benefits: Many communities are unfamiliar with the CRS program and an information workshop would be beneficial.

Plan Reference: See CRS icons and comments throughout the *Plan*.

Action Item 8: Property Protection Checklist - REMOVED

A checklist should be prepared for use by all agencies throughout the County for evaluating properties that are exposed to flood damage throughout DuPage County and protection alternatives.

Responsible Agency: DuPage County Stormwater Management Division, municipal stormwater administrators and NFIP coordinators.

Progress: This action item has been removed

Rationale: The Natural Hazard Mitigation Workgroup decided to discontinue efforts in 2012

Cost: Identified per project.

Benefits: Allows for the efficient collection of property information and a useful evaluation of alternatives.

Plan Reference: Chapter 5. Also see recommendation 12 in Section 5.7.

Action Item 9: Property Protection Projects

Properties that are exposed to flood damage throughout DuPage County should be protected through property protection measures where regional structural projects are not feasible. Property protection measures should include, but not be limited to, acquisition, elevation, or flood proofing. Priority should be given to repetitive loss properties.

Responsible Agency: DuPage County Stormwater Management Division, municipal stormwater administrators and NFIP coordinators.

Progress:

- 2011
  - DuPage County Stormwater Management provided the 25% local match share required for three of the homes Carol Stream
  - DuPage County was approved to purchase 5 homes throughout the County
  - DuPage County submitted a pre-application for grant funding. If approved, DuPage County may be able to purchase up to 10 homes that are on the Flood Prone Property Voluntary Buy Out list
- 2010
  - In 2010, the Village of Lisle completed a teardown of a house in a known floodplain. This residence was replaced with one that has been elevated to safe levels and meets all current floodplain codes.
- 2009
  - SWM worked with several municipalities to identify flood-prone properties that may qualify for property acquisition
- 2008
  - No reported progress

Next 5 years:

- DuPage County will continue to work with municipalities on property protection projects similar to those identified above.
- Property Protection projects should be aligned with the overall county strategy and risk assessment (i.e., hazard prioritization)

- Projects identified by the County or municipalities will be reviewed to ensure there are no or little negative impacts to surrounding jurisdictions.

Deadline: Ongoing.

Cost: Identified per project.

Benefits: Properties will be protected from future flooding. Also the exposure of the NFIP will be reduced. There will also be a reduction in emergency response as structures are protected or removed from flood prone areas.

Plan Reference: Chapter 5. Also see recommendations 4 through 7 in Section 5.7.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale.

Action Item 10: Continued Watershed Management

DuPage County should continue its watershed management efforts through continued support and funding of the countywide stormwater management program, including the regulatory efforts and watershed planning and implementation.

Responsible Agency: DuPage County and municipal stormwater administrators.

Progress: Several watershed projects have been completed since 2007 including:

2011:

- Re-evaluating Winfield Creek and Sugar Creek

2010

- Re-evaluating Brewster Creek, West Branch DuPage River, Klein Creek, Spring Brook / Salt Creek, and Sugar Creek

2009

- Several municipalities have conducted watershed evaluations to examine flooding

Next 5 years:

- DuPage County and municipalities should continue watershed management projects regulatory efforts
- Several mitigation fund applications have been submitted to IEMA for approval
- Watershed projects should be coordinated throughout DuPage County

Deadline: Ongoing.

Cost: Project specific (and annual Stormwater Division Budget).

Benefits: All residents will benefit from the continuation of County's watershed management efforts for the protection of property, transportation, and health and safety during minor and major flood events.

Plan Reference: Chapter 6. Also see recommendation 2 in Section 6.9.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook , Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 11: Structural Flood Control Projects

DuPage should continue support and funding of feasible structural flood control projects as they are identified in watershed plans.

Responsible Agency: DuPage County.

Progress:

2011

- Klein Creek Flood Reduction within Carol Stream
- West Branch River Flood Reduction in Warrenville
- Brewster Creek flood reduction and Water Quality Enhancement in Village of Bartlett.
- Hinsdale site investigation at Graue Mill
- Initial work on Whiskey Creek – unincorporated Winfield Township
- Initial work on Weeks Park Pond and pump station in unincorporated Carol Stream

2010

- Meacham Grove Labyrinth Weir Modification on Spring Brook / Salt Creek
- DuPage Airport culverts near Kress creek

2009

- River Dumoulin pump station in Lisle
- Numerous municipal stream bank stabilization projects

Next 5 years: DuPage should continue support and funding of feasible structural flood control projects as they are identified in watershed plans

Deadline: Ongoing.

Cost: Project specific.

Benefits: While some flood control projects constructed in DuPage County have not been fully tested, due to the absence of significant flood events in recent years, it is agreed that the floodwater storage and protection that they provide is important and

needed due to the population and urbanization of the County. Structural project benefits are determined during project development.

Plan Reference: Chapter 6. Also see recommendation 3 in Section 6.9.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hinsdale, Itasca, Lisle, Naperville, Villa Park, Warrenville, West Chicago, Wheaton, Willowbrook, Wood Dale, Woodridge.

Action Item 12: Stream Maintenance Programs

The County, municipalities, and institutions should develop and implement a formal and regular drainage system maintenance program. This effort should include the inspection of privately maintained drainage facilities. It is understood that each municipality will make these considerations based on available staffing and financial resources.

Responsible Agency: Public works department or other appropriate municipal or institutional departments.

Progress: Based on annual surveys of the Natural Hazard Mitigation Workgroup members, 20/32 (62%) of municipalities have been able to perform regular stream maintenance.

Next 5 years: Continue to implement a formal and regular drainage system maintenance program, including maintenance.

Deadline: Ongoing..

Cost: Staff time and equipment.

Benefits: The urbanized nature of DuPage County creates a range of stream maintenance problems. Sedimentation and debris can cause problems in large flood events but also during severe summer storms. Regular maintenance can protect both structures and property. Regular maintenance can also be more cost effective than major maintenance efforts that are done on an as-needed basis.

Plan Reference: Chapter 6 –Section 6.6 (page 6-9). Also see recommendation 6 in Section 6.9.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 13: Participation in StormReady:

DuPage County communities, other agencies, and colleges should maintain their status or consider joining the National Weather Service's StormReady program. Currently the County and seven communities in DuPage County participate. The StormReady program has been developed to provide communities guidelines to improve the timeliness and effectiveness of hazardous weather-related warnings for the public.

Responsible Agency: County, municipal, other agency, and institutional emergency managers.

Progress: DuPage County OHSEM has maintained StormReady Certification every year and is approved through 2014

10/32 (31%) of DuPage municipalities also participate in the StormReady Program

Next 5 years: DuPage County OHSEM plans on continuing participation in StormReady. All DuPage municipalities should take steps to become StormReady

Deadline: Ongoing. The StormReady certification is good for 3 years.

Cost: $2 per capita, staff time.

Benefits: By meeting StormReady requirements, the County, communities and institutions will be better able to detect impending weather hazards and disseminate warnings as quickly as possible. Given the County's population, all efforts to prevent injury, save lives, and protect property are of high value.

Plan Reference: Chapter 7 – Program description provided in Section 7.3 (page 7-7). Also see recommendation 16 in Section 7.8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Warrenville, West Chicago, Westmont, Wood Dale, Woodridge.

Action Item 14: Identification of Floodplain Structures:

A comprehensive list of structures located in the County's floodplains should be developed. The County continues to examine building footprints and floodplains, as part of the stormwater management program, a determination of the number of floodplain structures should be made. The developed information should be provided to communities, as appropriate.

Responsible Agency: DuPage County Stormwater Division and GIS Division.

Progress: In progress. Stormwater working with County GIS department.

Next 5 years: Continue development

Deadline: Ongoing

Cost: Staff time.

Benefits: The countywide stormwater management and hazard mitigation effort would benefit from a full picture of the number of DuPage County floodplain properties. Appropriate property protection measures could be better identified through this information. Also, having this information would allow municipalities to provide public information materials directly to these property owners.

Plan Reference: Chapters 4, 5, 7, and 9.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook , Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 15: Review of Critical Facilities

The location of critical facilities should be evaluated to determine if they are located in flood prone areas or other hazardous locations. Critical facilities have been mapped in the County's GIS. As the County further examines building footprints and floodplains as part of the stormwater management program, the review of critical facilities should be included. Where necessary, critical facilities should be protected from identified natural hazards.

Responsible Agency: DuPage County Stormwater Division, Department of Homeland Security and Emergency Management, and GIS Division, municipalities, other agencies and institutions.

Progress: DuPage County has worked with municipalities to identify Critical Facilities since 2007. This list was updated after the 2011 Blizzard.

County GIS has recently updated their mapping service for municipal users.

Next 5 years: DuPage County to continue

Deadline: 24 months.

Cost: Staff time.

Benefits: While it is known that some wastewater treatment plants are located in the County's floodplains, the extent of municipal or school facilities that may be in harm's way is not fully known. This review of critical facilities and any mitigation efforts will benefit DuPage County through preparedness, response and recovery.

Plan Reference: Chapter 7 and recommendation 13 in Section 7.8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 16: Development of Flood Stage Maps:

Flood stage maps should be developed to show varying depths of flooding and the respective area of inundation for floodplain areas. The maps should be developed by watershed.

Responsible Agency: DuPage County Stormwater Management Division, Department of Homeland Security and Emergency Management, and GIS Division.

Progress: Stormwater Management has made floodplain maps available on their website. The website will be updated as grant funding becomes available

Next 5 years: Continue

Deadline: Based on available grant funding.

Cost: Approximately, $100,000.

Benefits: Flood stage mapping would provide a depiction of the most at-risk structures, intersections, and utilities in the floodplain. They would aid in mitigation project planning. Most importantly, they would provide data for emergency response

(and response planning) and allow communities to assess and identify needed resources.

Plan Reference: Chapter 7. Also see recommendation 15 in Section 7.8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Wood Dale, Woodridge.

Action Item 17: Seek Mitigation Grant Funding for Additional Mitigation Planning Cost Beneficial Projects

The County, municipalities, fire protection district and educational institutions should apply for mitigation grant funding through available IEMA and FEMA programs for mitigation planning and mitigation projects. As required by IEMA and FEMA programs, projects would need to be cost beneficial.

Responsible Agency: DuPage County, municipalities, other agencies, and institutions.

Progress: Since 2007, several municipalities have received grant funding totaling over $3.5M

Next 5 years: Continue to apply for grant funding.

Currently, there are 10 applications pending for DuPage jurisdictions totaling over $18.8M. These projects should be implemented or in progress within the next 5 years (in the event funding is granted).

Deadline: As needed.

Cost: 25 percent of plan or project cost (non-federal share).

Benefits: The County, municipalities, other agencies and institutions, along with residents and property owners, would benefit from the available grant funding. The request for grant funding also allows the Mitigation Workgroup to benefit from the mitigation planning effort.

Plan Reference: Chapters 1 and 4 through 8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

9.2.3 Public Information Action Items

Action Item 18: Development of a Public Information Strategy

A countywide natural hazards public information strategy should be developed for the use of the County, municipalities and institutions. The strategy should be consistent with the recommended approach for the CRS program. The most important topics to cover are:

Safety

- During thunderstorms and lightning
- During winter storms
- Tornado safety precautions
- Emergency protection measures

Protecting your property

- Sewer backup protection measures
- Yard drainage issues
- Sources of assistance

Understanding floods

- Why there are floods
- Why we regulate the floodplain
- Flood insurance

Protecting our watersheds

- Benefits of open space
- Protecting wetlands
- Protecting water quality
- Stream and wetland dumping issues

The most appropriate ways to provide information are:

- Community newsletters
- Mailings to residents
- Websites and links to other sources
- Newspaper articles
- Cable television access

Publications developed by other agencies should be reviewed, consolidated, and tailored for distribution to DuPage County property owners. A set of countywide publications should be developed that can be used by communities as is, but developed in a format that allows communities to customize the materials.

Responsible Agency: DuPage County Hazard Mitigation Workgroup, municipalities, institutions.

Progress: DuPage County OHSEM has Developed a County Joint Information Center, and Joint Information System. Approximately 10 staff from different County Departments have been appointed to a Public Information team to assist with media relations during a disaster.

Approved publications are made available on the county website.

Next 5 years: County Public Information training and exercises.

Municipalities with mitigation information on websites should stay consistent or link to the County website: www.dupageco.org, or www.protectdupage.org (during emergencies)

Deadline: 12 months.

Cost: Staff time, publication costs.

Benefits: There are many benefits to having a well-informed public. For example, deaths from lightning have steadily decreased over the years because people are more aware of what they should and should not do. More self-help and self-protection measures will be implemented if people know about them and are motivated to pursue them.

By preparing a public information strategy and a master set of locally pertinent articles and materials, each interested office only has to select the most appropriate media and distribute the messages. By simply inserting an article in a newsletter or putting it on the website, the local level of effort is greatly reduced, which increases the likelihood that the messages will get out. The messages will also be technically correct and consistent throughout the County.

Plan Reference: Chapter 8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Wood Dale, Woodridge.

Action Item 19: Property Protection References

Provide municipal departments, libraries and other interested offices with a list of references on property protection that can be ordered for free from state and federal offices. Include a request that they make the references available for public use. A special effort should be made to identify references on insurance, emergency preparedness and property protection.

Also, identify websites that provide property protection information and provide their addresses to the County and municipal webmasters.

Responsible Agency: DuPage County Hazard Mitigation Workgroup, then municipal offices to place in libraries and offices. The American Red Cross should provide technical advice.

Progress: Information has been loaded on the County website regarding natural hazards and references State and Federal sources.

Next 5 years: These websites should be maintained and updated as necessary.

Deadline: Updates as needed.

Cost: Staff time.

Benefits: As with the other public information activities, this action item helps inform the public. It provides the greatest assistance to those people who want to learn more about property protection and take the right steps to reduce their exposure to damage by natural hazards.

Plan Reference: Chapter 8.

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 20: Backup Generation for Critical Facilities

County and municipal jurisdictions should supply backup generation capability to critical facilities.

Responsible Agency: DuPage County and local Emergency Management agencies to coordinate with various appropriate agencies.

Deadline: Over the next 5 years (2013 – 2018)

Cost: Varies by facility and type of generation

Benefits: Backup generation of critical facilities such as hospitals, nursing homes, and first response facilities helps ensure the mission of lessening the effects of a disaster.

Plan Reference: Chapter 7.5

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

Action Item 21: Construction of Safe Rooms

County and municipal jurisdictions should develop safe rooms or tornado shelters within wind-vulnerable structures.

Responsible Agency: County and municipal building code departments.

Deadline: Over the next 5 years (2013 – 2018)

Cost: Varies by facility construction materials

Benefits: Wind-vulnerable facilities are particularly susceptible to tornadoes and storms with high wind speeds. Construction of Safe Rooms and/or tornado shelter areas in or around these facilities has the potential to save lives.

Plan Reference: Chapter 5.2.2

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glendale Heights, Itasca, Naperville, Oakbrook, Oakbrook Terrace, Warrenville, West Chicago, Wood Dale, Woodridge.

Action Item 22: National Floodplain Insurance Program (NFIP) Compliance

All municipalities within DuPage County have floodplain ordinances that are at or above FEMA standards. Over the next five years, all communities should continue adopting ordinances compliant with FEMA standards.

Responsible Agency: Municipal and County Stormwater and Building departments

Deadline: annually

Cost: staff time for code enforcement

Benefits: Maintaining floodplain ordinances at or above the FEMA standards ensures that DuPage County jurisdictions maintain good standing in the National Flood

Insurance Program. This in turn provides residents with improved options for obtaining flood insurance for homes within a flood plain.

Plan Reference: Chapter 4.5

Municipalities who are considering this Action Item: Bartlett, Bensenville, Bloomingdale, Burr Ridge, Carol Stream, Darien, Downers Grove, DuPage County, Elmhurst, Glen Ellyn, Glendale Heights, Hanover Park, Hinsdale, Itasca, Lisle, Naperville, Oakbrook, Oakbrook Terrace, Roselle, Villa Park, Warrenville, West Chicago, Westmont, Wheaton, Willowbrook, Winfield, Wood Dale, Woodridge.

9.3 Summary of Action Plan Items

Table 9-1 summarizes the 19 action items, the responsible agencies and the deadlines for implementing them. The action items are categorized as mitigation program items, public information items, and administrative items. Administrative items include tasks needed to administer and support plan implementation.

The relationship between the goals and guidelines (from Chapter 3) are shown in Table 9-2.

9.4 Plan Implementation and Maintenance

The continuation of the DuPage County Natural Hazard Mitigation Workgroup is necessary for implementation of the Action Plan. The establishment of the Mitigation Workgroup as a permanent group is proposed to monitor the implementation of the *Plan*, report to the County Board, municipalities, other agencies, and colleges on its progress, and recommend revisions to this *Plan* as needed. This is explained in Action Item 2.

Maintenance and monitoring of the *DuPage County Natural Hazards Mitigation Plan* are addressed in Action Item 3. This Action Item explains how and when this *Plan* will be reviewed, revised, and updated. While Action Item 3 calls for the Mitigation Workgroup to meet at least once a year, it is anticipated that they will meet more frequently through the Stormwater Administrators' meetings and the Local Emergency Managers Coordinators group. The purpose of the Mitigation Workgroup meetings will be for the development and review of countywide mitigation activities.

Table 9-1 Action Items, Responsible Agencies and Deadlines

Responsible Agency:	1-Plan Adoption	2-Continuation of Mitigation Workgroup	3-Plan Monitoring and Maintenance	4-Improvement of BCEGS Rating	5-Urban Forestry - Tree City USA	6-CRS Participation	~~7-CRS Information Workshop~~	~~8-Property Protection Checklist~~	9-Property Protection Projects	10-Continued Watershed Management	11-Structural Flood Control Projects	12-Stream Maintenance Programs	13-Participation in StormReady	14-Identification of Floodplain Structures	15-Review of Critical Facilities	16-Development of Flood Stage Maps	17-Seek Mitigation Grant Funding	18-Public Information Strategy	19-Property Protection References	20–Backup Generation for Critical Facilities	21 – Construction of Safe Rooms	22 – NFIP Compliance
DuPage County																						
County Board	X	X	X														X					
Stormwater Management			X			X	X	X	X	X	X	X		X	X	X		X	X			X
Homeland Security & Emergency Management													X		X	X		X	X	X		
Building Department				X																	X	X
GIS														X	X	X						
Municipalities*																						
City Councils/Village Board	X		X														X			X		
Workgroup Representative			X																			
Stormwater Admin & NFIP Coordinator						X	X	X	X	X				X	X	X		X	X			X
Emergency Management													X		X	X		X	X	X		
Building Department				X																	X	X
Public Works					X							X										
Fire Protection Districts																						
Board	X		X																	X		
Staff								X					X									
Colleges and Schools																						
Board	X		X																	X		
Staff								X	X			X	X									
Other Agencies																			X			
Deadline for first product (months)																						

*Involved municipalities are shown in Table 1-2 on page 1-7 of the *Plan*.

Table 9-2 Action Items, Goals and Guidelines

	1-Plan Adoption	2-Continuation of Mitigation Workgroup	3-Plan Monitoring and Maintenance	4-Improvement of BCEGS Rating	5-Urban Forestry - Tree City USA	6-CRS Participation	~~7-CRS Information Workshop~~	~~8-Property Protection Checklist~~	9-Property Protection Projects	10-Continued Watershed Management	11-Structural Flood Control Projects	12-Stream Maintenance Programs	13-Participation in StormReady	14-Identification of Floodplain Structures	15-Review of Critical Facilities	16-Development of Flood Stage Maps	17-Seek Mitigation Grant Funding	18-Public Information Strategy	19-Property Protection References	20 – Backup Generation for Critical Facilities	21 – Construction of Safe Rooms	22 – National Floodplain Insurance Program Compliance
Goals																						
1. Protect the lives, health, and safety of the citizens.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Protect public services and critical facilities from loss of use.	X	X	X		X			X	X		X		X	X	X		X			X		
3. Protect utilities and streets.	X	X	X		X						X	X	X		X					X		
4. Mitigate potential damage to buildings and structures.	X	X	X	X		X	X	X	X	X	X	X		X	X		X	X	X			
5. Ensure that new developments do not create new exposures to damage.	X	X	X	X		X	X			X								X	X			X
6. Protect historic, cultural, and natural resources.	X	X	X	X	X			X	X	X				X			X	X	X	X		
Guidelines																						
1. Focus efforts on floods, summer storms, winter storms, tornadoes, extreme heat, and power outages	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
2. Mitigation initiatives should focus on protecting citizens and public property.	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3. Make people aware of the hazards they face; encourage people to take steps to protect themselves and their property.	X	X	X															X	X	X		X
4. Use available local funds, when necessary, in efforts that protect the lives, health, and safety of people from natural hazards.				X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	
5. Use available local funds, when necessary, to protect the public services and critical facilities from natural hazards.													X		X		X	X	X	X		
6. Create and foster public-private partnerships to accomplish mitigation activities.	X	X	X														X	X				
7. Strive to develop cost-effective mitigation projects and seek state, and federal support for mitigation efforts.								X	X	X	X			X	X	X	X					X
8. Strive to improve and expand business, infrastructure, education and housing opportunities in DuPage County in conjunction with planned mitigation efforts.										X		X										X

Table 9-3 Action Items By Municipality

Responsible Agency:	1-Plan Adoption	2-Continuation of Mitigation Workgroup	3-Plan Monitoring and Maintenance	4-Improvement of BCEGS Rating	5-Urban Forestry - Tree City USA	6-CRS Participation	7-~~CRS Information Workshop~~	8-~~Property Protection Checklist~~	9-Property Protection Projects	10-Continued Watershed Management	11-Structural Flood Control Projects	12-Stream Maintenance Programs	13-Participation in StormReady	14-Identification of Floodplain Structures	15-Review of Critical Facilities	16-Development of Flood Stage Maps	17-Seek Mitigation Grant Funding	18-Public Information Strategy	19-Property Protection References	20–Backup Generation for Critical Facilities	21 – Construction of Safe Rooms	22 – NFIP Compliance
Municipalities																						
Addison	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X		X
Bartlett	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bensenville	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Bloomingdale	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Burr Ridge	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carol Stream	X	X	X				N/A	N/A	X	X	X	X	X	X		X	X	X	X	X	X	X
Clarendon Hills	X	X	X	X	X	X	N/A	N/A	X	X		X	X	X	X	X	X	X	X	X	X	X
Darien	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X		X	X	X	X	X
Downers Grove	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
DuPage County	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Elmhurst	X	X	X		X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Glen Ellyn	X	X	X		X	X	N/A	N/A	X	X	X	X		X	X	X	X	X	X	X		X
Glendale	X	X	X	X	X	X	N/A	N/A	X	X	X	X	x	X	X	X	X	X	X	X	X	X

Heights																						
Hanover Park	X	X			X	X	N/A	N/A		X		X	X	X	X	X	X	X	X	X		X
Hinsdale	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X		X
Itasca	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Lisle	X	X	X	X	X	X	N/A	N/A	X	X	X		X	X	X	X	X	X	X	X		X
Lombard	X	X	X	X	X		N/A	N/A	X	X			X	X	X	X	X	X	X	X	X	X
Naperville	X	X	X	X	X		N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Oakbrook	X	X	X	X	X	X	N/A	N/A	X	X		X	X	X	X	X	X	X	X	X	X	X
Oakbrook Terrace	X	X	X	X	X	X	N/A	N/A	X	X		X	X	X	X	X	X	X	X	X	X	X
Roselle	X				X	X	N/A	N/A	X	X		X		X	X	X	X	X	X	X		X
Villa Park	X	X	X	X	X		N/A	N/A	X	X	X	X		X	X	X	X	X	X	X		X
Warrenville	X	X	X	X	X		N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Wayne	X	X	X	X	X	X	N/A	N/A	X	X		X	X	X	X		X	X	X	X		X
West Chicago	X	X	X			X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Westmont	X	X	X		X		N/A	N/A	X	X		X	X	X	X	X	X	X		X		X
Wheaton	X	X	X	X	X		N/A	N/A	X	X	X	X		X	X	X	X	X	X	X		X
Willowbrook	X	X	X	X	X	X	N/A	N/A	X	X	X	X		X	X	X	X	X	X	X		X
Winfield	X	X	X	X	X	X	N/A	N/A	X	X		X		X	X		X		X	X		X
Wood Dale	X	X	X	X	X	X	N/A	N/A	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Woodridge	X	X	X	X	X	X	N/A	N/A		X	X	X	X	X	X	X	X	X	X	X	X	X

Appendix A

Workgroup Participants

The following people participated in the development of the DuPage County Natural Hazard Mitigation Plan:

DuPage County Natural Hazards Mitigation Workgroup	
DuPage County Departments	
Agency	**Representative**
Homeland Security and Emergency Management	David Bunge Safia Rabah
Stormwater Management	Sarah Ruthko Mary Mitros Jamie Geils
Public Works	Greg Phillips
Economic Development	Jen Boyer Jim Stran Clayton Heffter
Forest Preserve	Brock Lovelace
Municipalities	
Village of Addison	Bob Nissen Rick Federighi Kai Liu
Village of Bartlett	Mike McGuigan Brian Goralski Steven Bosco
Village of Bensenville	Don Schultz
Village of Bloomingdale	Michael Marchi
Village of Burr Ridge	Tim Vaclav
Village of Carol Stream	Jim Knudsen
Village of Clarendon Hills	Dan Underleider
City of Darien	Gerry Piccoli
Village of Downers Grove	Karen Daulton Lange Nathaniel Hawk
City of Elmhurst	Don Novak
Village of Glendale Heights	John Hanson Steve Ewoldt Roy Charvat
Village of Glen Ellyn	Bob Minix Dave Buckley
Village of Hanover Park	Tom Cortese Howard Killian
Village of Hinsdale	Kevin Votava Dan Deeter

Village of Itasca	Scott Heher
Village of Lisle	Jason Elias Mary Lou Kalsted Randall Johnson
Village of Lombard	Doug Cail Jana Bryant
City of Naperville	Dan Nelson
Village of Oak Brook	Michael Hullihan Blaine Wing Michelle Ruska
City of Oakbrook Terrace	Todd Kupsak Wayne Holakovsky
Village of Roselle	Robert Tinucci
Village of Villa Park	John Beckwith Vydas Juskelis
City of Warrenville	Jim Burke Phil Kuchler
Village of Wayne	
City of West Chicago	Chris Woodill
Village of Westmont	David Lincoln Noriel Noriega
City of Wheaton	Vince Laoang
Village of Willowbrook	Garrett Hummel Tim Halik Peter Krumins
Village of Winfield	Chuck Martschinke, Peter Krumins
City of Wood Dale	John Forrest
Village of Woodridge	Bill Hoogland Chris Bethel
Argonne National Laboratories	Joseph Kirts Tonya Petty

Appendix B

Public Involvement Activities

Below are samples of public information and public involvement activities that were used during the development of the *DuPage County Natural Hazard Mitigation Plan*, including:

- Press Releases
- DuPage County Website
- Local Newspaper Articles
- Community Newsletter Articles
- Social Media Announcements
- Public Meeting Agenda
- Public Meeting held on November 19, 2012
- Frequently Asked Questions

1. Press Releases:

DUPAGE COUNTY

NEWS RELEASE

421 N. County Farm Road • Wheaton, Illinois 60187 • 630-407-6060
Website: WWW.DUPAGECO.ORG • **Twitter:** @dupagecounty • **Facebook:** DuPage County Board

Immediate release
Nov. 9, 2012

Contact: Johnna Kelly
(630) 407-6022

DuPage Hosts Public Meeting on Natural Hazard Mitigation Plan

Wheaton – The DuPage County Office of Homeland Security and Emergency Management will host a public meeting regarding a county-wide Natural Hazard Mitigation Plan at 7 p.m. Monday, Nov. 19, at the JTK Administration Building, 421 N. County Farm Rd., Room 3-500B, Wheaton.

The Natural Hazard Mitigation Plan helps community leaders evaluate and recognize the types of natural hazards that impact DuPage County. During the planning process, communities will work together to establish goals and develop strategies to reduce the long-term effects of natural hazards.

DuPage County Board Chairman Dan Cronin encourages residents to provide input regarding the planning process of the Natural Hazard Mitigation Plan.

"DuPage County is no stranger to damage from flooding and severe storms. By working together, we can create a comprehensive plan to protect our communities from the damages caused by future natural disasters," said Cronin.

For more information about the DuPage County Office of Homeland Security and Emergency Management, including how to sign up to receive instant alerts, please visit www.protectdupage.org.

###

2. DuPage County Website:

DuPage Hosts Public Meeting on Natural Hazard Mitigation Plan Nov. 19

The DuPage County Office of Homeland Security and Emergency Management will host a public meeting regarding a county-wide Natural Hazard Mitigation Plan at 7 p.m. Monday, Nov. 19, at the JTK Administration Building, 421 N. County Farm Rd., Room 3-500B, Wheaton.
Posted Date: 11/09/2012

THE COUNTY OF DUPAGE
WHEATON, ILLINOIS

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Home > News & Press Releases

PRESS RELEASE

Contact Information: Johnna Kelly 630-407-6022

Friday, November 09, 2012

DuPage Hosts Public Meeting on Natural Hazard Mitigation Plan Nov. 19

The DuPage County Office of Homeland Security and Emergency Management will host a public meeting regarding a county-wide Natural Hazard Mitigation Plan at 7 p.m. Monday, Nov. 19, at the JTK Administration Building, 421 N. County Farm Rd., Room 3-500B, Wheaton.

The Natural Hazard Mitigation Plan helps community leaders evaluate and recognize the types of natural hazards that impact DuPage County. During the planning process, communities will work together to establish goals and develop strategies to reduce the long-term effects of natural hazards.

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"DuPage County is no stranger to damage from flooding and severe storms. By working together, we can create a comprehensive plan to protect our communities from the damages caused by future natural disasters," said Cronin.

For more information about the DuPage County Office of Homeland Security and Emergency Management, including how to sign up to receive instant alerts, please visit www.protectdupage.org.

DuPage to Host Public Meeting on Natural Hazard Mitigation Plan

The DuPage County Office of Homeland Security and Emergency Management will host a public meeting regarding a county-wide Natural Hazard Mitigation Plan at 7 p.m. Monday, Nov. 19, at the JTK Administration Building, 421 N. County Farm Rd., Room 3-500B, Wheaton. View full press release and agenda.

2. Local Newspaper Articles:

NapervilleSun
A CHICAGO SUN-TIMES Publication

Disaster plans being laid in DuPage

Sun staff

Last Modified: Nov 14, 2012 01:30PM

DuPage County officials want to reduce the chances that people will get hurt the next time Mother Nature acts up.

The county's Office of Homeland Security and Emergency Management has set a public meeting to go over a new plan designed to improve the planning and response to natural disasters. The Natural Hazard Mitigation Plan will be discussed at 7 p.m. Nov. 19 in room 3500-B of the Jack T. Knuepfer Administration Building, 421 N. County Farm Road, Wheaton.

The public is invited to come to the meeting and provide their input for the planning process, during which "communities will work together to establish goals and develop strategies to reduce the long-term effects of natural hazards," the Office of Homeland Security said in a news release.

"DuPage County is no stranger to damage from flooding and severe storms," County Board Chairman Dan Cronin said in the release. "By working together, we can create a comprehensive plan to protect our communities from the damages caused by future natural disasters."

For more information, including instructions for signing up to receive instant alerts, go to www.protectdupage.org.

The Doings Weekly
A CHICAGO SUN-TIMES Publication

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Disaster plans being laid in DuPage County

November 12, 2012 5:36PM

+1 0 | Like 3 | Tweet 0 | Share | Reprints

Updated: November 15, 2012 3:30AM
WHEATON — DuPage County officials want to reduce the chances that people will get hurt the next time Mother Nature acts up.

The county's Office of Homeland Security and Emergency Management has set a public meeting to go over a new plan designed to improve the planning and response to natural disasters. The Natural Hazard Mitigation Plan will be discussed at 7 p.m. Nov. 19 in room 3500-B of the Jack T. Knuepfer Administration Building, 421 N. County Farm Road, Wheaton.

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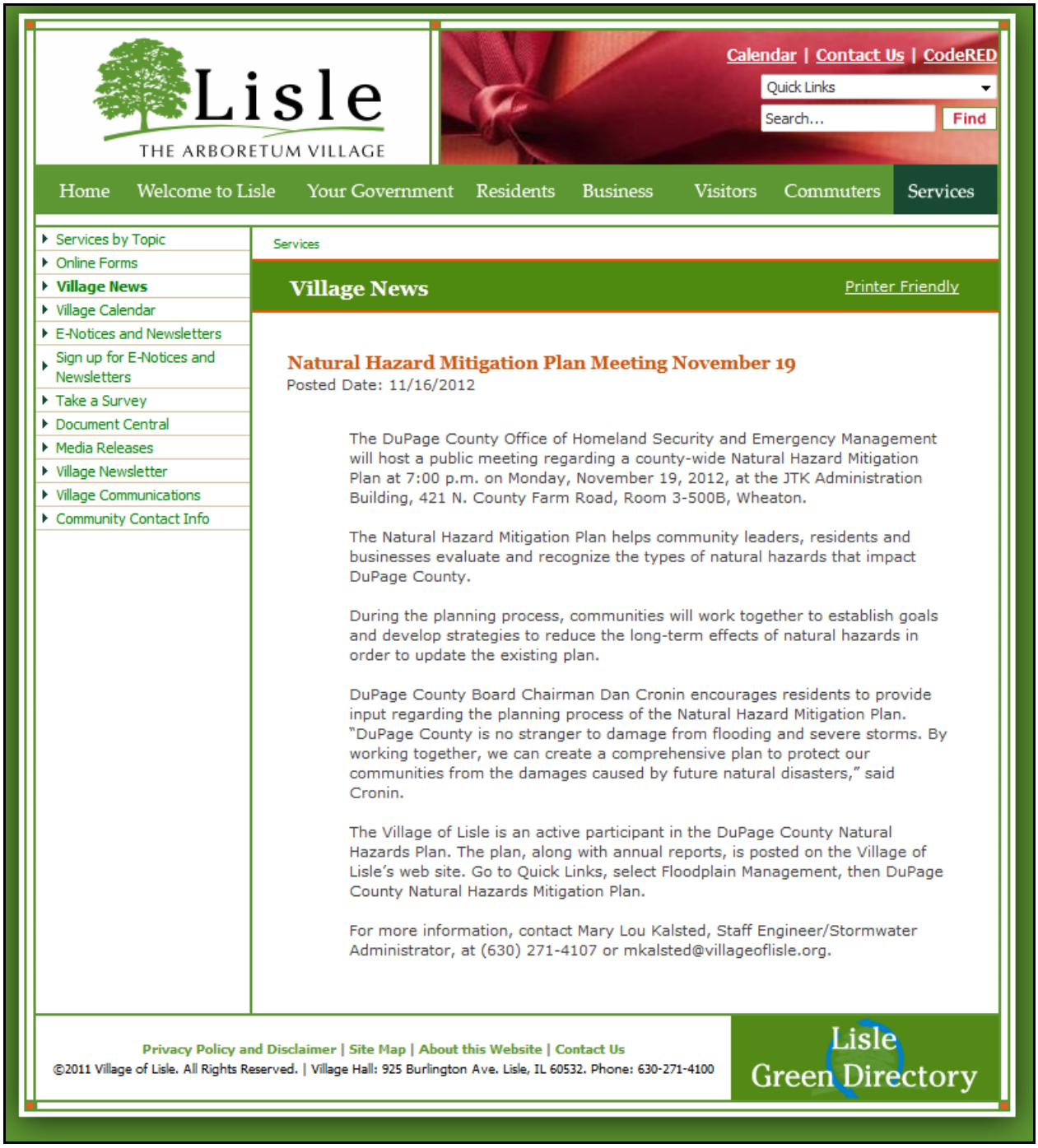
For more information, including instructions for signing up to receive instant alerts, go to www.protectdupage.org.

Stay Connected

Stay Connected with the The Doings-Weekly

3. Community Newsletter Articles:



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Natural Hazard Mitigation Plan Meeting November 19
Posted Date: 11/16/2012

The DuPage County Office of Homeland Security and Emergency Management will host a public meeting regarding a county-wide Natural Hazard Mitigation Plan at 7:00 p.m. on Monday, November 19, 2012, at the JTK Administration Building, 421 N. County Farm Road, Room 3-500B, Wheaton.

The Natural Hazard Mitigation Plan helps community leaders, residents and businesses evaluate and recognize the types of natural hazards that impact DuPage County.

During the planning process, communities will work together to establish goals and develop strategies to reduce the long-term effects of natural hazards in order to update the existing plan.

DuPage County Board Chairman Dan Cronin encourages residents to provide input regarding the planning process of the Natural Hazard Mitigation Plan. "DuPage County is no stranger to damage from flooding and severe storms. By working together, we can create a comprehensive plan to protect our communities from the damages caused by future natural disasters," said Cronin.

The Village of Lisle is an active participant in the DuPage County Natural Hazards Plan. The plan, along with annual reports, is posted on the Village of Lisle's web site. Go to Quick Links, select Floodplain Management, then DuPage County Natural Hazards Mitigation Plan.

For more information, contact Mary Lou Kalsted, Staff Engineer/Stormwater Administrator, at (630) 271-4107 or mkalsted@villageoflisle.org.

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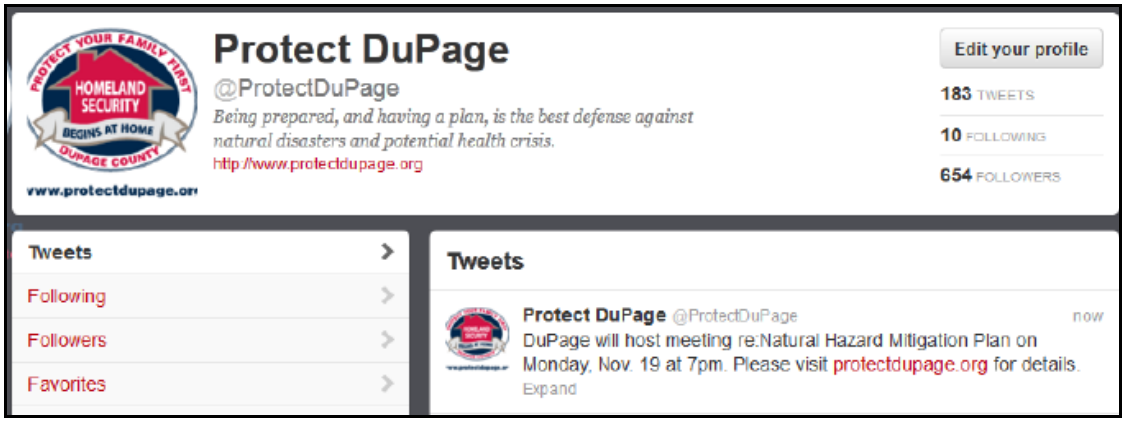
©2011 Village of Lisle. All Rights Reserved. | Village Hall: 925 Burlington Ave. Lisle, IL 60532. Phone: 630-271-4100

Lisle Green Directory

4. Social Media Announcements:

a. Protect DuPage Twitter:



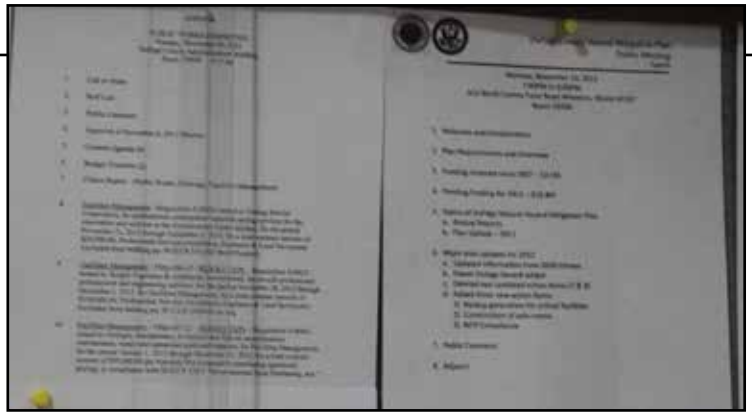
b. Protect DuPage Facebook:

5. Public Meeting Agenda:

DuPage County Hazard Mitigation Plan
Public Meeting
Agenda

Monday, November 19, 2012
7:00PM to 8:00PM
421 North County Farm Road Wheaton, Illinois 60187
Room 3500B

1. Welcome and Introductions
2. Plan Requirements and Overview
3. Funding received since 2007 – $3.5M
4. Pending funding for 2012 – $18.8M
5. Status of DuPage Natural Hazard Mitigation Plan
   a. Annual Reports
   b. Plan Update – 2012
6. Major plan updates for 2012
   a. Updated information from 2010 Census
   b. Power Outage hazard added
   c. Deleted two outdated action items (7 & 8)
   d. Added three new action items:
      1) Backup generation for critical facilities
      2) Construction of safe rooms
      3) NFIP Compliance
7. Public Comment
8. Adjourn



Agenda posted in front of meeting room 3-500B

6. Public Meeting – Sign-in Sheets:

DuPage County Office of Homeland Security & Emergency Management

Natural Hazard Mitigation Plan Meeting
November 19, 2012 7:00pm

NAME (Print)	AGENCY	E-MAIL ADDRESS
John Beckwith	Village of Villa Park	JohnB@ilvillaPark.com
Dan Deeter	Village of Hinsdale	ddeeter@villageofhinsdale.org
Steven Bosco	Village of Bartlett	sbosco@vbartlett.org
Karen Daulton Lange	Village of Downers Grove	KDLange@Downers.us
Molly O'Toole	MOTA	molly@mollyotoole.com
Don Schultz	Bensenville EMA	dschultz@bensenville.il.us
Chuck Martschinke	WINFIELD EMA	cmartschinke@villageofwinfield
Greg Phillipp	DPC Public Works	
Dave Buckley	APWA Public Works Cln Illy	dbuckley@glendale-org
David Lincoln	Westmont EMA	dlincoln@westmont.il.gov
Garrett Hummel	Willowbrook	ghummel@villowbrook.il.us
Donald Novak	City of Elmhurst EMA	don.novak@elmhurst.org
Chris Woodill	West Chicago	cwoodill@westchicago.org
Chris Bethel	Vlg of Woodridge	cbethel@vil.woodridge.il.us
Scott Hefner	Itasca PD	shefner@itasca.com
Wm Jon Kalstedt	Village of Lisle	wkalsted@villageofLisle.org

NAME (Print)	AGENCY	E-MAIL ADDRESS
McGuigan	Bartlett PD	—
Randall Johnson	LISLE PD	rjohnson@villageoflisle.org
David Burge	DuPage County OHSEM	david.burge@dupageco.org

7. Frequently Asked Questions:

Frequently Asked Questions (FAQs)

Mitigation Planning

Question 1: Are HMGP planning grants subject to a benefit-cost analysis in order to be eligible for funding?

Answer: The Disaster Mitigation Act of 2000 authorizes up to 7% of the HMGP ceiling to be used for the development of State, Indian Tribal, and/or local mitigation plans that meet the planning criteria outlined in 44 CFR Part 201. A benefit-cost analysis is not required for the use of the 7% planning funds.

Question 2: Are jurisdictions that are not participating in the NFIP eligible to receive HMGP Planning grants?

Answer: Yes. Non-participating jurisdictions are eligible for planning grants under the HMGP. Because of the post-disaster aspect of HMGP, FEMA wants to provide an opportunity to encourage sound mitigation planning, which may in turn serve to motivate non-participating jurisdictions to participate in the NFIP. Up to 7% of the total disaster HMGP funds may be used for State and local planning activities. For example, if a state receives $1 Million in HMGP, up to $70,000 could be used for planning grants to sub-applicants.

Question 3: If a jurisdiction does not have an approved plan when a disaster is declared, can the jurisdiction receive an HMGP project grant?

Answer: Yes. A local government can receive an HMGP project grant as long as the plan is approved prior to the grant award. In extraordinary circumstances, as defined by FEMA, FEMA Regional Directors may grant an exception to the local plan requirement. In these cases, a plan must be completed within 12 months of award of the project grant. Local governments would also be eligible to receive an HMGP planning grant to develop or finalize their plan.

Question 4: Must a local jurisdiction amend a previously approved plan to add mitigation projects eligible for PDM-C funding?

Answer: No. There is no need for additional "mitigation actions" to be added to FEMA-approved multi-hazard mitigation plans to remain eligible for PDM-C funding if the project is consistent with the goals and objectives of both the State or Tribal State-level mitigation plan, and the local or tribal local mitigation plan. If local governments wish to report to FEMA that they have updated their plans, they may do so, but there is no requirement for this action. FEMA does not desire nor require the updating and resubmission of local plans for PDM-C or HMGP eligibility if the plan is already FEMA-approved and the project is consistent with the plan's goals and objectives. This is also true for universities with their own approved mitigation plan.

Question 5: Are annual EMPG funds contingent upon a State meeting the Section 322 planning requirements?

Answer: No, EMPG funding will not be withheld from a State that does not update its mitigation plan in compliance with 44 CFR Part 201. However, FEMA does emphasize the need to encourage planning assistance and training with the EMPG funds. A State may choose to use the funding they receive under the EMPG to develop specific pieces of their plan as they relate to all hazards.

Question 6: Are separate plans required from State agencies when they are subgrantees to the State agency serving as the grantee to FEMA?

Answer: Not usually. State agency issues should be addressed in the State Mitigation Plan, and potential projects or funded activities should be included in the plan. The State has two options for addressing other State agency mitigation issues in a plan. The preferred option is to ensure participation in the State mitigation planning process by requiring each participating agency to sign-off on the State Mitigation Plan as a condition of mitigation project grant funding. State agencies should identify issues of particular interest to them, summarizing any specific projects, activities, or mitigation commitments in a brief document that can be an addendum to the State Mitigation Plan. The second option is: if agencies do not participate in the statewide planning process, then they must prepare a separate plan in order to be eligible for mitigation project grant funding.

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Appendix C

Community Resolutions (Examples)

- For creation of Mitigation Workgroup
- For joining the Mitigation Workgroup
- For DuPage County to adopt this Plan
- For communities to adopt this Plan

R E S O L U T I O N

SM-0008-12

DuPage County Natural Hazards Mitigation Plan
Work Group Participation

Whereas the County of DuPage is subject to natural hazards, such as, floods, earthquake, tornadoes, severe winter and summer storms that can damage property, close businesses, disrupt traffic, and present a public health and safety hazard; and

Whereas DuPage County is undertaking a natural hazards mitigation plan for the County; and

Whereas the County has invited the Cities and Villages located within DuPage County to participate in and benefit from this planning effort; and

Whereas several Federal programs require that DuPage County have an adopted hazard mitigation plan to qualify for their benefits;

Now, therefore, be it resolved that:

1. DuPage County hereby states its interest in coordinating the County's mitigation planning process.

2. County Staff is hereby appointed as our representative on the County's Mitigation Workgroup. He/she is charged with:

   a. Attending the regular meetings of the County's Mitigation Workgroup;

   b. Keeping County staff and this Board informed of the Workgroup's activities and recommendations;

   c. Assisting the County's efforts to collect information about the hazards facing the Cities, Villages, and Unincorporated areas of DuPage County and our current policies and programs that can mitigate the impacts of those hazards; and

   d. Obtaining input from County staff on mitigation issues relevant to their work.

3. When the County's Mitigation Workgroup has completed its work and presents its recommended plan, this Board will review it with the intention of adopting all or parts of it. It is understood that this resolution of commitment to participate in the planning process does not constitute a commitment to enact the recommended plan.

BE IT FURTHER RESOLVED that the County Clerk be directed to transmit certified copies of this **Resolution …..**

Enacted and approved this 8th day of August 2012 at Wheaton, Illinois.

_____

Daniel Cronin, Chairman
DuPage County Board

ATTEST: _____

Gary A. King, County Clerk

Community Resolution to Join Workgroup:

Resolution No. _____

Whereas the City/Village of _____ is subject to natural hazards, such as, floods, earthquake, tornadoes, winter and summer storms, and manmade hazards, such as, utility disruption and transportation incidents; and

Whereas the DuPage County is undertaking a natural hazards mitigation plan for the County; and

Whereas the County has invited the City/Village of _____ to participate in and benefit from this planning effort; and

Whereas several Federal programs require that the City/Village of _____ have an adopted hazard mitigation plan to qualify for their benefits;

Now, therefore, *be it resolved* that:

1. The City/Village of _____ hereby states its interest in participating in the County's mitigation planning process.

2. _____ is hereby appointed as our representative on the County's Mitigation Workgroup. He/she is charged with:

a. Attending regular meetings of the County's Mitigation Workgroup;

b. Keeping City/Village staff and this Council/Board of Trustees informed of the Workgroup's activities and recommendations;

c. Assisting the County's efforts to collect information about the hazards facing the City/Village of _____ and our current policies and programs that can mitigate the impacts of those hazards; and

d. Obtaining input from City/Village staff on mitigation issues relevant to their work.

3. When the County's Mitigation Workgroup has completed its work and presents its recommended plan, this Council/Board of Trustees will review it with the intention of adopting all or parts of it. It is understood that this resolution of commitment to participate in the planning process does not constitute a commitment to enact the recommended plan.

ADOPTED this the _____ day of _____, 2012

_____
Clerk of the City/Village of _____, Illinois

APPROVED this the _____ day of _____, 2012

_____
Mayor/President of the City/Village of _____, Illinois

DuPage County Resolution to Adopt Mitigation Plan and Continue Workgroup:

R E S O L U T I O N
SM-____-12

Adoption of the
DuPage County Natural Hazards Mitigation Plan
and
Continuation of the Natural Hazard Mitigation Workgroup

Whereas the County of DuPage is subject to natural hazards, such as, floods, severe summer and winter storms tornadoes, extreme heat events; and

Whereas natural hazards can damage property, close businesses, disrupt traffic, can threaten lives, and present public health and safety hazards; and

Whereas the DuPage County Hazard Mitigation Workgroup, created by resolution of the DuPage County Board of Commissioners, has prepared the DuPage County Natural Hazards Mitigation Plan that reviews the County's options to protect people and reduce damage from the hazards; and

Whereas the County has participated in the development of the DuPage County Natural Hazards Mitigation Plan; and

Whereas the recommended DuPage County Natural Hazards Mitigation Plan has been presented for review by residents, federal, state and regional agencies;

Now therefore, be it resolved that:

1. The DuPage County Natural Hazards Mitigation Plan is hereby adopted as an official plan of DuPage County.

2. The DuPage County Natural Hazards Mitigation Plan identifies a series of action items. The following action items are hereby assigned to the noted department, division or office of the County. The designated department, division or office shall be responsible for the implementation of the action item, provided that resources are available, by the deadline listed in the Plan.

a. Plan Monitoring and Maintenance (Homeland Security and Emergency Management)
b. Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating (Building Department)
c. Urban Forestry - Participation in Tree City USA (Public Works Department)
d. Community Rating System Participation (Stormwater Management Division)
e. Property Protection Projects (Stormwater Management Division)
f. Continued Watershed Management (Stormwater Management Division)
g. Structural Flood Control Projects (Stormwater Management Division)
h. Stream Maintenance Programs (Stormwater Management Division)
i. Participation in StormReady (Homeland Security and Emergency Management)
j. Identification of Floodplain Structures Stormwater Management Division)
k. Review of Critical Facilities (Homeland Security and Emergency Management)
l. Development of Flood Stage Maps (Stormwater Management Division)
m. Seek Mitigation Grant Funding for Additional Mitigation Planning Cost Beneficial Projects (Stormwater Management Division)
n. Development of a Public Information Strategy (Stormwater Management Division)
o. Property Protection References (Stormwater Management Division)

3. The DuPage County Hazard Mitigation Workgroup is hereby established as a permanent advisory body. It shall be comprised of representatives from:

a. The County's emergency management, stormwater management, Public Works, GIS and any other office that might be directly involved in the implementation of the Plan's action items as determined by the lead agency.

b. Those municipalities that pass a resolution to adopt the DuPage County Natural Hazards Mitigation Plan and send a representative to attend the meetings of the Workgroup.

c. Representatives of other interested agencies and organizations and associations appointed by the Chair of the County Board of Commissioners to represent stakeholders in hazard mitigation and the general public.

3. The Workgroup shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the DuPage County Natural Hazards Mitigation Plan. It shall meet at least once each year to review the status of ongoing projects.

4. The schedule of Workgroup meetings shall be posted in appropriate places. All meetings of the Workgroup shall be open to the public.

5. The Workgroup shall prepare an annual report of the DuPage County Natural Hazards Mitigation Plan for the County Board and the municipalities. The report will cover the following points:

a. A review of the original plan.

b. A review of the natural or manmade disasters that occurred during the previous calendar year.

c. A review of the action items in the original plan, including how much was accomplished dint eh previous year.

d. A discussion of why action items were not completed or why implementation is behind schedule.

e. Recommendations for new projects or revised action items. Such recommendations shall be subject to the approval of the County Board and the affected municipality's governing bodies as amendments to the Plan.

6. The Workgroup shall update the DuPage County Natural Hazards Mitigation Plan every five years, according to requirements provided by the Federal Emergency Management Agency, for the consideration of the County Board and the participating municipalities.

BE IT FURTHER RESOLVED that the County Clerk be directed to transmit certified copes of this Resolution …___ to the Illinois Emergency Management Agency in Springfield, Illinois, and the Federal Emergency Management Agency in Chicago, Illinois.

Enacted and approved this ___ day of _____ 2012 at Wheaton, Illinois.

_____

Dan Cronin, Chairman
DuPage County Board

ATTEST:_____

Gary A. King, County Clerk

Community Resolution to Adopt Mitigation Plan:

Resolution No. _____

Whereas the City/Village of _____is subject to natural hazards, such as, floods, severe summer and winter storms tornadoes, extreme heat events, and

Whereas natural hazards can damage property, close businesses, disrupt traffic, can threaten lives, and present public health and safety hazards; and

Whereas the DuPage County Natural Hazards Mitigation Workgroup has prepared a recommended *DuPage County Natural Hazards Mitigation Plan* that reviews the City/Village's options to protect people and reduce damage from the hazards; and

Whereas the City/Village has participated in the development of the *DuPage County Natural Hazards Mitigation Plan*; and

Whereas the recommended *DuPage County Natural Hazards Mitigation Plan* has been presented for review by residents, federal, state and regional agencies;

Now therefore, be it resolved that:

1. The *DuPage County Natural Hazards Mitigation Plan* is hereby adopted as an official plan of the City/Village.

2. The *DuPage County Natural Hazards Mitigation Plan* identifies a series of action items. The following action items are hereby assigned to the noted person or department of the City/Village. The designated person or department shall be responsible for the implementation of the action item, provided that resources are available, by the deadline listed in the Plan.

A. Improvement of Building Code Effectiveness Grading Schedule (BCEGS) Rating
B. Urban Forestry - Participation in Tree City USA
C. Community Rating System Participation
D. Community Rating System Information Workshop
E. Property Protection Checklist
F. Property Protection Projects
G. Continued Watershed Management
H. Structural Flood Control Projects
I. Stream Maintenance Programs
J. Participation in StormReady:
K. Identification of Floodplain Structures:
L. Review of Critical Facilities
M. Development of Flood Stage Maps:
N. Seek Mitigation Grant Funding for Additional Mitigation Planning Cost Beneficial Projects

O. Development of a Public Information Strategy
P. Property Protection References

3. [_____ name] is hereby appointed as the City/Village's representative on the DuPage County Natural Hazards Mitigation Workgroup. The offices charged with implementation of action items in Section 2 shall keep the representative advised of their progress and recommendations.

ADOPTED this the _____ day of _____, 2012.

_____Clerk

APPROVED this the _____ day of _____, 2012

_____Mayor/Village President