Village of Gurnee, Illinois
Flood Mitigation Plan

Adopted December 3, 2001

Flood Mitigation Planning Committee

Village of Gurnee, Illinois

Flood Mitigation Plan

Contents

Acknowledgments

This Flood Hazard Mitigation Plan was prepared under the guidance of the Village of Gurnee's Flood Mitigation Planning Committee. The members of the Committee are noted on page 1–2 .

This *Plan* was conducted under contract to the Lake County Stormwater Management Commission.

Financial and technical support was provided by the Lake County Stormwater Management Commission, Libertyville, Illinois.

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Illustrations

Except as noted, all photographs and illustrations are from FEMA, the Lake County Stormwater Management Commission, or French & Associates.

Chapter 1. Introduction

1.1. Background

The Village of Gurnee has several floodplains within its corporate limits, but the major flood problem is concentrated along the Des Plaines River. This area has always flooded. Recent damaging floods occurred in 1938, 1960, 1979, 1986, 1993, and 2000.

The Des Plaines' floodplain is the historical core of Gurnee. At one time, it included the original downtown businesses, the Village Hall, the Police and Fire Stations, many single family homes, the Gurnee Grade School, and the preserved house of one of the earliest settlers. The area deserved protection, so over the years, the Village implemented measures to protect its residents and businesses from flooding and from financial losses due to floods. These include:

Downtown Gurnee, 1986

- Joining the National Flood Insurance Program in 1980 so that property owners could purchase flood insurance to protect their properties from losses due to flooding,
- Adopting floodplain development regulations in 1980 and strengthening them in later years,
- Adopting an abbreviated flood hazard mitigation plan and flood response plan following the flood of 1986,
- Acquiring floodprone properties as they become available for sale,
- Acquiring floodprone properties as they become available for sale, and
- Relocating the Village Hall and other services to flood free sites.

One of the outcomes of the 1986 flood was new state legislation that authorized county stormwater management agencies in Northeastern Illinois. Gurnee's Mayor, Richard Welton, was one of the leading forces in creating the Lake County Stormwater Management Commission (SMC) and served as Chairman for its first 10 years.

SMC has recently initiated a program to prepare flood mitigation plans, with particular attention to reducing losses in repetitively flooded areas. Rather than use a single approach, such as a flood control project, this planning effort encourages a variety of approaches, including acquisition, floodproofing, flood warning, channel maintenance, public information, and various types of regulations for new development.

Because of Gurnee's repetitive flood history, recent mitigation activities and interest in flood loss reduction, SMC selected the Village as a pilot for a community-wide plan. SMC provided the funds and technical support and the Village provided the staff support for the preparation of this *Flood Mitigation Plan*. The objective of the plan is to guide flood protection activities for the next 5 – 10 years and ensure that the Village implements flood related activities that are most effective and appropriate for the situation.

Simply stated, a flood mitigation plan is the product of a rational thought process that reviews alternatives and selects and designs those that will work best for the community. This process is the opposite of making quick decisions based on inadequate information. This Flood Mitigation Plan offers carefully considered directions to the Village of Gurnee by studying the overall flood potential and ensuring that public funds are well spent.

1.2. Mitigation Planning Committee

This *Flood Mitigation Plan* was developed under the guidance of a Flood Mitigation Planning Committee. A resolution was passed on June 4, 2001, by the Village Board of Trustees that formally recognized the planning process and created the Committee. The resolution named the members, ensuring that at least half of them represented residents and stakeholders from the floodprone area (see box).

Flood Mitigation Planning Committee

Ben Martindale, Chair	Grade School District 56
Jeanne Balmes	Village Trustee
Kristina Kovarik	Village Trustee
George Johnson	Resident
Susan Stoodt	Resident
Dick Bury	Resident
Elmer Fallos	Resident
Shawn Depke	Business property owner
Bradly Burke	Assistant Village Administrator
Carl Peter	Public Works Department
Fred Friedl	Fire Department
Tracy Velkover	Planning Department
Chuck Balling	Gurnee Park District
Jason Obergfell	Lake County Stormwater Management Commission

The committee met during the summer of 2001. It reviewed the flood problems, considered a variety of ways to reduce and prevent flood damage, and recommended the most appropriate and feasible measures for implementation.

Technical support for the planning effort was provided by Village staff, the Lake County Stormwater Management Commission and French & Associates, Ltd., a flood mitigation consulting firm.

Planning Approach: The Mitigation Planning Committee followed a standard 10-step process, based on guidance and requirements of the Federal Emergency Management Agency (FEMA). This process is summarized in the flow chart on the next page.

Public Involvement: After it's organizational meeting, the Committee's first job was to obtain input from the public, particularly floodplain residents. This was done through several concurrent means, including:

Questionnaire: A one-page questionnaire was sent to all properties in the floodplain on June 5. The questionnaire asked about the respondents' flood history, what steps they had taken to protect themselves from flooding, and what suggestions they had for the Village's program. One-third of the questionnaires were returned. The Village sent a follow up letter and questionnaire on July 20. The final response rate was 65%. The results are discussed in later chapters.

Planning Committee meeting

Planning Committee: Residents were encouraged to provide input through their representative on the Committee. They were also invited to attend meetings and provide their comments and concerns. An average of five residents attended the Committee meetings.

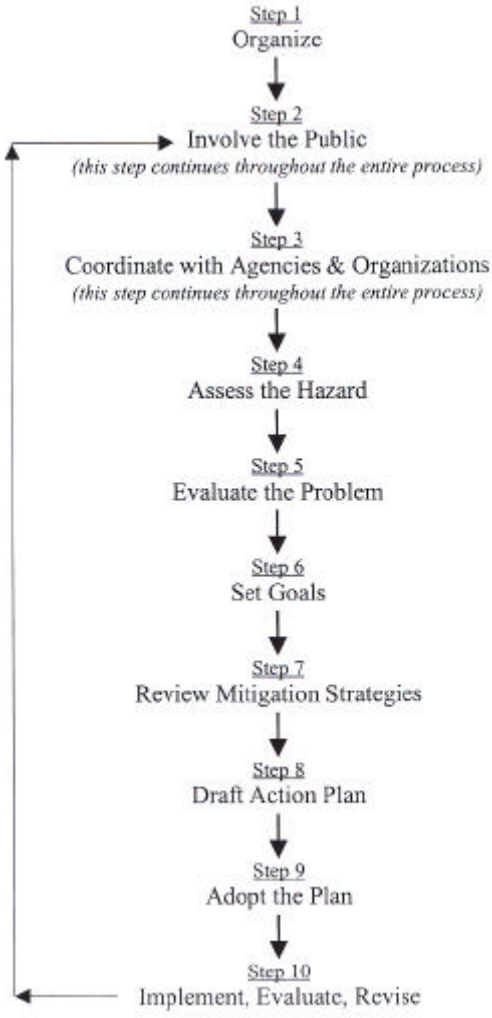
Web site: The Village's web site (www.gurnee.il.us) posted a flood mitigation link on its home page. The mitigation page included background information on the planning process, meeting times, planning committee minutes, and other relevant information.

Newspapers and newsletter: Several newspapers carried articles on the planning effort. The Village's newsletter, "Keeping Posted" had an article on the plan and requested public input.

Public meeting: A public meeting was scheduled for November 12, 2001, to explain and receive comments on the draft recommended plan.

Coordination: During the planning process, contacts were made with agencies and organizations to determine how their programs affect or could support the Village's flood mitigation efforts. These are listed on the next page. At the end of the planning process, each of these agencies was sent a copy of the draft plan and asked to comment in time for the November 12 public meeting.

Mitigation Planning Process



Organizations Contacted During The Mitigation Planning Process

Village of Gurnee
Fire (Emergency Management)
Engineering
Public Works
Planning
Building

Private Organizations
American Red Cross
Mayor's Business Luncheon
Warren Township Historical Society
Canadian Pacific Railroad
Six Flags Great America

Regional Agencies
Gurnee Park District
Lake County Forest Preserve District
Lake County Planning and Zoning
Lake County Stormwater Management Commission
Lake County Soil and Water Conservation District
North Shore Sanitary District

State Agencies
IL Emergency Management Agency
IL Department of Natural Resources
IL State Water Survey

Federal Agencies
FEMA
U.S. Geological Survey
U.S. Army Corps of Engineers

Goals: The Committee conducted a goal setting exercise at one of its meetings. The goals were then drafted and revised at subsequent meetings. The results are discussed in Chapter 3 of this *Plan*.

Mitigation Strategies: Everything that could affect flood damage in Gurnee was considered by the Mitigation Planning Committee. The technical support experts ensured that time was not wasted on irrelevant activities, but the process was not limited to just a few alternatives such as a levee or acquisition project.
The Committee's work and the subsequent plan document explored six general strategies for reaching the goals. These strategies are the subject of Chapters 4 – 9 in this *Plan*.

- preventive – e.g., zoning, floodplain, stormwater, and other ordinances
- structural projects – e.g., levees, reservoirs, channel improvements
- property protection – e.g., relocation, floodproofing, insurance
- emergency services – e.g., warning, sandbagging, evacuation
- natural resource protection – e.g., wetlands protection, best management practices
- public information – e.g., outreach projects, technical assistance

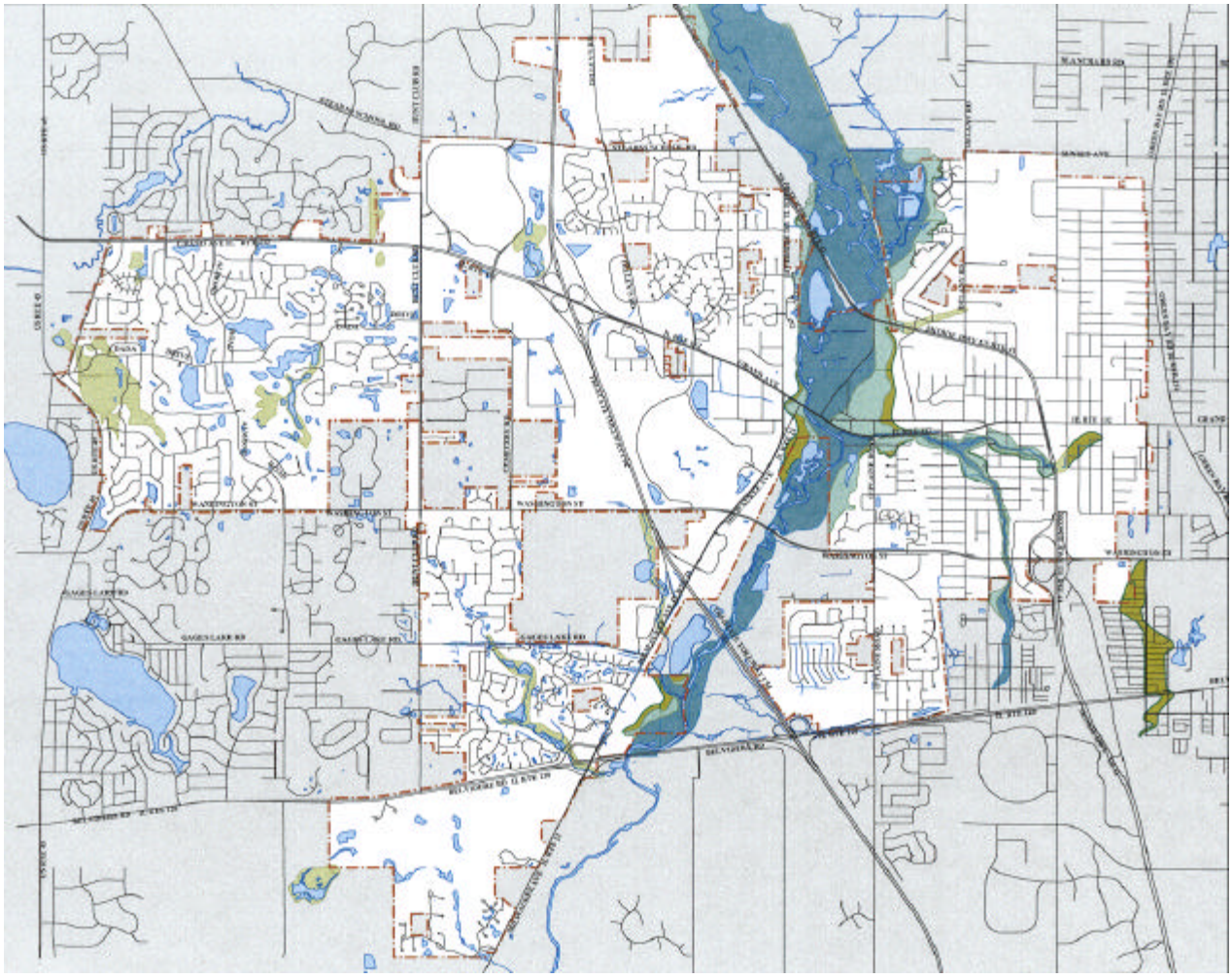
After the many alternatives were reviewed, the committee drafted an "action plan" that specifies recommended projects, who is responsible for implementing them, and when they are to be done. The action plan is included in the last chapter of this *Flood Mitigation Plan*.

It should be noted that this plan recommends flood mitigation measures that should be pursued. Implementation of these recommendations depends on adoption of this plan by the Gurnee Village Board and the cooperation and support of the offices designated as responsible for each action item.

1.3. Planning Area

The map below shows all of Gurnee's mapped floodplains as they appeared on FEMA's 1996 Flood Insurance Rate Map. They include the main stem of the Des Plaines River and several tributaries. The newer parts of Gurnee, west of the Des Plaines River were developed after the first floodplain maps were published. In some cases, development was kept out of these floodplains and they are occupied by golf courses.

Gurnee's Floodplains (1996 FEMA Data)

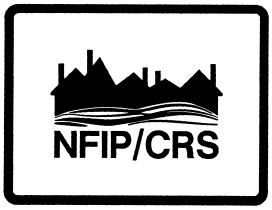


Note: The FEMA floodplain boundaries were revised in 2001, but the new areas have not yet been included in the Village's geographic information system (GIS). The ponding areas in the western half of Gurnee are now smaller and do not include any buildings. They have been reserved for golf courses and wetlands. Because they are preserved as open space, they are not included in this *Flood Mitigation Plan*.

In the far western part of the Village, areas were filled to allow development along the streets. Most of the floodplains were not affected and they are preserved as open space. The map was later revised to reflect these changes.

There are buildings only in the mapped floodplains in the older parts of the Village: on the main stem and the two tributaries that flow from the east. This is the planning area for the flood portions of this *Plan*. It is bounded by the corporate limits on the north and south, Riverside Drive/Highway 21 on the west, and Delany Road on the east. The planning area is shown at a better scale on the map on page 2-3.

This *Plan* reviews other natural hazards, such as tornados. and winter storms. Because these hazards are not limited to a particular locale, the planning area for them is the entire Village.



1.4. The Community Rating System

The Federal Emergency Management Agency's National Flood Insurance Program (NFIP) administers the Community Rating System (CRS). Under the CRS, flood insurance premiums for properties in participating communities are reduced to reflect the flood protection activities that are being implemented.

A community receives a CRS classification based upon the credit points it receives for its activities. It can undertake any mix of activities that reduce flood losses through better mapping, regulations, public information, flood damage reduction and/or flood warning and preparedness programs.

There are ten CRS classes: class 1 requires the most credit points and gives the largest premium reduction; class 10 receives no premium reduction (see table). A community that does not apply for the CRS or that does not obtain the minimum number of credit points is a class 10 community.

Community Rating System Premium Reductions

Class	Premium Reduction In Floodplain	Premium Reduction Outside Floodplain
1	45%	10%
2	40%	10%
3	35%	10%
4	30%	10%
5	25%	10%
6	20%	10%
7	15%	5%
8	10%	5%
9	5%	5%
10	0	0

As of April 1, 2001, there were 931 communities in the United States in the CRS. Twenty-seven Illinois communities participate, including the following Lake County and Des Plaines River cities:

- Lincolnshire (Class 7)
- Deerfield (Class 8)
- Wheeling (Class 8)
- Northbrook (Class 8)
- Prospect Heights (Class 9)
- Mount Prospect (Class 8)
- Des Plaines (Class 8)

There are over 19,000 communities in the NFIP. At first glance, having only 5% in the CRS looks like a low participation rate. However, these 931 cities and counties represent over 66% of all flood insurance policyholders. CRS communities have the bulk of the nation's flood problems.

Program incentive: The CRS provides an incentive not just to start new programs, but to keep them going. If Gurnee were to join the CRS, there are two requirements that would "encourage" the Village to implement flood mitigation activities.

First, the Village would receive CRS credit for this plan when it is adopted. To retain that credit, though, the Village must submit an evaluation report on progress toward implementing this plan to FEMA by October 1 of each year. That report must be made available to the media and the public.

Second, the Village must annually recertify to FEMA that it is continuing to implement its CRS credited activities. Failure to maintain the same level of involvement in flood protection can result in a loss of CRS credit points and a resulting increase in flood insurance rates to residents.

It is expected that this undesirable impact of loss of CRS credit for failure to report on the plan's progress or for failure to implement flood loss reduction projects will be a strong encouragement for the Village to continue implementing this plan in dry years when there is less interest in flooding.

Chapter 2. Problem Description

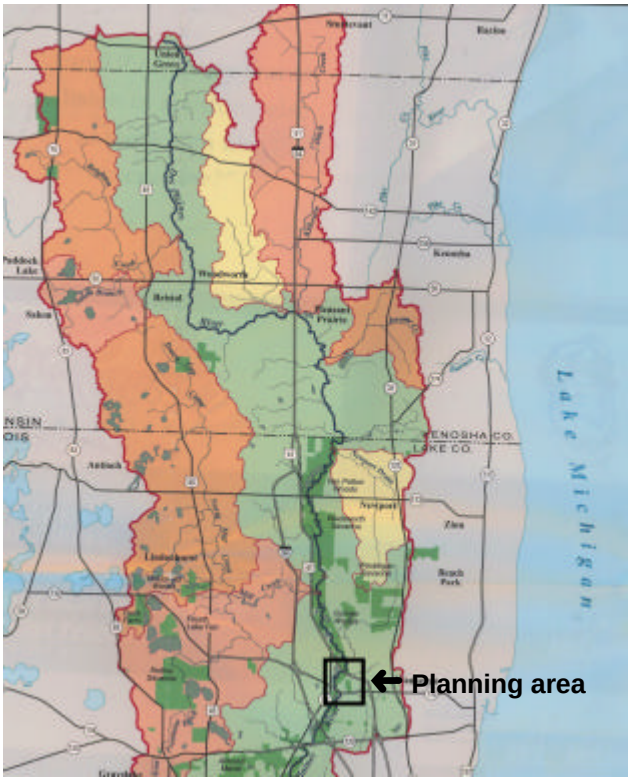
2.1. Source of Flooding

The frequency and extent of flooding in Gurnee depends on three factors: precipitation, the condition of the watershed, and obstructions in the river channel and floodplain.

Precipitation: The Gurnee area receives an average of 32 – 36 inches of rain each year, including an annual average of 39 inches of snow (generally, 7 inches of snow has the equivalent water content of one inch of rain). However, it is not spread out evenly over the year. The amount of rain that falls varies from storm to storm and varies over an area.

Watershed: A "watershed" is an area of land that drains into a lake, stream or other body of water. The runoff from rain is collected by the 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.

Gurnee is subject to flooding from the main channel of the Des Plaines River. The watershed for the Des Plaines River upstream of Gurnee includes areas of Racine and Kenosha Counties, Wisconsin, and Lake County, Illinois. The watershed at the Gurnee gage on Highway 120 is 232 square miles.



Des Plaines River watershed above Gurnee

The condition of the watershed affects what happens to the rain. For example, more rain will run off if the terrain is steep, if the ground is already saturated from previous rains, if the watershed is covered with lots of pavements and parking lots, or if depressional storage areas have been filled in. Most of the watershed that drains to Gurnee is in agricultural land, but more and more is being converted to residential and urban uses.

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 man made. Natural obstructions, like log jams, can be cleared out or are washed away during floods. The greater problem is man made obstructions, which tend to be more permanent. There are a few permanent obstructions in the Gurnee area. They are discussed in later sections of this chapter and 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 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 wrong. 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 to not have a 50-year flood over the course of 100 years.

The Des Plaines river has been subject to several different flood studies. The official floodplain study for insurance and regulatory purposes is the *Flood Insurance Study* for Lake County by the Federal Emergency Management Agency (FEMA).

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

Time 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.

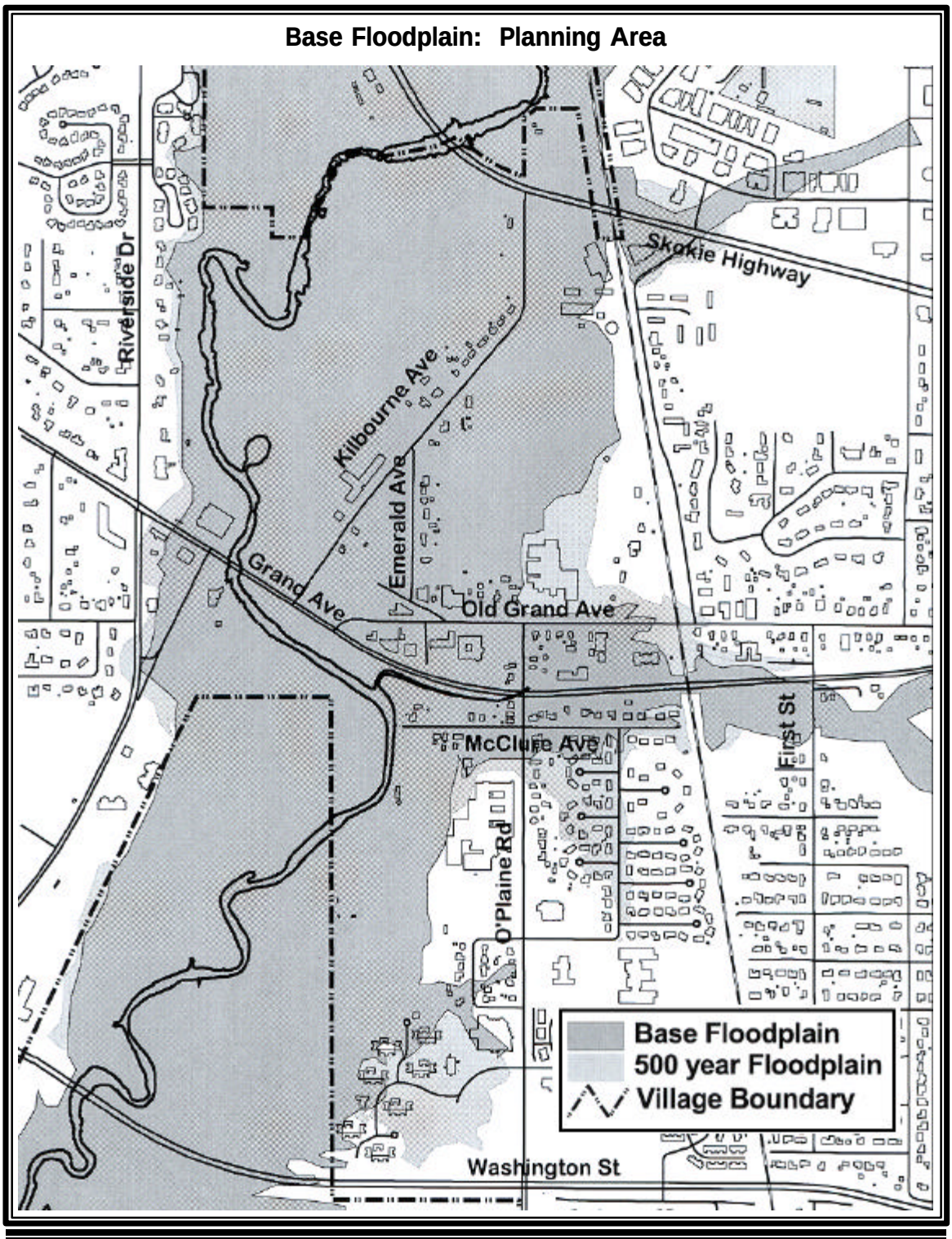
FEMA uses the "base" flood as the basis for its regulatory requirements and flood insurance rate setting. This plan and the Lake County Stormwater Management Commission use the base flood, too.

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.

Another term used is the "500-year flood." This has a 0.2% 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.

Gurnee's floodplain: The area inundated by the base flood is the "base floodplain." FEMA maps also call this the Special Flood Hazard Area or A Zone. The base floodplain for the Des Plaines River in Gurnee is shown in the map below.

The 500-year flood is 2 – 2.5 feet deeper than the base flood. Where the terrain is steep, such as just east of Riverside Drive north of Grand Avenue, the 500-year floodplain boundary is the same as the base floodplain's. In other areas, it is up to 600 feet wider than the base floodplain.



2.2. Flood Levels

Gurnee gage: Flood levels on the Des Plaines River have been recorded on the "Gurnee Gage" since 1946. This gage is located upstream of the Highway 120 bridge (see photo). It is operated and maintained by the U.S. Geological Survey (USGS).

USGS gage at Highway 120

The gage measures water levels starting from an arbitrary "stage" of zero. Records are in stage, but they can be converted to elevation above sea level. The stage of zero equates to an elevation of 650.3 feet above sea level. Water that reaches a stage of 13.0 feet at the Gurnee gage is 663.3 feet above sea level.

Highlights of historical flooding are shown in the graph to the right. The "flood of record," or highest flood in recorded history, was in September 1986.

The official "flood stage" for the Gurnee gage is 7.0 (657.3 feet above sea level). This is a somewhat arbitrary designation that reflects when the water goes out of banks. While technically the river may be flooding at flood stage, there is little flood damage until the water reaches buildings or covers roads, which happens at higher stages. One local record noted that over 27 years, water went over flood stage 21 times, but Gurnee "has experienced only 3 floods."

Flood Stages and Elevations
Des Plaines River Gage, Highway 120

Stage	Elevation	
	667.0	– 500-year flood (2000 FIS)
6.0	666.0	
15.0	665.0	– 100-year flood (2000 FIS)
14.0	664.0	– 50-year flood (2000 FIS)
13.0	663.0	
12.0	662.0	– 9/27/86 – 10-year flood (2000 FIS)
11.0	661.0	– 100-year flood (1980 FIS) – 7/4/38
10.0	660.0	– 4/3/60 – 3/22/79, 6/16/2000 – 4/22/93

Base flood elevation: The graph shows two 100-year or base flood levels, one for the 1980 Flood Insurance Study (FIS) and one for the 2000 FIS. The earlier study calculated the base flood elevation at the gage to be 661.5 feet above sea level. The 1986 flood was higher than the 100-year or base flood as calculated by the 1980 study.

A newer study of the Des Plaines River concluded that the 1980 Flood Insurance Study underestimated the true risk. There were several reasons for this:

- The newer study included more years of gage records. The later years have been wetter than the earlier ones on the records. The 100-year discharge (the amount of water coming downstream during a base flood) increased by about 35%.
- Development in the watershed converted open land to impervious surfaces at many sites. The resulting increased runoff contributed to the higher discharge.
- The newer hydraulic model (the computer model used to predict where the base flood discharge will go) is more thorough and accurate than models used in the 1970's. It was "calibrated" so that it matched the flood flows of more recent floods.
- The hydraulic model picked up a major obstruction to flood flows just downstream of Highway 120 that was missed in the mapping for the earlier study. The obstruction is a landfill. Because it includes hazardous materials, there are no plans to remove it.

According to the 1996 *Upper Des Plaines River Feasibility Report* by the U.S. Army Corps of Engineers, the 1986 flood is now rated as approximately a 20-year flood at the Gurnee gage. The relative depths of four floods at the Fire Station on Old Grand Avenue is shown in the photo to the right. Based on the 2000 Flood Insurance Study, the base or 100-year flood elevation is 1.9 feet over the garage bay floor.

Approximate flood depths at the Fire Station

The 100- and 500-year flood levels are according to the 2000 Flood Insurance Study.

2.3. Historical Flooding

As noted on the previous page, the Des Plaines River has gone overbank almost every year. The higher historical floods were in 1938, 1960, 1986 and 1979. Other than the gage heights, there are not many records readily available about these earlier floods.

1986: There is much information on the 1986 flood. Northeastern Illinois received almost one inch of rain daily from September 21 through October 4. On some days, there was as much as three inches. Over this two week period, the watershed received up to 12.9 inches of rain. This is a lot when compared to the normal monthly amount of 3 inches.

Four people were killed by the flooding in Lake County. One person drowned when his boat capsized and three people had heart attacks fighting the flood.

On September 25, the river was two feet over flood stage and high enough to reach buildings. The flooding resulted in a disaster declaration by the President on October 7. Approximately 100 buildings in Gurnee were flooded. Based on flood insurance claims, they suffered an average of $10,000 in damage.

Most severely affected were the public properties. Gurnee Grade School suffered structural damage when the northern half settled, cracking the walls and roof. The Police Station basement floor buckled from hydrostatic pressure.

The village government estimated its cost of flood fighting and reconstruction to be over $200,000. Damage to the Gurnee Grade School, the Viking Junior High School and the school district offices were estimated at $1,200,000. Damage to Park District property was estimated at $43,000.

In addition to damage to buildings and contents, businesses were closed for up to three weeks and Gurnee Grade School was not reoccupied by students for three months. The flood closed the Route 132 bridge and prevented dry land access to key buildings such as the police and fire stations and the Department of Public Works garage.

The Village Hall was flooded in 1986

The police, fire and emergency services operations had to be relocated. While the recently built fire station was high and dry, the police station suffered structural damage and Village Hall was flooded. (The Village has since relocated Village Hall out of the floodplain. The police station will be relocated in 1 – 2 years.)

1993: Steady rain in the watershed caused the Des Plaines River to rise over a period of six days in late April to crest at 660.2 feet above sea level. However, this flood level did not cause nearly as much damage as the stormwater flooding from the June and July storms (see page 2-26).

2000: On June 16, the River crested only inches higher than in 1993. However, for some reason insurance claim payments were higher. Six properties on Kilbourne, Emerald and Grand received claims that averaged over $26,000. It was a good thing that people carried insurance, because the flood was too localized to warrant a disaster declaration and there was no disaster assistance.

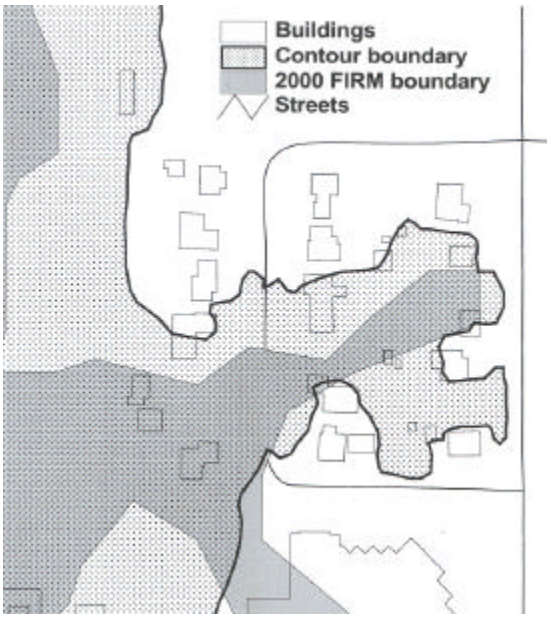
2.4. Flood Data

Floodplain: The Des Plaines River floodplain is shown on page 2-3. The base floodplain is the area that has a 1% chance of going underwater each year. The odds are higher that the lower parts of the floodplain, closer to the river, will be flooded.

Flood studies calculate flood elevations. The elevations are then transferred to maps, based on available topographic information. If the information on ground elevations are inaccurate, then the floodplain boundaries will not be accurate. During the field survey work, two areas were identified where the floodplain boundaries did not match the ground contours of the Village's recent base maps:

1. The Grove Avenue area is flooded by the tributary, north of Skokie Highway. This area was developed over the last ten years. Development included extensive grading and rerouting of surface drainage patterns. The Flood Insurance Rate Map (FIRM) reflects the pre-development contours.

2. The West Street area is flooded by the Des Plaines River. At this location, the Flood Insurance Study shows the 100-year flood elevation to be 667.4 feet above sea level. Using the Village map's ground contour information, the base floodplain boundary is substantially different from the FIRM's. This is seen in the map to the right.

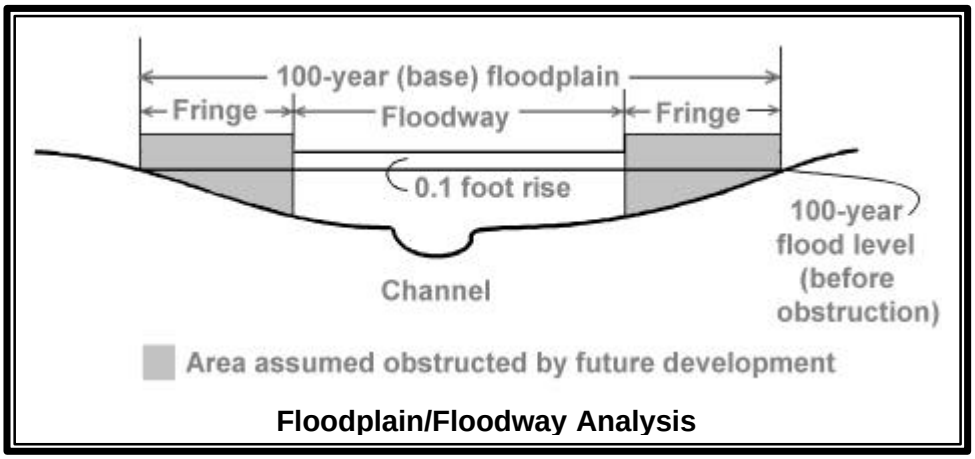


Floodplain Boundary Mapping Differences in the West Street area

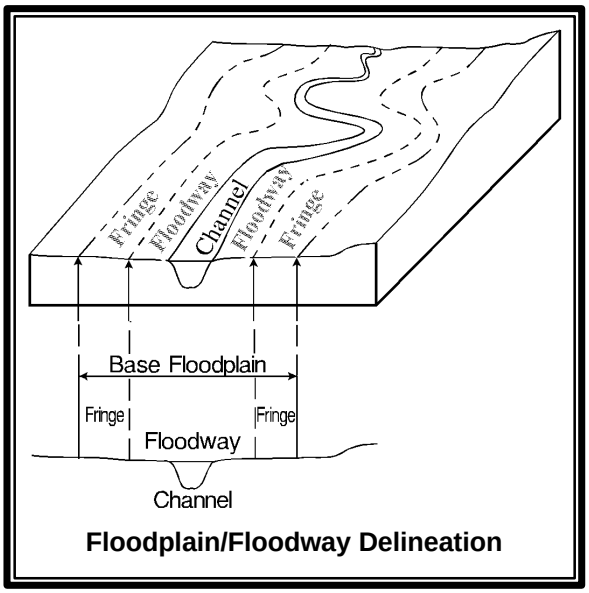
These differences are not uncommon where more accurate base maps are made after the FIRMs are prepared. However, the differences should be corrected by revising the FIRM to reflect the more accurate contour map information.

Floodway: 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.

A floodway analysis determines the boundaries of the floodway. A floodway analysis is done with a computer program that calculates the effects of development in the floodplain. Beginning at both edges of the floodplain, the computer model starts "filling" the floodplain. This "squeezes" the floodwater toward the channel and causes the flood level to rise. At the point where this causes a 1/10 foot (0.1') rise, the floodway boundaries are drawn.



Floodplain/Floodway Analysis



Floodplain/Floodway Delineation

The floodway boundaries at each cross section are then transferred to a map. The plotted points are connected to show the floodway and floodway fringe on the floodplain map. As shown on the map on the next page, most of Gurnee's floodplain is in the mapped floodway.

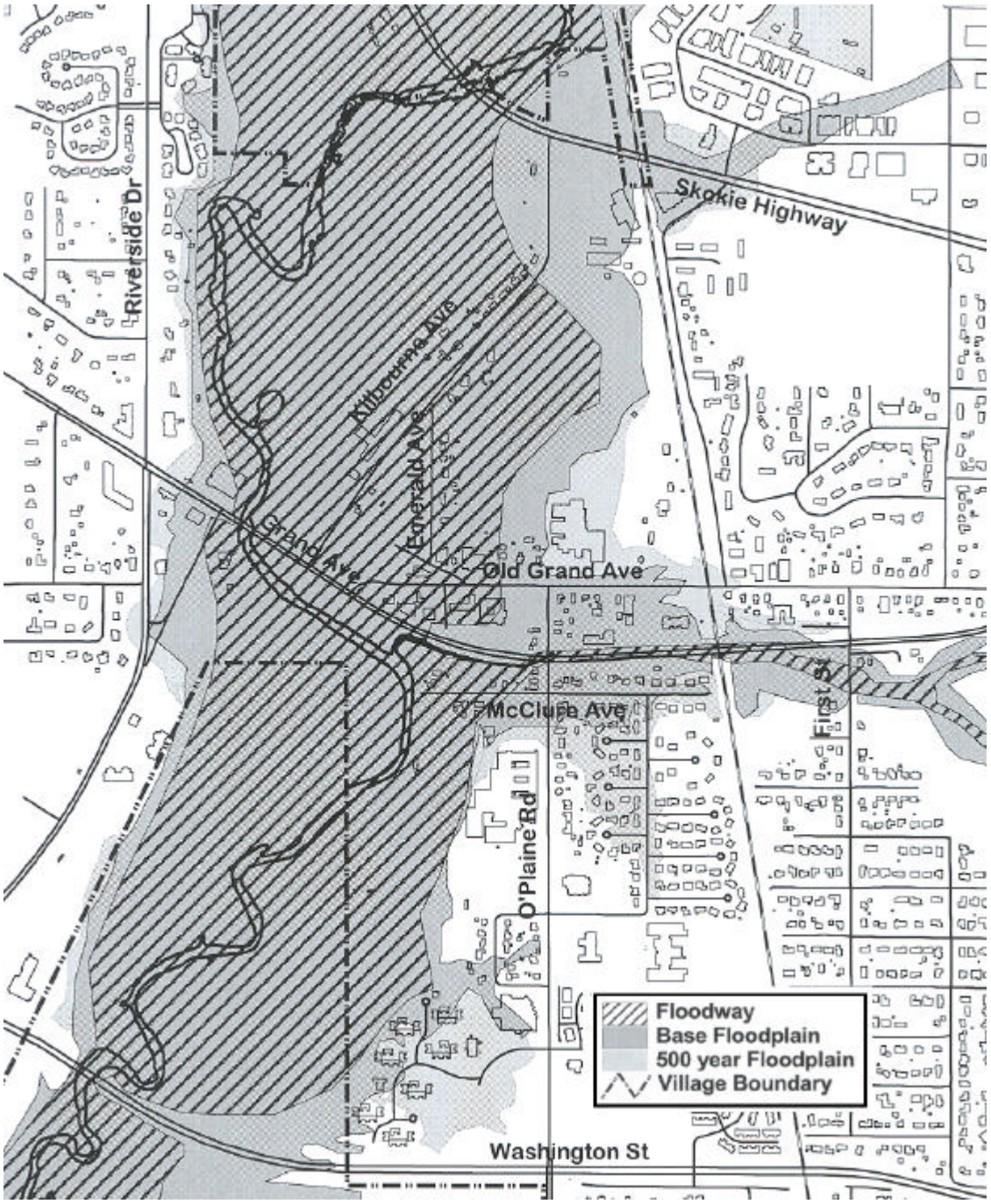
Velocity: The speed of moving water, or velocity, is measured in feet per second. Flood velocity is important to mitigation because the faster water moves, the more pressure it puts on a structure and the more it will erode stream banks and scour the earth around a building's foundation.

The FEMA Flood Insurance Study includes the "average floodway velocity" for the Des Plaines River. 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. Sites close to the channel will probably have higher velocities than this figure and sites at the fringe of the floodplain will be subject to lower velocities.

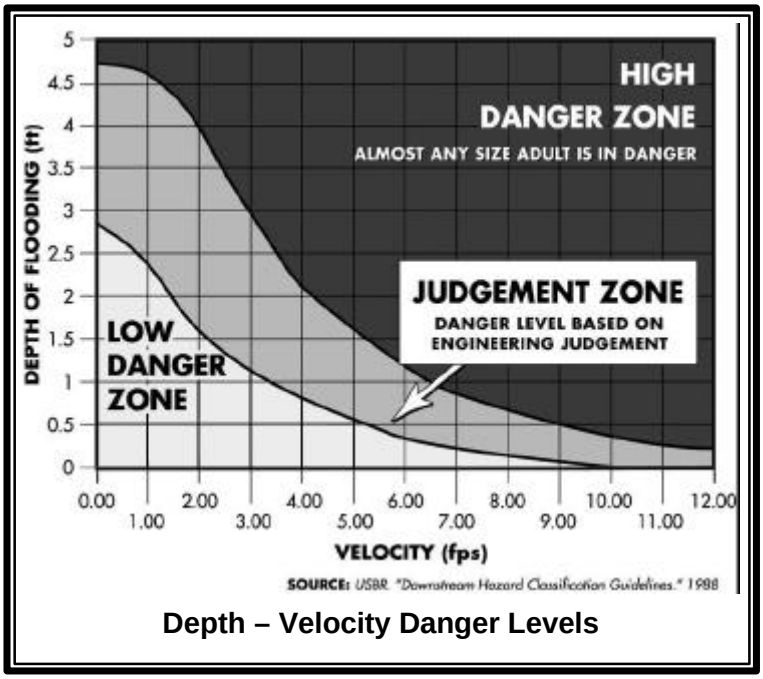
The Des Plaines River drops only 1.27 feet per mile. A stream this flat will have low velocities. For the Des Plaines River within Gurnee's corporate limits, all calculated average floodway velocities are less than one foot per second. Floodwater moving faster than five feet per second is generally considered high velocity flooding, requiring special design considerations for buildings, roads, bridges, and other manmade structures in its path. Therefore, flood velocity is a relatively low hazard in this area.

Although velocity is one factor that contributes to the potential harm of a flood, the total impact of moving water is related to the depth of the flooding. Studies have shown that deep water and low velocities can cause as much damage as shallow water and high velocities (see graph, page 2-10).

Base Floodplain and Floodway



Rate of rise: An important flood mitigation concern is how fast floodwaters rise. Fast rising floods are known as flash floods. Flash floods occur in hilly areas and in urban areas where large parts of the watershed are covered with pavement and other impervious surfaces. In these areas, stormwater runs off quickly and can cause a stream to go overbank in a few hours. That is what happened in the June 1993 flooding throughout the Village.



Depth – Velocity Danger Levels

In contrast, the Des Plaines River has a relatively slow rate of rise. In April 1993, after it reached "flood stage," the river rose at a rate of one foot per day. There is at least 24 hours of warning time for the Des Plaines River at the Gurnee gage (Highway 120).

Duration: Another concern is how long floodwaters remain up ("duration"). The longer the duration, the more damage will be done to property and the longer businesses and roads will stay closed. Floods can take several days to rise and fall on the Des Plaines River. Street and yard flooding from local storms typically last only a few hours.

2.5. Safety and Health Hazards

Safety: Gurnee has not experienced any fatalities during past floods. In the 1986 flood, four people were killed by the flooding in other parts of Lake County. One person drowned when his boat capsized and three people had heart attacks fighting the flood. 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. Victims of floods have often put themselves in perilous situations by ignoring warnings about travel or mistakenly thinking that a washed-out bridge is still there.

Electrocution is the second most frequent 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.

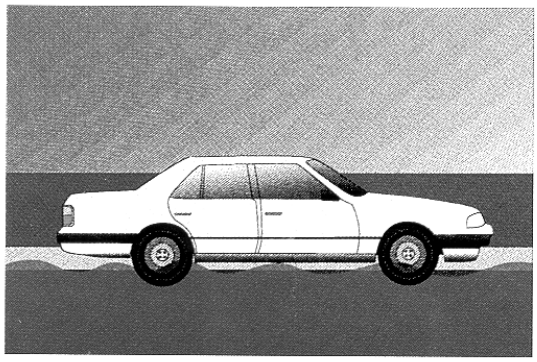
These hazards are ever present during a flood. As noted by the Fire Department's narrative after the 1993 flooding:

> The Gurnee Fire Department responded to hundreds of requests during the storms, and flooding of 1993. The majority of calls responded to by the fire department were for public safety, these calls were mainly for flooded basements and houses. These checks were done to insure that any gas or electric services were not endangered and to secure those services that were. Multiple gas services were shut off due to extinguished pilot lights, several electric services were also disconnected. Other calls responded to were wires and trees down, gasoline in basements, people trapped in the water, and lightning strikes.

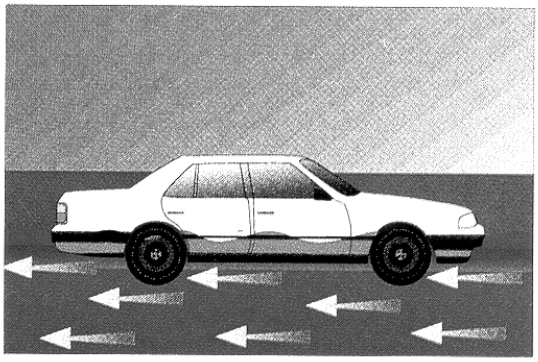
In 1981 a boy was killed playing in fast moving floodwaters in the south suburbs. The photo shows similar activity during the 1993 flood in Gurnee.

As with driving through flooded streets, safety problems can be avoided by a well-informed public. (This issue is covered in Chapter 9. Safety precautions are listed on page 9-9).

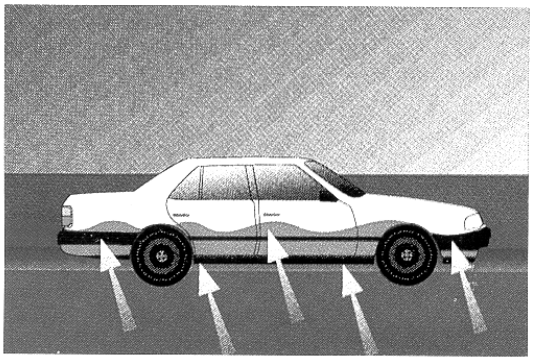
Boys playing in floodwaters, 1993



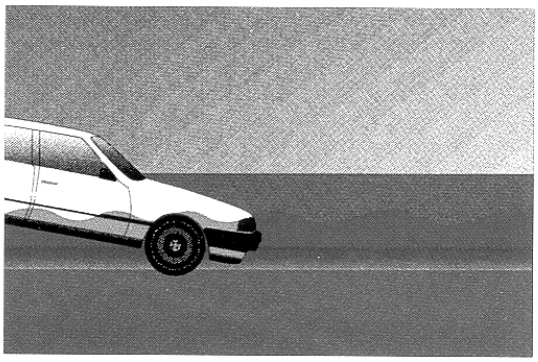
Water weighs 62.4 lbs. per cubic foot and typically flows downstream at 6 to 12 miles an hour.



When a vehicle stalls in the water, the water's momentum is transferred to the car. For each foot the water rises, 500 lbs. of lateral force are applied to the car.



But the biggest factor is buoyancy. For each foot the water rises up the side of the car, the car displaces 1,500 lbs. of water. In effect, the car weighs 1,500 lbs. less for each foot the water rises.



Two feet of water will carry away most automobiles.

Source: *Flash Floods and Floods … The Awesome Power*, National Weather Service

Effects of shallow water on cars

Health: There is no available data on health problems caused by floods in Gurnee. While such things are not reported, three general types of health problems accompany floods. The first comes from the water itself. Floodwaters carry whatever was on the ground that the upstream runoff picked up, including dirt, oil, animal waste, and lawn, farm and industrial chemicals. Pastures and areas where cattle and hogs are kept can contribute polluted waters to the receiving streams.

Flood waters saturate the ground which leads to infiltration into sanitary sewer lines. When wastewater treatment plants are flooded, there is nowhere for the sewage to flow. 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.

Post-flood silt, mold and mildew

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.

2.6. Floodprone Buildings

Building damage: Damage to buildings, especially residences, is usually a city's largest single flood problem. In a few situations, deep or fast moving waters will push a building off its foundation, but this is rare. More often, structural damage is 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. It was hydrostatic pressure that destroyed the floor of the Police Station in 1986.

Due to the relatively shallow flood depths in the Des Plaines River floodplain, the most 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.

Soaking damages most household contents

The longer these materials are wet, the more moisture, sediment and pollutants they will absorb. Walls present a special problem: a "wicking" effect pulls water up through wood and wallboard, soaking materials several feet above the actual high-water line (see photo, page 2-16).

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. As shown in the photo, 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.

Effects of soaking on walls, floors and cabinets

In June 2000, the average flood insurance claim was for $21,880 in clean up, repair and replacement costs for the building and $7,619 for the contents. These figures do not include items not covered by a flood insurance policy, such as landscaping and automobiles, and the value of lost family heirlooms.

Building count: In June, 2001, a field survey was conducted of each building in the floodplain shown on the map on page 2-3. The surveyors gathered basic data on each property, such as use, type of foundation, and first floor elevation. There are 111 buildings in Gurnee's Des Plaines River floodplain. Some of these may have two or three commercial addresses with common walls in one building. Because they have separate ownership and different uses, each address is counted as one building.

The field survey information was used to delineate 11 "clusters" of similarly situated buildings. Their general locations are shown on the map on the next page and their data are summarized below.

Planning Area Clusters

Cluster	Residential (1)		Non-Residential			Total
	Single-family	Multi-family	Com-mercial	Indus-trial	Public (2)	
GV – Grove			2	6	2	10
WG – West Grand			3		1	4
GS – Grade School					3	3
KE – Kilbourne/Emerald	20					20
DT – Downtown			9		4	13
EG – East Old Grand	8		7		1	16
MY – McClure Floodway	6	3				9
MG – McClure Fringe	13	7				20
FS – First Street	5					5
WS – West Street	5					5
BH – Brookhaven		5	1			6
Total	57	15	22	6	11	111

Parcels not in these 11 clusters are publicly owned vacant lands.

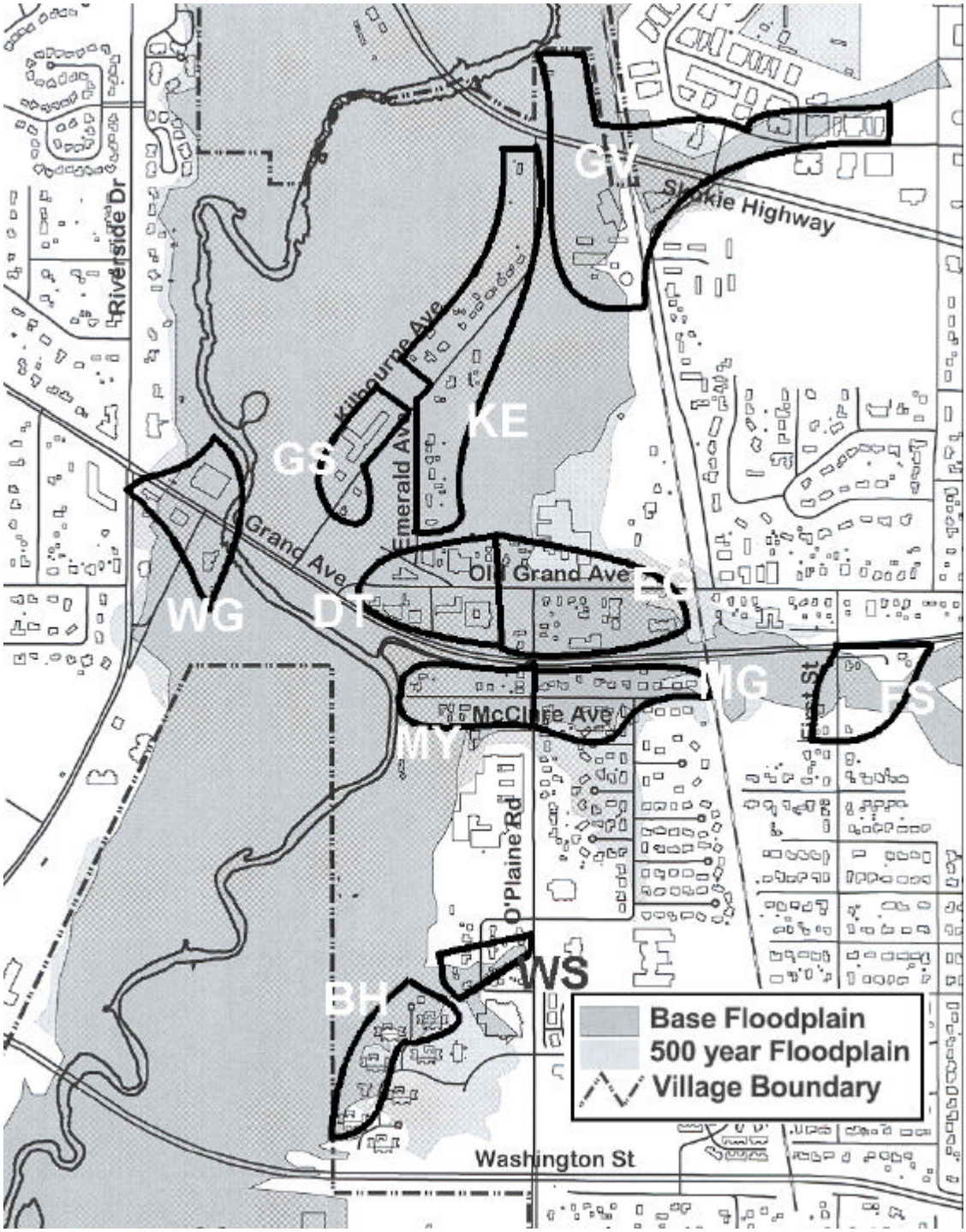
Notes: (1) The single-family residence category Includes duplexes.
(2) The public category includes private, non-profit facilities.

The table and map show that commercial properties are concentrated along Old Grand Avenue in three clusters, West Grand, Downtown and East Old Grand. Residences are in Kilbourne/Emerald, East Old Grand and all five clusters south of Grand. The industrial properties are on Grove Avenue.

Floodprone public buildings include the Gurnee Grade School, Viking School and the school bus depot next to the grade school. Village owned buildings include the Police Station/old Village Hall, Fire Station #1, water tower pump station, and Department of Public Works complex. Other buildings in the public category include the American Legion Hall, the Mother Rudd Home, and a church.

Concession stands, the band shelter, and similar structures are not considered as "buildings" because they have low damage potential and/or cannot be covered by flood insurance. These facilities are considered as open space in this plan.

Planning Clusters



Note: This map shows the FEMA mapped floodplain. The data on the buildings and clusters are based on flood elevations. Therefore, some buildings (e.g., in the West Street cluster) are considered in this *Plan*, even though they are currently mapped as outside the floodplain.

Flood depths: The three major factors in damage to buildings are flood depth, velocity, and duration. As noted earlier, velocities are relatively low, less than one foot per second. Duration can vary from flood to flood, but floodwater will stay longer in the lower buildings.

The wicking effect of water means that damage will be higher than the flood level.

Therefore, in Gurnee, the key determinant of flood damage to buildings is flood depth. Deeper flooding means:

- greater hydrostatic pressure on walls and floors,
- more of the building gets wet, and
- water will soak materials and contents for a longer time

The table below shows how deep the base flood is over the first floors of buildings. For example, in the Kilbourne/Emerald cluster, the numbers "2, 12, 6," mean the base flood is lower than the first floor of two buildings and 12 buildings will have the base flood over the first floor, but less than three feet deep. The base flood will be three feet or deeper over the first floor of six buildings. It should be noted that these figures are for the first floor. Many buildings have basements which would be completely flooded when the base flood is over the first floor.

Base Flood Depths

Cluster	Residential Buildings			Non-Residential Buildings			
	≤0'	<3'	≥3'	≤0'	<3'	≥3'	N/A
GV – Grove				2	2		6
WG – West Grand				1	3		
GS – Grade School					2	1	
KE – Kilbourne/Emerald	2	12	6				
DT – Downtown				1	5	7	
EG – East Old Grand	4	3	1	4	3	1	
MY – McClure Floodway	3	3	3				
MG – McClure Fringe	12	7	1				
FS – First Street	5						
WS – West Street	3	1	1				
BH – Brookhaven		5					1
Total	35	30	7	8	15	9	7

≤0' = the base flood is below the first floor
<3' = the base flood is less than three feet deep over the first floor
≥3' = the base flood is three feet or deeper over the first floor
N/A = base flood or building elevations not available
Note that flooding is deeper for buildings with basements, bilevels and trilevels

With this caveat in mind, it can still be concluded that the area subject to the greatest flood depth is the Downtown cluster, where the base flood will be over the first floor of all but one building and three feet or deeper over the first floor in over half the buildings.

The residential clusters most exposed to flood damage are Brookhaven, Kilbourne/ Emerald and McClure Floodway where the base flood is over the first floors of 100%, 90% and 67% of the homes, respectively. The homes in the First Street cluster are in the floodplain, but all of their first floors are above the base flood elevation.

Flood insurance payments: A readily available source of building damage data is flood insurance claim payments. FEMA has paid Gurnee property owners nearly $350,000 in 33 claim payments since 1979. Thirty claim payments were for structure damage but only 12 were for contents. Because contents are more likely to be damaged that the structure in Gurnee's slow moving, shallow floods, this statistic shows that most property owners do not have adequate contents coverage.

Flood Insurance Claims Data

Year of flood	Claims submitted	Claims paid	Average payment		Total payment
			Structure	Contents	
1979	9	7	$3,050	$950	$21,158
1986	17	16	$9,170	$3,500	$155,082
1989	1	1	$1,725	0	$1,725
1993	9	2	$4,365	0	$8,733
1996	1	1	$446	0	$446
2000	6	6	$21,888	$7,619	$161,805
Total	43	33			$348,949

Source: Federal Emergency Management Agency

The highest average payments were for the deepest flood, 1986, and the most recent, 2000. It is not clear why claim payments were so much higher in 2000.

Repetitive Losses: A "repetitive loss property" is one which has received two flood insurance claim payments for at least $1,000 each since 1978. These properties are important to the National Flood Insurance Program and its Community Rating System because they account for one-third of the country's flood insurance claim payments. 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 *Flood Mitigation Plan* meets FEMA's repetitive loss planning criteria).

Gurnee has 1 officially designated repetitive loss property. It is a commercial building in the Downtown cluster. Flood insurance claims were paid in 1979, 1986, 1989, 1993 and 2000. The Privacy Act prohibits publishing its exact location or address in a public document. Lake County Stormwater Management Commission's repetitive loss mitigation plan has identified two other similarly situated properties. This group of three is a priority for the SMC's mitigation efforts.

2.7. Critical Facilities

"Critical facilities" are not strictly defined by any agency. Generally, they fall into two categories:

- Buildings or locations vital to the flood response and recovery effort, such as police and fire stations and telephone exchanges and
- Buildings or locations that, if flooded would create secondary disasters, such as hazardous materials facilities and nursing homes.

The Mitigation Planning Committee identified the following sites that are critical during a flood in Gurnee.

The Police Station has been identified as a critical facility in the floodplain. It is in the old Village Hall which was moved to a new building on high ground after the 1986 flood. Plans are to relocate all police activities outside the floodplain by 2003.

- Fire Station #1
- Police Station
- Public Works complex
- North Shore Sanitary District treatment plant
- Water pumping station

While the fire station and public works complex may be dry during most floods, access to them can be cut off. Five sites have been identified as critical facilities because they are in the floodplain and they store large amounts of gasoline or other hazardous materials.

- Public Works complex
- Bass Pro
- Marathon gas station
- Dada's dry cleaning
- Warren Township High School

Skokie Highway, 1986 flood

When two schools were flooded and closed in 1986, there was an adverse impact on both education and the local tax base:

- Gurnee Grade School
- Viking School

There are only three bridges across the Des Plaines River in Gurnee. All three go underwater during floods, effectively dividing the Village:

- U.S. Highway 41/Skokie Highway
- State Route 132/Grand Avenue
- Washington Street

A wireless communication building is in the floodplain, next to Fire Station #1. However, it has been elevated on columns, nearly four feet above the base flood elevation. It is not considered to be threatened during a flood and is therefore not on the critical facilities list for flooding.

This wireless communication building is elevated above the base flood elevation.

2.8. Economic Impact

Businesses: Floods cause other problems that are not as easy to identify as damage to buildings and critical facilities. Businesses that are disrupted by floods often have to be closed (in 1986, they were closed for up to three weeks). They lose their inventories, customers cannot reach them. and employees are often busy protecting or cleaning up their flooded homes.

As noted in the story about Hurricane Floyd (right), most businesses are not fully insured for flood damage. A review of the 43 flood insurance claims concluded that businesses have received claims at about the same level as residences. However, while there are currently 57 residential flood insurance policies in force in Gurnee, there are only 11 "other structures" with insurance and no "small business" structures with flood insurance.

Impact of Hurricane Floyd on Businesses

A recent study completed on the businesses affected by 1999's Hurricane Floyd in North Carolina found that the average repair cost for all business sizes was $40,000 and the lost revenue per business averaged $80,000. Across the 44 counties surveyed in the report, almost 75 percent of the businesses shut down because of the storms and floods. The length of shutdown for most was between 5 and 8 days, but some never reopened.

While most businesses had liability, property and casualty and fire insurance, most were not insured for loss of revenue or floods. Less than half of the businesses surveyed after Floyd reported that their insurance covered the replacement cost of their losses. When asked what portion of their losses was covered by insurance, the average estimate was 18 percent.

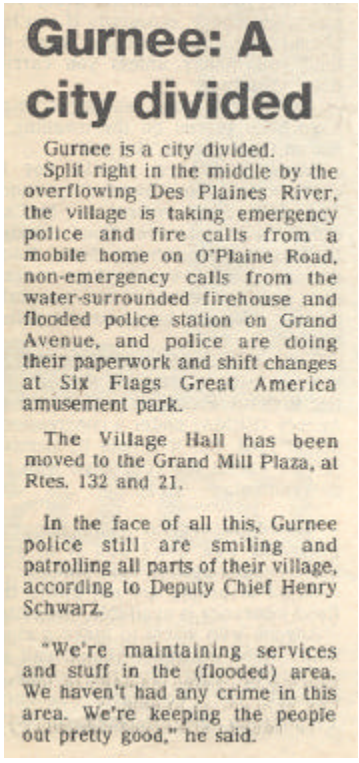
Impact on taxes: As with flooded roads, public expenditures on flood fighting, sandbags, fire department calls, clean up and repairs to damaged public property affect all residents of Gurnee. In 1979, 1986 and 1993, there were presidential disaster declarations that provided disaster assistance to local governments and non-profit organizations. Federal government handouts cannot be counted on in the future. Further, a recent law now requires that public agencies purchase insurance. The amount of insurance that should be carried will be deducted from disaster assistance payments.

Even with Federal disaster assistance, public agencies incur many expenses that must be paid by local taxpayers. For example, after the 1986 flood damaged Gurnee Grade and Viking Schools, the Federal government provided $660,000 to help with repairs. It took almost 10 years to receive the final Federal reimbursement. It actually cost the School District over $1.6 million to repair and replace the facilities, supplies and materials.

Viking School was later rebuilt as a flood protected facility for a cost of $17 million – all of which was paid by Gurnee taxpayers.

1986 flood damage to the Grade School

These dollar figures do not convey the later transportation and rental costs and the disruption that was caused to the education of the school children. For several months after the flood, students attended school in a vacant department store in the Lakehurst Shopping Center (four miles south). For the next two years, they attended school in Zion (eight miles north) while the renovation of Viking & Gurnee Grade Schools were completed. Of these millions of dollars in extra expenses, all but $660,00 were borne by the Gurnee taxpayer.



Gurnee: A city divided

Gurnee is a city divided.

Split right in the middle by the overflowing Des Plaines River, the village is taking emergency police and fire calls from a mobile home on O'Plaine Road, non-emergency calls from the water-surrounded firehouse and flooded police station on Grand Avenue, and police are doing their paperwork and shift changes at Six Flags Great America amusement park.

The Village Hall has been moved to the Grand Mill Plaza, at Rtes. 132 and 21.

In the face of all this, Gurnee police still are smiling and patrolling all parts of their village, according to Deputy Chief Henry Schwarz.

"We're maintaining services and stuff in the (flooded) area. We haven't had any crime in this area. We're keeping the people out pretty good," he said.

News Sun, October 3, 1986

Transportation: Loss of road access is a major flood impact that affects all residents and businesses in Gurnee, not just those that own property in the floodplain. This can have an impact on the Village's image, as noted in the newspaper headline from the 1986 flood.

After the 1993 flood, a study was conducted for the Village to determine the cost of closing the three bridges (U.S. 41, Grand Avenue and Washington Street) during high water. Using $.28 per mile, the length of the detour from the bridges to highway 120 (Belevidere Road), and normal traffic counts, it was found that closing the bridges cost over $106,000 per day in vehicle operating costs.

The study totaled the extra travel time and multiplied that times the median income for Lake County. The value of the lost time was computed to be $277,000. The total "economic cost" of flooded roads in Gurnee was over $383,000 per day. Because these figures were for 1993 when wages were lower and there was less traffic, the cost would be higher today. As with taxes, these costs are borne by everyone, not just floodplain residents.

Other impacts: In addition to lost income, there are costs for fighting the floods, finding temporary housing, and cleaning up. Repetitively flooded areas tend to deteriorate over time and property values go down.

2.9. Natural and Beneficial Floodplain Functions

Floodplain lands and adjacent waters combine to form a complex, dynamic physical and biological system found nowhere else. When portions of floodplains are preserved in their natural state, or restored to it, they provide many benefits to both human and natural systems.

Some are static conditions—such as providing aesthetic pleasure—and some are active processes, such as reducing the number and severity of floods, helping handle stormwater runoff and minimizing non-point water pollution. Such natural processes cost far less money than it would take to build facilities to correct flood, stormwater, water pollution, and other community problems.

Natural and Beneficial Floodplain Functions

Water Resources: resources and functions that are part of or provide a benefit to the hydrologic cycles on the earth's surface and below ground

Natural Flood and Erosion Control
- Provide flood storage and conveyance
- Reduce flood velocities
- Reduce flood peaks
- Reduce sedimentation

Water Quality Protection
- Filter nutrients and impurities from runoff
- Process organic wastes
- Moderate temperature fluctuations

Groundwater Recharge/Discharge
- Promote infiltration and aquifer recharge
- Help to maintain natural base flows instream

Biological Resources: resources and functions that benefit plants and animals

Biological Productivity
- Support high rate of plant growth
- Maintain biodiversity
- Maintain integrity of ecosystem

Fish and Wildlife Habitats
- Provide breeding and feeding grounds
- Create and enhance waterfowl habitat
- Protect habitats for rare/endangered species

Societal Resources: resources and functions that directly benefit human society

Harvest of wild and cultivated products
- Enhance agricultural lands
- Provide sites for aquaculture
- Restore and enhance forest lands

Recreational Opportunities
- Provide areas for active and passive uses
- Provide open space
- Provide aesthetic pleasure

Areas for Scientific Study and Outdoor Education
- Contain cultural resources (historic and archaeological sites)
- Provide opportunities for environmental and other studies

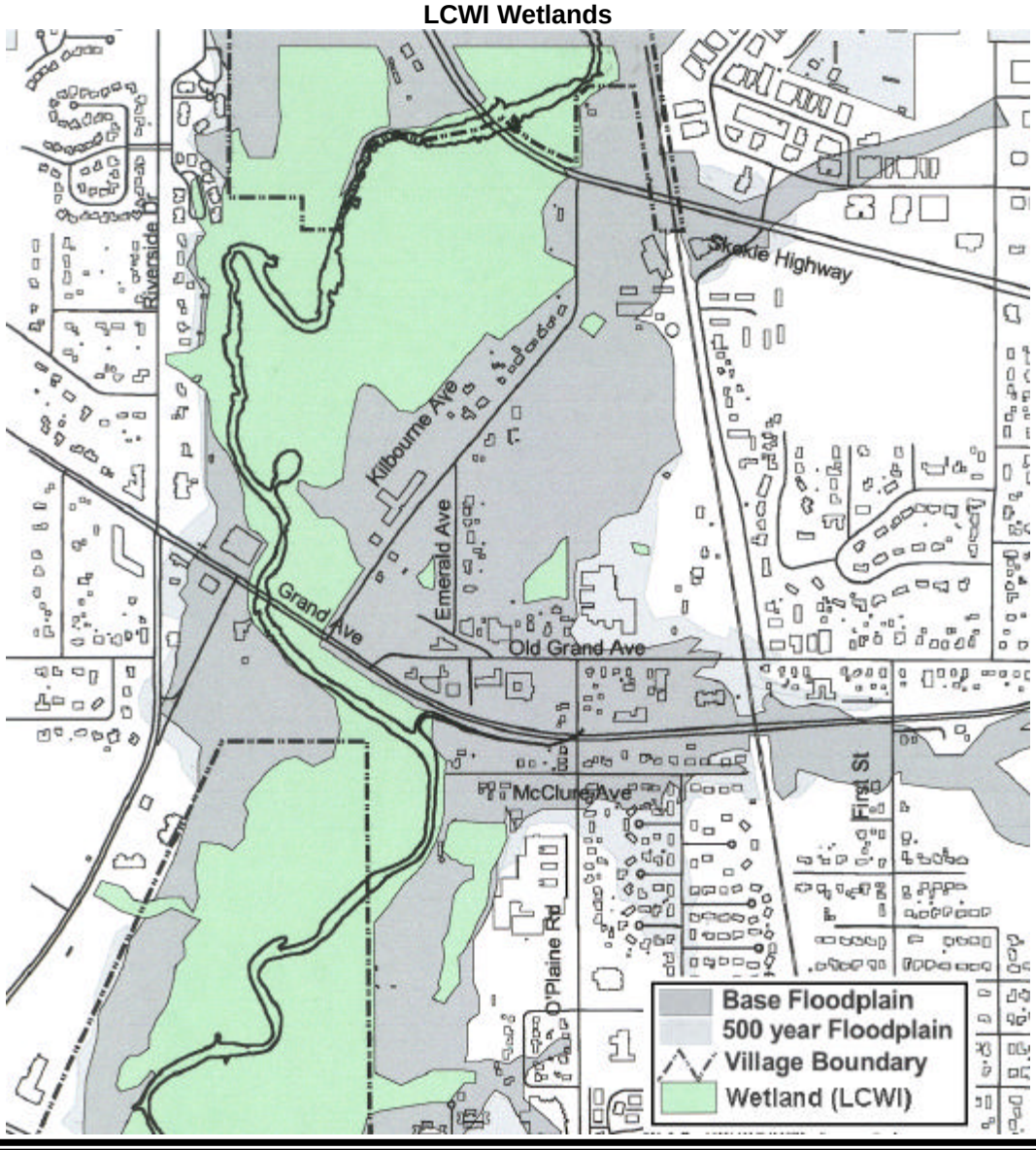
Source: *A Unified National Program for Floodplain Management*, 1994, Federal Interagency Floodplain Management Task Force, FEMA - 248.

Wetlands: One key determinant of an area's natural value is whether it is designated as a wetland. Wetlands provide habitat for species that cannot live or breed anywhere else. They reduce flood velocities and erosion. Wetland vegetation filters water, making it cleaner for those downstream.

Wetlands are identified based on soil and vegetation conditions. The Lake County Wetlands Inventory (LCWI) was completed in 1993. It identified areas important for their habitat quality, stormwater storage and water quality mitigation. As shown in the map below, much of the Des Plaines River floodplain qualifies as wetland under these criteria.

The LCWI maps are not the final determinants as to whether development on a site requires a wetland permit. The maps are based on interpretations from aerial photographs and available soils information. The final determination of whether a site is in a wetland is made by an on-site investigation of the soils and vegetation. Wetland protection is discussed more in Chapter 9.

LCWI Wetlands



2.10. Other Natural Hazards

The Village's Emergency Operations Plan and the Illinois Emergency Management Agency's Hazard Mitigation Plan identify other natural and technological hazards that can occur in Gurnee. The natural hazard with the highest risk is tornado. Those with moderate risk are drought/heat, earthquake, winter storms, severe thunderstorms (and lightning and resultant local drainage problems), excessive heat and excessive cold. Excessive cold is covered under winter storms. All of these natural hazards can occur anywhere in the Village.

Tornado: Tornadoes' destructive paths average 200 yards wide. They can move forward at up to 70 miles per hour, pause, slow down and change directions.

The winds can be intense and destructive Debris hurled by the wind ("missiles") 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 are most likely to occur in April through June. Over half hit between 3:00 and 7:00 p.m.. There are no recurrence intervals calculated for tornadoes, but the southeast half of Lake County has been identified as in a belt of "high tornado frequency."

Fifteen tornadoes have been recorded for Lake County since 1950. In April 1965, one caused a lot of property damage in the western part of Gurnee.

The tornado that struck Zion on April 19, 1996 caused enough damage to result in a Federal disaster declaration for the County. Two people were injured and damage was estimated at $6,600,000. It was rated as an F2 (see box).

Tornado Damage Categories

F0 Light: Chimneys are damaged, tree branches are broken, shallow-rooted trees are toppled.

Fl Moderate: Roof surfaces are peeled off, windows are broken, some tree trunks are snapped, unanchored mobile homes are overturned, attached garages may be destroyed.

F2 Considerable: Roof structures are damaged, mobile homes are destroyed, debris becomes airborne (missiles are generated), large trees are snapped or uprooted.

F3 Severe: Roofs and some walls are torn from structures, some small buildings are destroyed, non-reinforced masonry buildings are destroyed, most trees in forest are uprooted.

F4 Devastating: Well-constructed houses are destroyed, some structures are lifted from foundations and blown some distance, cars are blown some distance, large debris becomes airborne.

F5 Incredible: Strong frame houses are lifted from foundations, reinforced concrete structures are damaged, automobile-sized missiles become airborne, trees are completely debarked.

Tornadoes are a hazard facing Gurnee

On May 18, 1997, Gurnee had an F2 touch down. While, no damage or injuries were reported, it was a recent reminder of how exposed the Village is.

Drought: A drought is a long period of time without substantial rainfall. It is often accompanied by extreme heat (i.e., ten degrees or more above the average high). Drought is not just a problem for farmers. It impacts all water users and public water supplies.

In September 1983, all 102 counties in Illinois were proclaimed State disaster areas because of the high temperatures and low precipitation since mid-June. Northeastern Illinois was hit by drought conditions in 1988 when April through August rainfall was less than 50% of normal amounts. It was hit again in May 1992, the driest May on record in Chicago.

Excessive heat: As with drought, heat impacts people more than property. Combinations of high temperatures and high humidity are measured by a heat index. A high index means hardships for respiratory and cardiovascular systems of every person, but especially in toddlers and the elderly.

In July 1995, the heat index went as high as 125 degrees. Scattered power outages compounded the problem when electric utilities could not keep up with the record demand. There were 583 fatalities associated with the heat, 75 death certificates listed heat as the primary cause, and 508 as the secondary cause. In a sampling of 134 of the heat victims, 61% were over the age of 65, but only 2 of the 134 fatalities were toddlers. 504 of the deaths were in Chicago.

Heat Index (Apparent Temperature)

Air Temperature	Relative Humidity (%)													
		40	**45**	**50**	**55**	**60**	**65**	**70**	**75**	**80**	**85**	**90**	**95**	**100**
	110	136												
	108	130	137											
	106	124	130	137										
	104	119	124	131	137									
	102	114	119	124	130	137								
	100	109	114	118	124	129	136							
	98	105	109	113	117	123	128	134						
	96	101	104	108	112	116	121	126	132					
	94	97	100	103	106	110	114	119	124	129	135			
	92	94	96	99	101	105	108	112	116	121	125	131		
	90	91	93	95	97	100	103	106	109	113	117	122	127	132
	88	88	89	91	93	95	98	103	100	106	110	113	117	121
	86	85	87	88	89	91	93	95	97	100	102	105	109	112
	84	83	84	85	86	88	89	90	92	94	96	98	100	103
	82	81	82	83	84	84	85	86	88	89	90	91	93	95
	80	80	80	81	81	82	82	83	84	84	85	85	86	87

Earthquake: 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.

Liquefaction was a factor in the structural damage in San Francisco's Marina District from the 1989 Loma Prieta earthquake.

Lake County is considered to be an area of low risk for earthquakes, but could be affected by an earthquake along the New Madrid fault. Earthquakes happen all the time in the New Madrid seismic zone (about 150 per year), but most are too small to be felt by people. Small earthquakes ranging in magnitude from 3.0 to 5.0 on the Richter scale occur about once every 20 years in Lake County. The most significant of these occurred on May 26, 1909 when a 5.1 earthquake shook northern Illinois and southern Wisconsin.

According to the US Geological Survey, a large earthquake of about magnitude 6 or 7 in the New Madrid seismic zone could cause shaking intensities of up to V or VI in Lake County. Intensities of V and VI do not cause serious damage. Intensity VI shaking is felt by all people, causes books and pictures to fall, can cause glassware and windows to break, and can cause some cracks in plaster.

Such an event is likely to occur (about 25% to 90% chance of occurrence) somewhere in the New Madrid seismic zone in the next 50 years, and so it would affect structures built today. But this estimate of shaking intensity is a worst-case estimate, because it assumes that the earthquake would occur on the northernmost end of the New Madrid seismic zone. Thus, the strongest shaking likely to be experienced in Gurnee could cause minor damage.

Vulnerable buildings, roads, bridges and utility lines and the unpredictability and instantaneous nature of earthquakes can result in losses of life. Because the greatest potential for loss of life is to people within a collapsing building, the true extent of the risk is dependent on a review of each building. Usually, the existing inventory of buildings built to earlier standards (or no standard) can pose major threats to life safety or the functioning of key public services.

In November, 2001, a windshield survey was conducted of major public buildings in Gurnee. The survey followed the guidance in FEMA's *Rapid Visual Screening of Buildings for Potential Seismic Hazards*.

The screening produces a structural score "S," which relates to the probability of the building sustaining major life threatening structural damage. S scores range from 0 to 10. Higher S scores correspond to better seismic performance. If a building has an S score of 2 or less, it is recommended for a professional structural investigation.

Village staff identified 38 buildings for the survey located throughout the village. They included:

- 12 public assembly buildings (churches)
- 6 schools
- 5 industrial buildings
- 4 government buildings
- 3 emergency service buildings
- 3 commercial buildings
- 3 residential buildings
- 1 historic building

S Score	*Number of Buildings*
<2	1
2-4	11
4-6	20
6-8	2
8-10	4

"Rapid Visual Screening" results

As seen in the results box, the windshield screening found only one building with an S score below the 2 point threshold. It is a commercial office outside the floodplain. However, the Gurnee Grade School did receive a score of 2.2.

Winter storms affect trees and utilities

Winter storms: Winter storms bring snow, ice and wind. They can cause safety hazards and property damage, but typically do not result in a disaster situation. There is a relatively low threat to life and safety because people usually have time to seek shelter.

However, if streets are icy or power lines are down on roads, there is an added hazard to drivers. There can be a secondary threat to life if ambulances, police, or fire vehicles cannot respond to calls. Such calls often increase due to accidents to pedestrians and fires during storms and power outages.

Today's building construction practices offer protection from most storms. The major damage to property from ice is to exposed utilities, especially power lines and water pipes. Ice, wind and broken tree limbs wreak havoc on these wires. Buildings and vehicles are affected when tree limbs fall on them. The loss of antennas and telephone lines hampers emergency services and radio and television broadcasts.

Water pipes break in older buildings with water lines that do not meet the current building code (which requires the pipes to be in interior or insulated walls). Another problem is lost business when businesses are closed due to inclement weather or loss of power.

The most significant winter storm in recent history occurred in 1978-1979 when heavy snowfall and extremely low temperatures hit the area. The snowfall of over 80 inches was the prime contributor to spring floods in 1979. There have been 14 fatalities due to extreme cold in Illinois since 1995. On New Year's Day, 1999, record snowfall (over 21 inches in Chicago), high winds, and blizzard conditions resulted in a Federal disaster declaration for Lake and 50 other counties.

Thunderstorms: 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 threat from thunderstorms is flash flooding. Other threats include lightning, high winds, hail and tornadoes.

Thunderstorms bring lightning and local flash flooding

Flash floods kill an average of 140 people each year while lightning deaths have averaged 93. National Weather Service records show six lightning fatalities in Illinois since 1995.

Gurnee's most recent major storm flooding event was in June 1993 when the Village received record rainfall during the month: nine inches saturated the ground. An intense storm on June 30 dropped over four inches of rain as measured at the Gurnee Public Works Department rain gauge. Another severe storm occurred on July 8. Many areas of town had streets and basements flooded from local runoff. Flooding of basements led to overloaded sanitary sewers which backed up into basements in other homes. As reported by the Village Engineer:

> … the river accepted all of the stormwater without reaching the critical stage. The intensity was such that most residents with whom I spoke had 4-6 inches of water running across their yards. In many cases, much more water than this was running in drainage swales, ditches, and in the streets.
>
> With the water around many homes at 4 - 6 inches in depth, window wells filled with water, sump pumps became inundated, and basements began taking in stormwater. Once stormwater enters the basement, its outlet is to a drain in the basement floor. This drain connects directly to the sanitary sewer. This in turn creates a surcharge in the sanitary sewer and the lowest floors of homes along the surcharged line become flooded with sewage. This scenario was confirmed in three areas of the Village which affected several dozen homes.
>
> As two residents indicated to me, "When the water stopped coming in the windows, I thought I had it licked. Then a fountain erupted out of the floor drain."

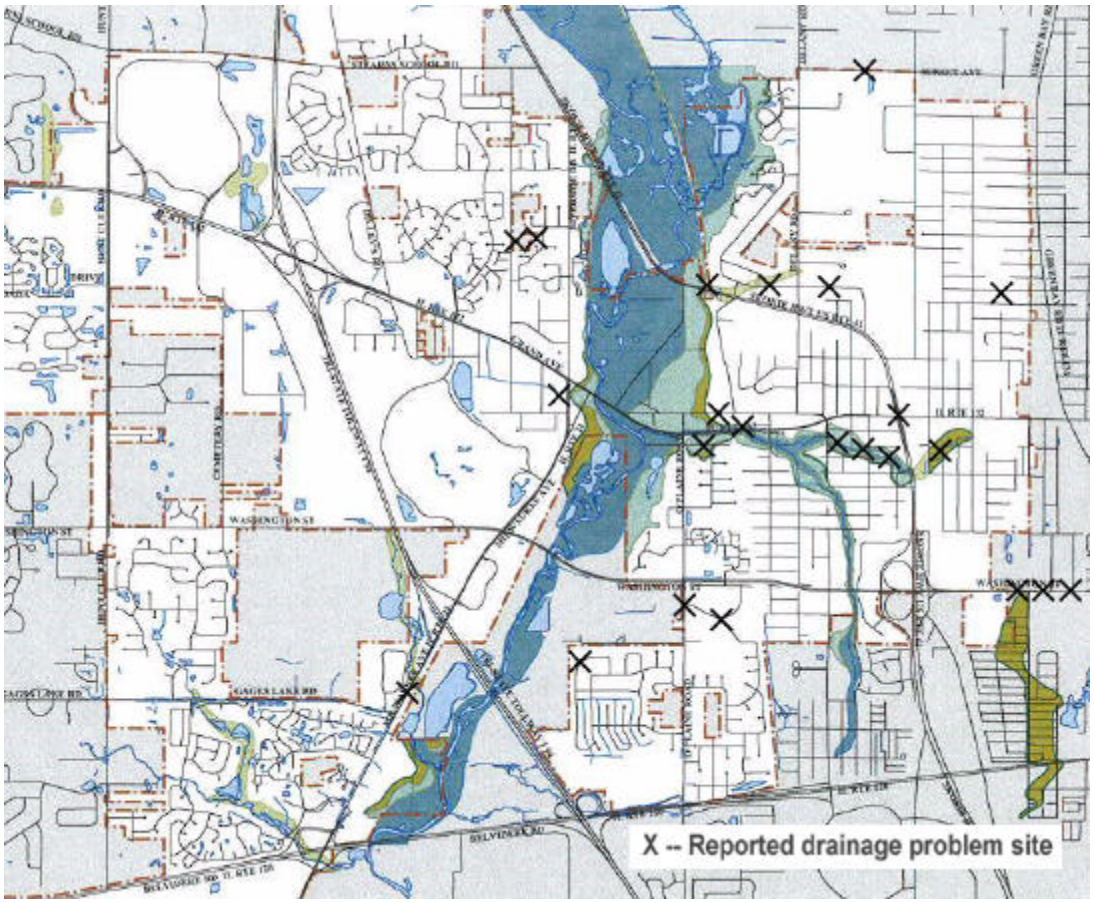
The Village's flood problem log lists calls about sewer backups, yard and house flooding, and power outages at over 300 addresses throughout the Village. Surprisingly, the floodplain on and north of Grand Avenue reported few problems. The area south of Grand on McClure Avenue and O'Plaine Road had problems where the stormwater's flow toward the river was blocked by the raised pavement of new Grand Avenue (Highway 132).

The June and July 1993 flooding covered streets and yards throughout the Village.

Nine flood insurance claims were filed in June and July 1993, five of them for properties on McClure. Only two claims were paid, substantiating the fact that damage was primarily to basements (where the covered damage probably did not exceed the deductible) and to properties outside the mapped floodplain where people did not carry flood insurance.

The County was declared a disaster area by the President, at the same time as the record flooding on the Mississippi. FEMA approved disaster assistance to the Village for flood fighting, clean up and repairs of public buildings at a total cost of $114,000.

Local Drainage Problem Sites

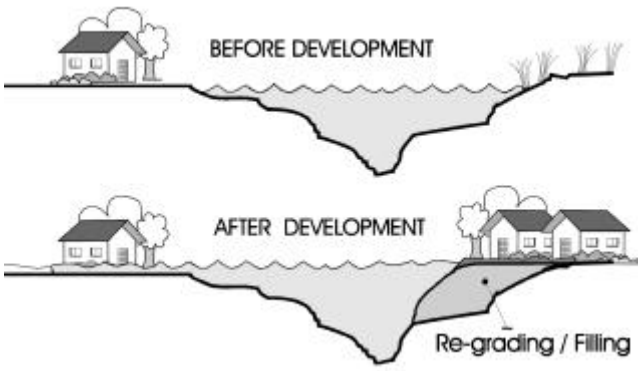


These are sites of historical flash flooding during and after thunderstorms and heavy rains. Note that there are no reported problem sites in the Western parts of the Village where stormwater facilities have been constructed to newer and higher standards.

2.11. Future Trends

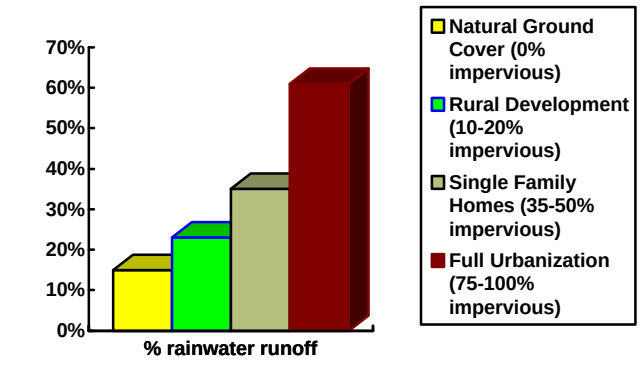
The problem: Flood problems are greatly increased when buildings and other forms of development are located in the floodplain. A community's flood problem can become worse if new development is allowed that does not account for the flood hazard.

Development within the floodplain contributes to flooding problems. As development occurs near channels, overbank flood flows are obstructed. As a result, flood levels rise upstream. Development that fills in floodplains means less area to store floodwaters. If there is no compensation for this loss of storage, water surface levels will rise downstream.



Development in the floodplain can aggravate flooding

Development in the watershed also has an impact on flooding. Stormwater runoff increases when vacant land is replaced with rooftops, pavements and storm sewers (see chart). Unconstrained watershed development often will aggravate downstream flooding and overload the community's drainage system.



Development in the watershed increases stormwater runoff

Growth potential: Gurnee and the surrounding area is growing. The best available predictors of future development trends in Lake County are the forecasts for changes in population and households made by the Northeastern Illinois Planning Commission (NIPC). Preliminary NIPC forecasts for changes in population, households and employment through the year 2020 are based on 4 potential scenarios.

Overall, the average of the four alternative forecasts projects an 80% increase in households and a 66% increase in population in the Illinois portion of the Des Plaines River watershed. The Village's 1997 Comprehensive Plan Update reviewed building permit trends and concluded that "the NIPC figure appears somewhat low" for Gurnee (page 16). It predicted an annual growth of 200 households in the Village.

Impact: The *Lake County Flood Hazard Mitigation Plan* (draft) notes

> The greatest increase in flood damage caused by new development will probably occur along the main stem of the Fox and Des Plaines Rivers and around the shorelines of developed lakes. There are several reasons why future flood damage is likely to worsen in these areas.
>
> First, of the four Lake County watersheds, the Fox and Des Plaines have the greatest amount of land still available for development.

Second, as large river watersheds, any increase of runoff volume will have its greatest flood impact along these receiving waters. Even small increases in runoff will compound based on the sheer number of sites and acres being developed in the Fox and Des Plaines watersheds. As a result, the Fox and Des Plaines Rivers and some of the natural lakes are likely to continue experiencing increases in base flood elevation.

The magnitude of future flooding along the Fox and Des Plaines Rivers in Lake County will also depend on how well future development avoids and protects floodplains and wetlands. Planning, regulatory authority and acquisition are the three tools that will have the strongest influence on wetlands and floodplain protection.

According to the *Lake County Flood Hazard Mitigation Plan* (draft), the impact new development has on flood damage in Lake County will largely depend upon four primary factors:

1. How well wetlands and floodplains are protected and managed;
2. How much more of the landscape is covered by impervious surface;
3. How well new development sites are designed to minimize runoff;
4. Future development trends in the Wisconsin portion of the Des Plaines watershed.

Chicago area wetland for sale for development

If land continues to be developed as it has in the past with little attention given to the amount of impervious surface, new development will almost certainly result in increased flood heights on the Des Plaines River. On the other hand, if through the use of development site designs and best management practices (discussed in Chapters 4 and 8), the volume and rate of runoff from developed areas is significantly reduced, localized flood damage should be minimized.

2.12. Conclusions

Chapter 2 summarizes Gurnee's flood problems. The summary is based on available information. While some of the data may be incomplete, the information does show some patterns that are important to the design of a flood mitigation plan. The key considerations are:

1. The major flood problem facing the Village of Gurnee is in the base floodplain of the Des Plaines River. This area is shown on the map on page 2-3.

2. While past flooding has been bad, the latest studies show that the base flood would be 2 ½ feet higher than the 1986 flood of record.

3. The severity of the next flood cannot be predicted. To provide a sufficient level of protection, the Village should prepare a plan based on both historic flood levels and the risk of higher floods in the future. The base flood was selected by the Mitigation Planning Committee as the basis for this mitigation plan.

4. The base floodplain boundaries shown on the 2000 Flood Insurance Rate Map should be corrected to reflect better ground contour information.

5. Floods present a variety of safety and health hazards to people.

6. There are 111 buildings subject to the base flood. Of these, 72 (65%) are residences. These buildings are grouped into 11 clusters in the map on page 2-15.

7. The area subject to the greatest flood damage potential is the Downtown cluster.

8. The three residential clusters most exposed to flood damage are Brookhaven, Kilbourne/Emerald and McClure Floodway where the base flood is over the first floors of 85% of the homes.

9. Several critical facilities are affected by flooding, including the Police Station, Fire Station #1, the public works complex, two schools, six gasoline storage sites, and three highways.

10. Flooding impacts the entire community by closing roads, affecting businesses and costing all taxpayers.

11. Gurnee is subject to damage and threats to safety and health from tornadoes, drought, heat, earthquakes, winter storms, and lightning and flash flooding from severe thunderstorms.

12. Additional investigations should be conducted of those buildings where an earthquake would most threaten lives and safety.

13. Floodplains provide natural and beneficial functions and improve the recreational opportunities for Village residents.

14. Future development can aggravate the Village's flooding problems. Regulatory constraints are needed to prevent or minimize the impact new development has on flood heights, water quality and habitat.

2.13. References

1. *A Unified National Program for Floodplain Management*, Federal Interagency Floodplain Management Task Force, FEMA – 248, 1994.

2. *Comprehensive Land Use Plan Update,* Village of Gurnee, 1997

3. Emergency logs and disaster assistance correspondence, Village of Gurnee, 1986 – 2000.

4. Field survey conducted by French & Associates, Ltd., Summer, 2001.

5. Flood insurance claims records, Federal Emergency Management Agency, as of March 31, 2001.

6. *Flood Hazard Mitigation Plan,* Village of Gurnee, 1987.

7. Flood Hazard Mitigation Study working papers, Lake County Stormwater Management Commission, 1995.

8. *Flood Insurance Study, Lake County, Illinois and Incorporated Areas*, Federal Emergency Management Agency, November 6, 2000.

9. *Floodplain Management Home Study Course,* Illinois Association for Floodplain and Stormwater Management, 2000.

10. *Illinois Hazard Mitigation Plan,* Illinois Emergency Management Agency, 2000.

11. *Inventory and Analysis of Urban Water Damage Problems in Village of Gurnee, Lake County, Illinois*, U.S. Army Corps of Engineers, Chicago District, 1979

12. *Lake County Flood Hazard Mitigation Plan* (draft), Lake County Stormwater Management Commission, June, 2001.

13. *Multi-Hazard Identification and Risk Assessment*, Federal Emergency Management Agency, 1997.

14. *Rapid Visual Screening of Buildings for Potential Seismic Hazards*, FEMA 154 and 155, 1988.

15. Responses to questionnaires submitted by Village residents, 2001.

16. *Upper Des Plaines River Feasibility Report and Environmental Impact Statement*, U.S. Army Corps of Engineers, 1999.

17. *Village of Gurnee Emergency Operations Plan*, Gurnee Emergency Management Agency, (undated).

Chapter 3. Goals

3.1. Findings

The Mitigation Planning Committee conducted several exercises to reach a consensus on the goals for mitigation planning. These brought out members' concerns about the planning area and the problems residents and businesses face. They also identified the strong points about the area and the community that should be preserved and built on.

Planning Committee member during the goal setting exercise

These concerns, plus the previous chapter's description of the flood problem sets the stage for what the Village should do about flooding. The Village's approach is based on the following findings.

1. The primary natural hazard threatening Gurnee is overbank flooding of the Des Plaines River. This river has inundated its floodplain for centuries. Over the last half century, it has flooded the planning area on the average of once every ten years.

2. Past floods have shown the threats to life and health, damage to property and disruption of commerce that can occur. However, flooding in the future could be worse.

3. Flooding affects 72 residences and 39 business and public properties. These are not just floodprone buildings. They are people's homes, businesses that form part of the economic base of the Village, roads that are used by everyone, and schools and municipal services that are vital to the community. The area exposed to the greatest damage is the historic central core of Gurnee.

4. Flooding in the planning area affects all residents of Gurnee and also non-residents who need to go to a business or use a road that has been flooded.

5. The planning area has more than just flood problems. It is exposed to the dangers and damage caused by other natural hazards and the torment of mosquitoes. It is subject to traffic congestion and the other problems that accompany urban growth.

6. Living and working in the planning area has real advantages. It means proximity to natural areas and recreational opportunities, good schools and Village services, and ready access to local businesses and other destinations in the region. There is a sense of community that is not found in many other places.

7. Residents and property owners need to be assured that the flood problems will be addressed, mitigation alternatives will be pursued, and that new development will not aggravate current problems.

3.2. Technical Concerns

The following technical concerns should be kept in mind when setting goals and designing a mitigation program:

1. Goals are long range targets that the Village's flood mitigation program aims for. They are kept in mind when the current and needed mitigation measures are reviewed and when the specific recommendations and action items are drafted or revised by the Flood Mitigation Planning Committee.

2. People should not expect 100% protection from the forces of nature. Mitigation does not mean eliminating all threats, it means reducing the impact of the threats.

3. To be successful, flood mitigation must account for both the natural and human facets that comprise the floodplain. Mitigation measures need to minimize disruption to the community and the environment.

4. It makes sense to select mitigation tools that can address multiple hazards.

5. Mitigation measures need to be effective and affordable. This means they will take time to plan, fund and implement.

3.3. Goals

With the above findings and concerns in mind, the Flood Mitigation Planning Committee set four overall goals for the mitigation effort, each with more detailed objectives.

1. Protect existing properties

a. Use the most effective approaches to protect buildings from flooding, including acquisition or relocation where warranted.
b. Enact and enforce regulatory measures that ensure that new development will not increase flood threats to existing properties.
c. Use appropriate measures to mitigate against the danger and damage posted by other natural hazards.

2. Protect health and safety

a. Advise everyone of the safety and health precautions to take against flooding and other natural hazards.
b. Improve traffic circulation, during floods and at other times.
c. Improve water quality and habitat.
d. Do something about the mosquitoes.

3. Improve the quality of life in Gurnee.

a. Preserve and improve the downtown core of businesses and services.
b. Ensure that current owners can maintain and improve their properties.
c. Use acquisition programs to expand open space and recreational opportunities.
d. Maintain an attractive riverfront and other public open spaces.

4. Ensure that public funds are used in the most efficient manner.

a. Prioritize mitigation projects, starting with those sites facing the greatest threat to life, health and property.
b. Utilize public funding to protect public services and critical facilities.
c. Utilize public funding for those projects on private property where the benefits exceed the costs.
d. Maximize the use of outside sources of funding.
e. Maximize owner participation in mitigation efforts to protect their own properties.
f. Encourage property-owner self-protection measures.

Chapter 4. Preventive Measures

Preventive measures are designed to keep the problem from occurring or getting worse. Their objective is to ensure that future development does not increase the damage caused by a flood or other hazard and that new construction is protected from those hazards. Preventive measures are usually administered by building, zoning, planning, and/or code enforcement offices. They include the following:

4.1 Planning
4.2 Zoning
4.3 Open space preservation
4.4 Building codes
4.5 Floodplain development regulations
4.6 Stormwater management

The first three measures, planning, zoning, and open space preservation, work to keep damage-prone development *out* of the hazardous or sensitive areas.

The next two measures, building codes and floodplain development regulations, impose construction standards on what is allowed to be built *in* the floodplain. They protect buildings, roads, and other projects from flood damage and prevent development from aggravating the flood problem. Building codes are also very important in mitigating the impact of non-flood hazards on new buildings.

Stormwater management addresses the runoff of stormwater from new developments onto other properties and into floodplains.

4.1. Planning

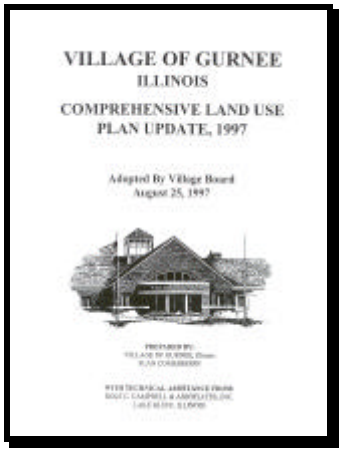
"Planning" can cover a variety of community plans including, but not limited to, comprehensive plans, land use plans, transportation plans, capital improvement plans, and economic development plans. While plans generally have limited authority, they reflect what the community would like to see happen in the future. Plans also guide other local measures such as capital improvements and the development of ordinances.

One of the objectives of planning is to keep intensive development out of floodplains and sensitive areas.

Comprehensive and land use plans generally identify how a community should be developed and are the most likely tools for hazard mitigation. Use of the land can be tailored to match the hazards on that land, typically by reserving flood prone areas for parks, recreational trails, open space, golf courses, or similar compatible uses.

A community's capital improvement program states where major public expenditures will be made over the next 5-20 years. Capital expenditures may include acquisition of land for public uses, such as parkland, wetlands, or natural areas, and extension or improvement of roads, utilities, channels and drainage structures.

Local implementation: The Village of Gurnee's first plan was prepared in 1958. The current *Comprehensive Land Use Plan* was prepared in 1990 and received a thorough "Update" in 1997. Its objective is to "guide the location of future land uses" within the Village and its 1 ½ mile extra-territorial planning jurisdiction.


VILLAGE OF GURNEE
ILLINOIS
COMPREHENSIVE LAND USE PLAN UPDATE, 1997
Adopted By Village Board
August 25, 1997

The *Comprehensive Plan* identifies where certain types of development should go and sets goals, objectives and policies for those developments. The third column in the table below lists the general type of development recommended for the eleven Des Plaines River floodplain clusters used in this mitigation plan.

Current and Planned Land Uses

Cluster	Current	*Comp Plan*	Zoning Ordinance
GV – Grove	Industrial	Industrial	General industrial
WG – West Grand	Commercial	Commercial	Community business
GS – Grade School	Public	Public	Public
KE – Kilbourne/Emerald	Residential	Residential	Residential
DT – Downtown	Commercial	Business/public	Business/public
EG – East Old Grand	Res/Commercial	Res/Office	Village Center
MY – McClure Floodway	Residential	Residential	Residential
MG – McClure Fringe	Residential	Residential	Residential
FS – First Street	Residential	Residential	Residential
WS – West Street	Residential	Residential	Residential
BH – Brookhaven	Residential	Residential	Residential
Outside planning clusters	Open space	Public/quasi-pub.	Public land

Current land uses are the predominant use in the cluster (see the table on page 2-14)

It is significant to note that the *Comprehensive Plan* calls for preserving the open spaces outside the 11 developed clusters. The goals and objectives for the public areas include:

(i) Public and Quasi-Public Goals
- Provide sufficient open space to meet the passive and active recreational needs of the community.
- Preserve the natural amenities in the area by increasing the amount of property which is designated as open space and which will remain undeveloped.

(ii) Public and Quasi-Public Objectives
- Continue to refine the delineation of wetland and flood plain areas.
- Require developers to delineate clearly in their proposals and plans wetland areas, wooded areas, and other areas which are environmentally sensitive….

(*Comprehensive Land Use Plan Update, 1997*, page 11)

The *Comprehensive Plan* recognizes the importance of preserving floodplain open space:

> Another determinant guiding land use planning in Gurnee is the abundance of natural resources including flood plains, wetlands, wooded areas, and others. People are increasingly concerned that development be sensitive to the preservation of these natural areas.…The Des Plaines River runs through Gurnee, and extensive open areas have been planned for this river corridor. (page 24)

> Many of the developments which have a large variety of housing styles are in areas with natural amenities such as wetlands or woods. Clustering the homes in the buildable areas makes it possible to preserve the beauty of the natural features. These preservation efforts enhance the overall quality of the Village and contribute to the economic value of the residential property. (page 31)

While undeveloped areas are recommended to stay that way, the *Comprehensive Plan* calls for increased utilization of a "special development area," the Village Center. The Village Center has three sub-areas, two of which are outside of the floodplain. Sub-area B corresponds to the Downtown, East Old Grand and McClure clusters.

In 1979, the Village adopted a "Village Center Development Plan" to maintain the area as a "focal point of community life." The Village Center includes shopping, offices, public services (police, fire, Village Hall, library, parks, etc.) and recreational amenities. The 1997 *Update* calls for steps to make the area more attractive, including burying power lines, making parking areas "greener," increasing public park land, and connecting trails and paths to the Des Plaines Trail.

In short, the *Comprehensive Plan* seeks to preserve existing land use patterns. Currently developed areas would stay in their current uses while open spaces in the floodplain are to stay open. The open spaces are essentially the same areas shown on the map on page 4-7. However, the recommended improvements to the Village Center could bring more development and traffic to the two clusters along Old Grand Avenue.

Capital improvement program: In October 2000, the Village adopted a five-year Capital Improvement Program. It addresses needs and plans for water, sanitary sewers, and other parts of the Village's infrastructure. It notes that there is no complete inventory of the stormwater management system and recommends that one be conducted. After such an inventory is done, a multi-year drainage improvement and maintenance program can be established. This would have a major impact on the local drainage problems caused by heavy storms.

Under "Other Capital Improvements," the plan calls for beautifying the Grand Avenue corridor in support of the Village Center plans discussed above. Other projects to be funded are improvements to the public works facility and a new police department building outside of the floodplain.

The Village has set aside property north of the public works facility for a possible train station, should the Metra line be extended. Assuming that the train station and the public works facility project will meet the floodplain development regulation standards, all of these projects support the goals in this mitigation plan.

While not mentioned, the Village Center plans could include a waterfront orientation. Many communities, notably San Antonio, Texas, and Naperville, have developed riverwalks that connect parks and attract people to the area, combining flood mitigation with recreation and economic development.

The Des Plaines River Trail could be connected to the Village Center to link shopping with a tourist attraction

The Forest Preserve and Park Districts have their own capital improvement programs which are discussed in the later section on open space preservation.

CRS credit: The CRS does not credit a comprehensive plan or capital improvements program. It does credit the products of those tools, such as the amount of open space in the floodplain and the regulations that implement the plan's recommendations.

4.2. Zoning

A zoning ordinance regulates development by dividing a community into zones or districts and setting development criteria for each zone or district. Zoning ordinances are considered the primary tool to implement a comprehensive plan's guidelines for how land should be developed.
There are two ways that a zoning ordinance can address floodplain development:

1. The floodplain can be designated as one or more separate zoning districts created to permit only those uses or activities that are not susceptible to damage by flooding, such as conservation areas and agricultural uses.

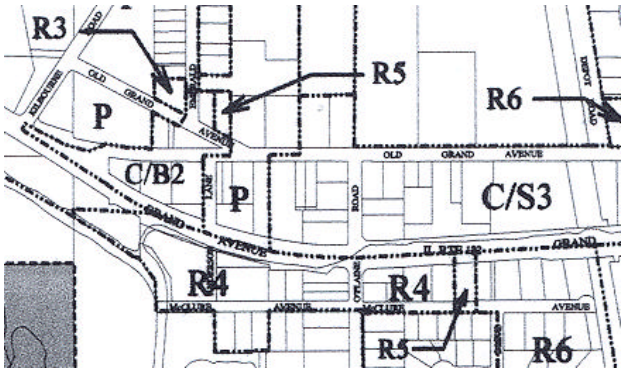
2. The floodplain can be shown as an "overlay" district in order to prevent development that would contribute to or cause increased flood damage, regardless of the use in the underlying zone.

Local implementation: The "Gurnee Zoning Ordinance" was adopted in 1980, but has been updated frequently since then. The current version (last amended November 6, 2000) was drafted by the same planning firm that prepared the 1997 *Comprehensive Land Use Plan Update* that is discussed in the previous section.

The Zoning Ordinance specifically avoids floodplain requirements, referring to the Villages' floodplain management ordinance. This is a good approach, as many communities have conflicting requirements in different ordinances.

The ordinance's zoning districts are similar to the current land uses and the recommendations in the *Comprehensive Plan Update's* land use map. They are shown in the right column of the table on page 4-2. With one exception, they are consistent with the current uses and the *Comprehensive Plan.*

The exception is the East Old Grand cluster which is designated as "Village Center Residence/Business District." This zone also includes the commercial properties in the Downtown cluster, east of the Police and Fire Stations (see map). The objective of the Village Center Residence/Business zone is to allow both residential and commercial development, provided they "reinforce the character of the community" and are in "compatible architectural structures." Anything other than one and two family dwellings must go through the special use permit process which requires a public hearing before the Plan Commission.



Zoning districts in the Downtown, East Old Grand and McClure clusters

C/B2 – Community business
C/S3 – Village Center residence/business
P – Public land R – Residential

Article 5 of the Zoning Ordinance authorizes the planned unit development approach as an alternative to single lot traditional zoning. Instead of subdividing the property into individual lots, each of which must comply with the district's set back and area requirement, the planned unit development process allows developers more flexibility in site design. One of the objectives of this approach is:

> To encourage land development that, to the greatest extent possible, preserves natural vegetation, respects natural topographic and geologic conditions, and refrains from adversely affecting flooding, soil drainage, and other natural ecologic conditions. (Gurnee Zoning Ordinance, Section 9.1.2)

Because the larger undeveloped properties in the Des Plaines River floodplain are in public ownership, this will not have a major impact on overbank flood protection. However, planned unit development approach does allow other areas to have more imaginative and effective ways to manage stormwater runoff.

It also allowed recent developments along the floodplain boundary, including the Brookhaven cluster, to avoid the standard individual parcel arrangement. Buildings were grouped on high ground and the floodplain was kept open. Properties that were partially in the floodplain were developed without increasing the flood hazard.

NFIP/CRS

CRS credit: The CRS credits low density zoning. Only the public areas would qualify for this, but they would receive more credit as preserved open space. The draft 2002 *CRS Coordinator's Manual* proposes to credit up to 100 points for provisions like the planned unit development language in the Zoning Ordinance that encourage developers to avoid building in the floodplain.

4.3. Open Space Preservation

Keeping the floodplain open and free from development is the best approach to preventing flood damage. Preserving open space is beneficial to the public in several ways. Preserving floodplains, wetlands, and natural water storage areas maintains the existing stormwater storage capacities of an area. These sites can also serve as recreational areas, greenway corridors and provide habitat for local flora and fauna. In addition to being preserved in its natural landscape, open space may also be maintained as a park, golf course, or in agricultural use.

Des Plaines River Forest Preserves are excellent examples of floodplain open space that serve the entire community.

Open space preservation should not be limited to floodplains, as some upland areas within a watershed may be key to limiting runoff that will worsen flooding problems in adjacent or downstream lowlands. A significant increase in runoff from surrounding uplands will raise the base flood elevation and enlarge the floodplain boundary. Therefore, the amount of land maintained as open space will directly affect the level of flood hazard.

Comprehensive and capital improvement plans should identify areas to be preserved by acquisition and other means, such as purchasing an easement. With an easement, the owner is free to develop and use private property, but property taxes are reduced or a payment is made to the owner if the owner agrees to not build on the floodprone part or the part set aside in the easement.

Although there are some Federal programs that can help acquire or reserve open lands, open space lands and easements do not always have to be purchased. Developers can be encouraged to dedicate park land and required to dedicate easements for drainage and maintenance purposes. These are usually linear parcels along property lines or channels. Maintenance easements also can be donated by streamside property owners in return for a community channel maintenance program.

Greenways: Greenways are protected corridors of open space along natural features, such as streams and ridges. Greenways provide two key flood mitigation benefits.

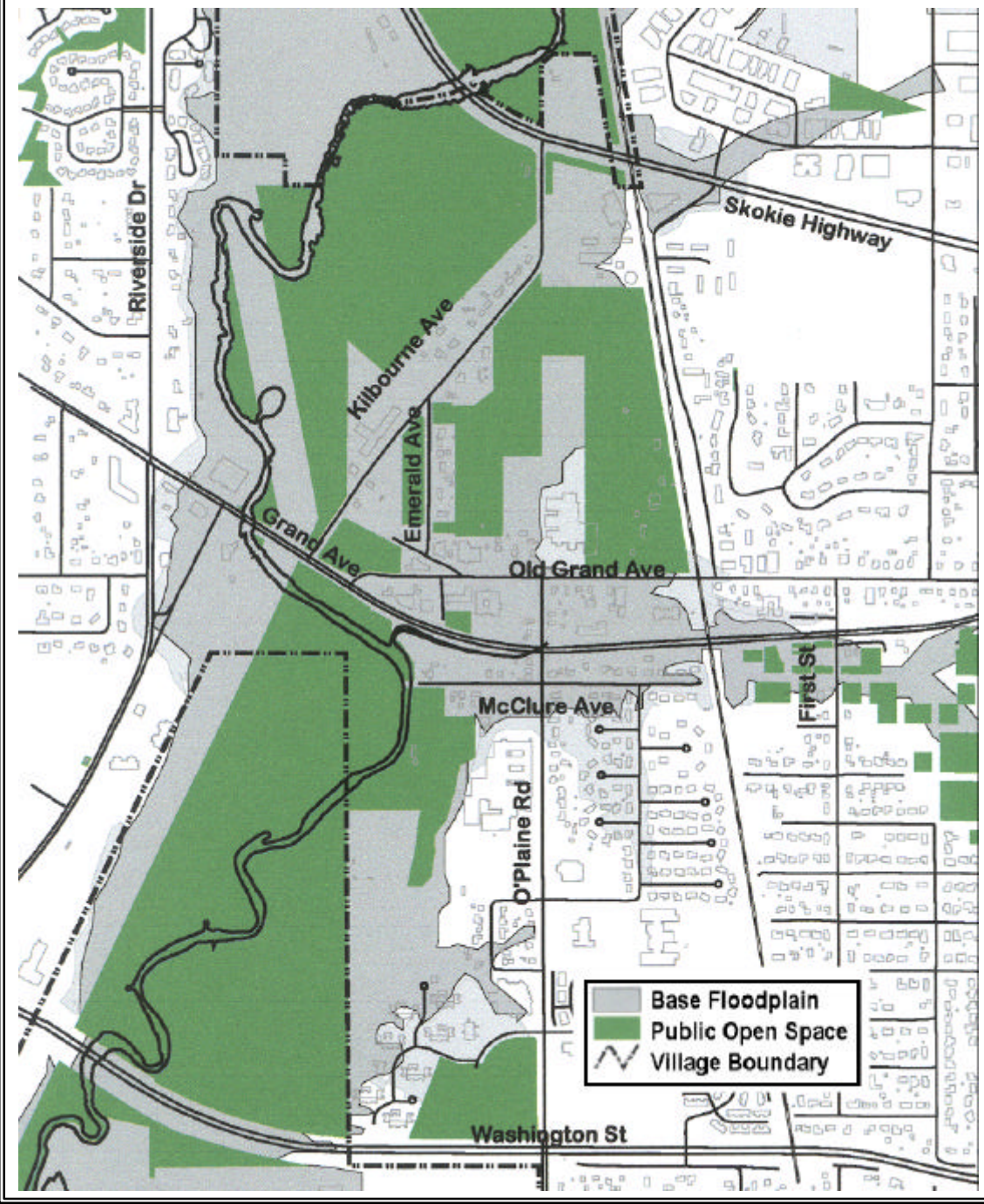
1. First, they preserve some floodplain from buildings and other more damage-prone development. While these may be narrow strips of open space, they are usually the area closest to the channel, i.e., the most dangerous area during a flood and that part of the floodway where the most water is carried.

2. Second, they draw people to the rivers where they can learn to appreciate the benefits of open space and become more familiar with the rivers and creeks in the Village. This second benefit is discussed more in Chapter 9. Public Information.

Local implementation: As shown on the map below, approximately 50% of the Des Plaines River floodplain is owned by public agencies and kept as open space. The largest single owner of floodplain property is the Lake County Forest Preserve District, which owns 6,784 acres of land adjacent to the Des Plaines River in Lake County.

Other lands are owned by the Gurnee Park District, the Village and the school districts. These public lands account for almost all of the undeveloped parcels in the Des Plaines River floodplain. As noted in the Lake County Flood Hazard Mitigation Plan (draft), the actions of these agencies "have prevented millions of dollars of flood damage through the foresighted acquisition of floodplains."

Publicly Owned Open Space



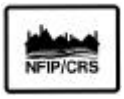
There are several golf courses in the two mapped floodplains in the southwestern part of the Village. The Village has purchased and cleared most of the properties along the unnamed tributary to the Des Plaines that flows from the east, through the First Street cluster. Because these areas are preserved as open space, this flood mitigation plan limits its attention to the built up Des Plaines River floodplain.

The Gurnee Park District is increasing its holdings of floodplain and sensitive areas. It has recently received 64 acres of wetlands through a developer donation agreement. Although not in the Des Plaines River floodplain, the land is in the floodplain of a tributary. Not only will the natural and beneficial functions of the area be preserved, keeping the wetlands open will help minimize increases in downstream flood heights.

The Lake County Forest Preserve has its own capital bond program for land acquisition. It has consistently had supportive referenda approving expenditures to pursue its goals:

1) Protect wildlife habitat
2) Preserve wetlands, prairies, and forests
3) Provide trails, greenways, and river/lake access
4) Protect against flooding
5) Save large refuges
6) Expand existing preserves

While the Forest Preserve District does not release acquisition plans for specific properties, it can be seen that goals 2, 3, 4 and 6 directly support preserving and expanding open space in the Des Plaines River floodplain.



CRS credit: Gurnee would receive a score of at least 350 out of a total possible of 725 points. The score is based on the percentage of floodplain preserved as open space. The Commonwealth Edison right-of-way along the western edge of the floodplain would be counted as open space by the CRS because no buildings will be built there. (The only way to obtain the maximum score is to preserve the entire floodplain as open space).

This score is higher than most CRS communities in the country. It could be increased if some of the parcels have deed restrictions mandating open space preservation in perpetuity (Section 421.b) and where floodplain open space areas were documented as being preserved in their natural state (Section 421.c).

4.4. Building Codes

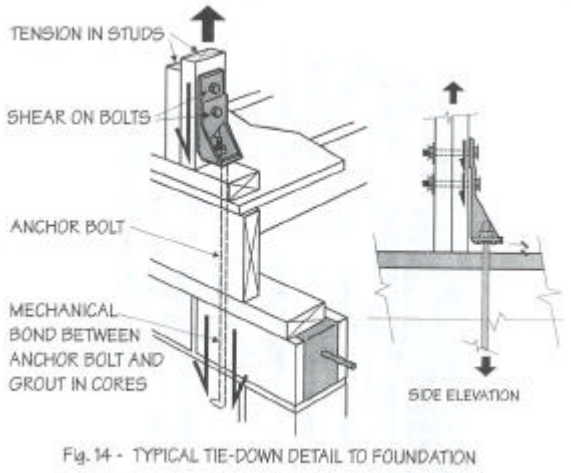
Hazard protection standards for all new and improved or repaired buildings can be incorporated into the local building code. These standards should include criteria to ensure that the foundation will withstand flood forces and that all portions of the building subject to damage are above, or otherwise protected from, flooding.

Building codes are also a prime mitigation measure for other natural hazards, especially earthquakes, tornadoes, windstorms and heat and cold. When properly designed and constructed according to code, the average building can withstand the impacts of most of these forces. The code could include provisions such as:

- Requiring sprinkler systems for fire protection in larger or public buildings,
- 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
- Making sure roofing systems will handle high winds and expected snow loads.

Most communities in Illinois that have a building code have adopted the *National Building Code* of the Building Officials and Code Administrators International, Inc. (BOCA). This is being replaced by the International Code series. The I-Codes have more provisions for natural hazard protection, but it is up to the community to adopt a separate flood section.

Just as important as the code standards is the enforcement of the code. There were many reports of buildings that lost their roofs during Hurricane Andrew because sloppy construction practices did not put enough nails in them. Adequate inspections are needed during the course of construction to ensure that the builder understands the requirements and is following them. Making sure a structure is properly anchored requires site inspections at each step.



Both builders and inspectors need to know the details of proper anchoring.

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

There is a relatively new program that measures local building code natural hazard protection standards and code administration. The Building Code Effectiveness Grading Schedule is 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: community programs are reviewed and scored, a class 1 community is the best, and a class 10 community has little or no program.

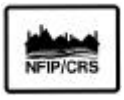
Local implementation: Gurnee administers BOCA's *National Building Code.* It does not include all of the flood protection standards needed to meet the requirements of the National Flood Insurance Program (see next section). While the International Codes have stronger provisions for other hazards, the Village has decided to wait a few years until the "bugs" are worked out of this new approach.

Gurnee's Building Code Effectiveness Grading Schedule classification is a Class 6. BCEGS provides up to 100 points under three general activities. The table below shows that the Village is strongest in the field of adopted code provisions. However, this score decreases over time unless the codes are kept current. Therefore, to keep the current scores, the Village will need to adopt the I-Codes in a few years.

Gurnee's BCEGS Scores

Code Activity	Score	Max	Percentage
Administration of codes			
Adopted code and zoning provisions	15.33	16.0	96%
Staff training/certification/education/experience	5.62	33.5	17%
Administration and enforcement policies/procedures	1.56	4.5	35%
Plan review			
Staff level and experience	7.38	10.5	70%
Procedures	9.50	12.5	84%
Field inspection			
Staff level and experience	8.28	12.0	69%
Procedures	8.25	11.0	75%

The table shows that the Village's code enforcement program was weakest in staff training and certification when the scoring was conducted (1998). Since then, the construction and inspection workload has declined, allowing staff to attend more training and become certified in several different code specialties.



CRS credit: Ten points can be obtained for the Village's Building Code Effectiveness Grading Schedule classification of 6. This classification is needed if the Village wants to obtain one of the better CRS classes.

4.5. Floodplain Development Regulations

Most communities with a flood problem participate in the National Flood Insurance Program (NFIP). The NFIP sets minimum requirements for the participating communities' subdivision regulations and building codes. These are usually spelled out in a separate ordinance. Additional requirements are set by State law and the Lake County Stormwater Management Commission's Watershed Development Ordinance. These minimum requirements are summarized in the box on the next page.

Subdivision regulations govern how land will be subdivided into individual lots, and set the construction and location standards for the infrastructure the developer builds to serve those lots, including roads, sidewalks, utility lines, storm sewers, and drainageways. They provide an additional vehicle for floodplain development rules. For example, some communities require that every subdivision in a floodplain provide a building site above the flood level for every lot and/or require streets to be at or no more than one foot below the base flood elevation.

Minimum Floodplain Regulatory Requirements

The National Flood Insurance Program (NFIP) is administered by the Federal Emergency Management Agency (FEMA). As a condition of making flood insurance available for their residents, communities that participate in the NFIP agree to regulate new construction in the area subject to inundation by the 100-year (base) flood. State laws and the Lake County Stormwater Management Commission set additional requirements. Here are the basic requirements:

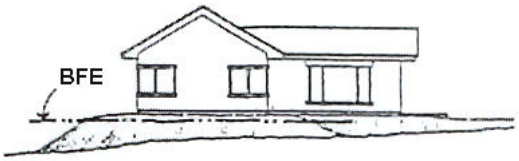
1. All development in the regulatory floodplain must have a permit from the community. "Development" is defined as any manmade change to improved or unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of materials.

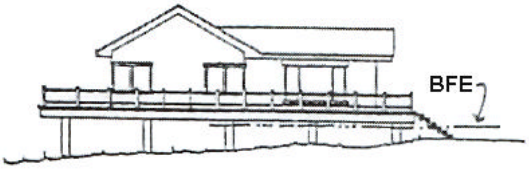
2. The regulatory floodplain is the floodplain mapped on the Flood Insurance Rate Map plus areas subject to flooding that have at least a one square mile drainage area or a storage volume of 0.75 acre-feet or more when inundated by the base flood.

3. Only "appropriate uses" are allowed in the floodway. The floodway is the channel of a river or other watercourse and the adjacent land areas that are needed to convey the base flood (see map, page 2-9). Appropriate uses include flood control structures, recreational facilities, detached garages and accessory structures, floodproofing activities, and other minor alterations. They do not include buildings, building additions, fences, or storage of materials. Larger projects in the floodway require a permit from the State in addition to the City permit. The result of this requirement is that vacant floodways will essentially remain as open space, free of insurable buildings or other obstructions.

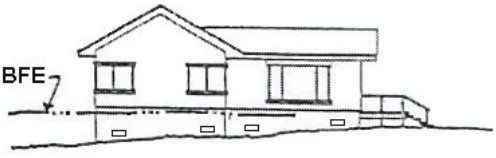
4. The volume of flood storage that fill or a structure will displace must be compensated by excavating and removing at least 1.2 times the displaced storage volume caused by that fill or structure.

5. New buildings may be built in the floodplain, but they must be protected from damage by the base flood. The lowest floor of residential buildings must be elevated two or more feet above the base flood elevation (BFE). Nonresidential buildings must be either elevated or floodproofed.

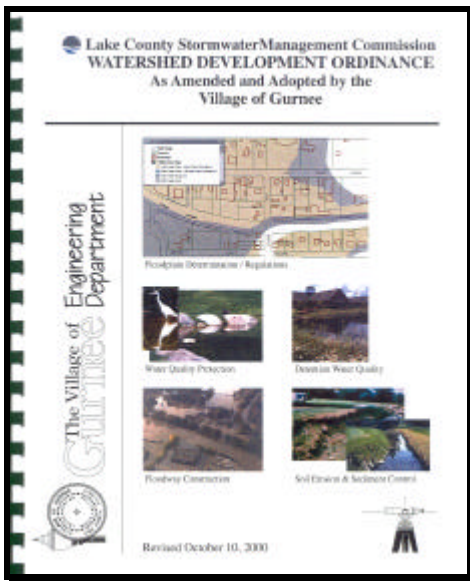




6. A "substantially improved" building is treated as a new building. The regulations define "substantial improvement" as any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement. This requirement also applies to buildings that are substantially damaged.



7. Chemicals, explosives, pollutants and other hazardous or toxic materials are prohibited below the base flood elevation plus two feet.



Local implementation: Gurnee is in the NFIP and complies with all State, FEMA, and County requirements. The Village's regulations are in the Watershed Development Ordinance (WDO) which is based on the Stormwater Management Commission's model and was adopted in October 2000. The WDO covers a variety of flood and stormwater concerns, including water quality and sedimentation control, which are discussed in other sections of this mitigation plan.

The WDO adopts the September 2000 Flood Insurance Rate Map and Flood Insurance Study. However, the most recent maps are not yet in the Village's geographic information system (GIS). Because the 2000 map shows wider floodplain and floodway boundaries, this increases the chance of an error or omission on the part of the permit office.

A related problem is that the Flood Insurance Rate Map and the GIS contour map have conflicting information on where the floodplain boundary should be. The WDO defines "regulatory floodplain" by projecting the base flood elevation onto the site topography and includes more areas than just those mapped by FEMA.
Because of all of these issues, it is important that Village staff have maps that correctly show all areas subject to the regulations.

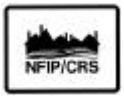
The Lake County Stormwater Management Commission model and Gurnee's Watershed Development Ordinance provide a comprehensive set of standards to protect new development in the floodplains. Because so much of the vacant areas in the floodplain are in the floodway or otherwise preserved as open space, the WDO's greatest impact on floodplain construction will be on redevelopment and improvements to existing buildings.

The ordinance will also be very important after a flood or other disaster, when the Village must review all damaged buildings to determine if they are substantially damaged. If they are, they must comply with the requirements for new construction. A substantially damaged home will have to be elevated so the lowest floor and utilities are at least two feet above the base flood elevation.

Just as important as the regulatory standards is the administration of the regulatory program. FEMA periodically conducts Community Assistance Visits to determine how well communities are meeting their obligations to the NFIP. Such a visit was conducted in April 1999. FEMA found that the procedures and records were in order and the Village was in full compliance with the NFIP requirements.

This finding has implications beyond flood protection. Studies have shown that the best codes have little impact on wind and other natural hazards if they are not properly enforced. For tornadoes, for example, FEMA notes "The greatest protection is afforded by quality construction….In tornado damage studies, the wind engineering research com-

munity has found considerable variability in construction quality and material." *(Multi-Hazard Identification and Risk Assessment,* page 46.)



CRS credit: Because the State, County and Village floodplain development standards exceed the minimum NFIP requirements, there are several places were Gurnee would receive credit. These credits are estimated to total approximately 250 points. The exact score requires some calculations that account for areas that are undevelopable and preserved as open space.

The following items would receive some points:

1. The State's and WDO's higher floodplain and floodway mapping standards.

2. Requiring base flood elevations at the time of permit application in those areas not fully mapped by FEMA (only applicable outside the Des Plaines River floodplain). Section IV.C.1.b.(4)

3. Freeboard (requiring buildings to be protected to two feet above the base flood level). Appendix A's definition of the flood protection elevation.

4. Fill protection standards for new buildings placed on fill. Section IV.C.2.e.(1)(a)

5. Compensatory storage requirements (requiring excavation to compensate for flood storage lost by filling or structures). Section IV.C.2.c.

6. Prohibiting hazardous materials in the floodplain. Section IV.C.2.(d)1.

7. Buffer areas along streams to minimize disruption to channel banks. Section IV.B.1.i

4.6. Stormwater Management

Development outside a floodplain can contribute significantly to flooding problems. Runoff is increased when natural ground cover is replaced by urban development. To prevent stormwater from flooding roads and buildings, developers construct storm sewers and improve ditches to carry the water away more efficiently.

This combination of increased runoff and more efficient stormwater channels leads to increases in downstream storm peaks and changes in the timing when storm peaks move downstream. Unconstrained watershed development often will overload a community's drainage system and aggravate downstream flooding.

A second problem with stormwater is its impact on water quality. Runoff from developed areas picks up pollutants on the ground, such as road oil and lawn chemicals, and carries them to the receiving streams.

Retention ponds manage the increased runoff from new developments.

Retention/detention: Stormwater management 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.

The Community Rating System uses three factors to measure the impact of stormwater management regulations on downstream flooding:

1. What developments have to account for their runoff? If only larger subdivisions have to detain the increased runoff, the cumulative effect of many small projects can still produce greater flows to downstream properties.

2. How much water is managed? Historically, local stormwater management programs address smaller storms, such as the 2- or 10-year storms. The CRS reflects the growing realization nationally that the runoff from larger storms must be managed. It provides full credit only for programs that address all storms up to the 100-year storm.

3. Who is responsible to ensure that the facility works over time? Roads and sewers are located on dedicated public rights-of-way and the community assumes the job of maintaining them in the future. Stormwater management detention basins have traditionally stayed on private property and maintenance has been left up to owner. Often homeowners associations do not know how and do not have the capability to properly maintain these facilities. Half the CRS credit is based on whether the community assumes responsibility to ensure that the facilities are maintained.

Watershed approaches: The standard regulatory approach of requiring each development to manage stormwater to the same criteria has several shortcomings:

1. It does not account for differences in stream and watershed conditions (although the standards can be revised to reflect findings from watershed studies).

2. Municipalities within the same watershed may require different levels of control of stormwater (although all Lake County communities must adopt the WDO).

3. There is no review of the downstream impacts from runoff or any determination of whether the usual standards compound existing flooding problems.

4. It results in many small basins on private property that may or may not be properly maintained.

The way to correct these deficiencies is to conduct a master study of the watershed to determine the appropriate standards for different areas and, sometimes, to identify where a larger central basin would be more effective and efficient than many smaller ones. The CRS provides up to double the stormwater management regulations credit if communities adopt such master plans.

Another way to compensate for these deficiencies is to require measures that enhance the infiltration of stormwater. Run-off reduction measures such as vegetated swales, filter strips, infiltration trenches, and permeable paving blocks, are measures that should be added to standard detention practices to improve stormwater infiltration. A third approach is to preserve the natural drainage system (including depressional storage areas) and native vegetation, and minimize pavement and other impermeable surfaces.

Local implementation, retention/detention: The Watershed Development Ordinance (WDO) includes detention requirements that control the rate of stormwater release from developments. The allowable release rate is the determinant of the volume of stormwater that needs to be detained.

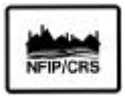
1. What developments have to account for their runoff? Section IV.A.1.f identifies the many types of projects that are regulated by the WDO. This includes all projects with more than one acre of new impervious surface and projects with more than ½ acre if the impervious surface is more that 50% of the lot.

2. How much water is managed? All developments are required to limit the release of the 2-year storm to 0.04 cubic feet per second and the 100-year storm to 0.15 cubic feet per second.

3. Who is responsible to ensure that the facility works over time? The WDO leaves maintenance up to the property owner.

Local implementation, watershed approaches: The WDO specifies uniform release rates (0.04 and 0.15 cubic feet per second). This is the same for the entire County, except where watershed studies recommend different standards. It is anticipated that as comprehensive watershed studies are completed, Lake County Stormwater Management Commission will have more watershed-specific release rates.

Although the WDO addresses the rate of stormwater release, it does not effectively regulate the increased volume of runoff. Controlling the increased rate of runoff through detention may reduce flooding impacts in small watersheds, but detention has little effect on flooding along large rivers such as the Des Plaines. The increased volume of runoff ultimately collects in these large river basins resulting in higher flood elevations.



CRS credit: Because the Watershed Development Ordinance uses different factors than the CRS scoring system, a score for Gurnee was not readily available. It is expected that the ordinance would do well (at least 100 points) if the Village submitted it for credit.

4.7. Conclusions

1. The *Comprehensive Plan* and zoning ordinance are relatively consistent with the current designation of land uses in the Des Plaines River floodplain. They support the status quo, which means little new floodplain development.

2. There are opportunities for improving the Des Plaines River floodplain, especially as a recreational asset. However, the "Village Center" and capital improvement plans deserve special attention as they call for improving and preserving development in the area of deepest flooding.

3. At least one-half of the floodplain is open space in public ownership. Almost all of the privately owned floodplain is already developed. This limits the ability of preventive measures to have a major impact on new development in the floodplain, because not much can be expected to occur there.

4. The Village's building code, floodplain development and stormwater management regulations exceed minimum national and State standards and will be helpful in preventing flood problems from increasing.

5. The Village's building code and other preventive measures are appropriate for the hazards expected from earthquakes, heat, drought, winter storms and thunderstorms.

6. The official regulatory map is not yet in the Village's geographic information system (GIS) and that map and the GIS contour map have conflicting information on where the floodplain boundary should be.

4.8. Recommendations

1. The Village should continue to enforce its current Zoning Ordinance, building code, and Watershed Development Ordinance.

2. The Village should pursue implementation of the Capital Improvement Program.

3. The Village Center special development area plan and zoning district should be reviewed in light of the high risk of flooding and the impact of flooding on buildings, business and public property. Flood mitigation activities should be coordinated with and support the economic development, tourism and recreation potential of the Village Center.

4. The Village's geographic information system should be updated to include the current Flood Insurance Rate Map and other areas subject to regulation as specified by the Watershed Development Ordinance. Where contours differ from the mapped floodplain boundaries, the official floodplain map should be revised.

4.9. References

1. *Capital Improvement Program*, 2000 – 2005, Village of Gurnee, 2000.
2. *Comprehensive Land Use Plan Update*, Village of Gurnee, 1997.
3. *CRS Coordinator's Manual*, FEMA, 1999.
4. Interviews with Village, County and Park District staff, Summer, 2001.
5. *Lake County Comprehensive Stormwater Management Plan*, Lake County Stormwater Management Commission, 1990.
6. *Multi-Hazard Identification and Risk Assessment*, Federal Emergency Management Agency, 1997.
7. *Subdivision Design in Flood Hazard Areas*, American Planning Association and FEMA, PAS Report 473, 1997.
8. *Watershed Development Ordinance*, Village of Gurnee, 2000.
9. *Zoning Ordinance*, Village of Gurnee, 2000.

Chapter 5. Property Protection

Property protection measures are used to modify buildings or property subject to damage. Property protection measures fall under three approaches to protect buildings and other property. While flood hazards are discussed here, as noted later, most of these measures can also protect from other hazards.

Property protection measures are normally implemented by the property owner, although in many cases technical and financial assistance can be provided by a government agency.

The first nine sections of this chapter review the property protection measures.

5.1 Building relocation
5.2 Building acquisition
5.3 Building elevation
5.4 Barriers
5.5 Dry floodproofing
5.6 Wet floodproofing
5.7 Sewer backup protection
5.8 Insurance
5.9 Measures for other hazards

After the measures are explained, there are three sections that discuss the building-by-building survey and the measures that are recommended for the buildings in Gurnee's floodplain.

5.10 Property protection criteria
5.11 Retrofitting recommendations
5.12 Acquisition recommendations

Section 5.13 discusses government actions that promote or support protection measures undertaken by property owners.

5.1. Building Relocation

Moving a building to higher ground is the surest and safest way to protect it from flooding. While almost any building can be moved, the cost goes up for heavier structures, such as those with exterior brick and stone walls, and for large or irregularly shaped buildings. However, experienced building movers know how to handle any job.

Building relocation

In areas subject to flash flooding, deep waters, or other high hazard, relocation is often the only safe approach. Relocation is also preferred for large lots that include buildable areas outside the floodplain or where the owner has a new flood-free lot (or portion of their existing lot) available.

Relocation can be expensive, with costs ranging for $30,000 for a small wood frame building to over $60,000 for masonry and slab on grade buildings. Two story houses are more expensive to move because of the need to relocate wires and avoid overpasses. Additional costs may be necessary for acquiring a new lot on which to place the relocated building and for restoring the old site. Larger buildings may have to be cut and the parts moved separately.

Local implementation: While buildings have been moved in the Gurnee area, there are no know examples of moves for protection from floods or other hazard.

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 Community Rating System does not differentiate between the mode of clearing buildings out of the floodplain. Gurnee's credits are discussed in the next section.

5.2. Acquisition

Like relocation, acquisition of buildings in a floodprone area ensures that they will no longer be subject to damage. The major difference is that acquisition is 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.

This home was acquired in 2000 by the Stormwater Management Commission and the site was cleared for open space.

Acquiring buildings and removing them from the floodplain is not only the most effective flood protection measure available, it is also a way to convert a problem area into a community asset and obtain environmental benefits.

Occasionally acquisition and relocation projects are undertaken jointly. The purchasing agency typically sells the building for salvage. Sometimes, the original owner of the acquired building can make arrangements to buy it back at the salvage value.

The advantage of this approach is that the owner relocates the building rather than demolishes it. This way, the owner gets to keep the building and may have enough money from the sale to pay for a new lot and moving expenses. There is a further savings in that the local government does not have to pay for demolition of the building.

While acquisition is appropriate for any type of flood hazard, it is more cost-effective in areas subject to flash flooding, deep waters, or repetitive flooding where other property protection measures are not feasible. Acquisition, followed by demolition, is most appropriate for buildings that are difficult to move—such as larger, slab foundation, or masonry structures—and for dilapidated structures that are not worth protecting.

An acquisition budget should be based on the median price of similar properties in the community, plus $10,000 to $20,000 for appraisals, abstracts, title opinions, relocation benefits, and demolition. Costs may be lower after a flood or other disaster. For example, the community may have to pay only the difference between the full price of a property and the amount of the flood insurance claim received by the owner.

One problem that sometimes results from an acquisition project is a "checkerboard" pattern in which nonadjacent properties are acquired. This can occur when some owners, especially those who have and prefer a waterfront location, prove reluctant to leave. Creating such an acquisition pattern in a community simply adds to the maintenance costs that taxpayers must support.

Local implementation: The Village of Gurnee has purchased properties when they come up for sale. Since the 1986 flood, Gurnee has purchased 14 properties in the Des Plaines River floodway. Nine of these had buildings on them, 8 of which have been cleared. The ninth building is being rented out.

In 1997, the Lake County Stormwater Management Commission began coordinating the county's first acquisition projects in Sturm Subdivision and William's Park, two of the most repetitively flood damaged locations in the county (see photo, previous page). The acquisition is being cost-shared with Federal Emergency Management Agency (FEMA) post-disaster mitigation funds through the Illinois Emergency Management Agency (IEMA). The buyout involves eligible willing sellers only and is funded with 75% federal dollars and 25% local.

Demolition of a house on Old Grand Avenue that was purchased by the Village.

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. However, the score is adjusted based on the number of buildings remaining in the floodplain. A city that acquires 12 out of 100 floodprone buildings will receive a higher score than one that removes 12 out of 1,000. Gurnee would receive 200 points under Activity 520 (Acquisition and Relocation) for the eight properties that the Village has acquired and cleared from the Des Plaines River floodplain.

5.3. Building Elevation

Raising a building above the flood level is the best on-site property protection method. Water flows under the building, causing little or no damage to the structure or its contents. Alternatives are to elevate on continuous foundation walls (creating an enclosed space below the building) or elevation on compacted earthen fill.

Although elevating on compacted fill is sometimes the most desirable elevation solution, it is a complicated alternative. The building has to be temporarily moved, so that the fill can be placed and properly compacted, and then replaced. This process may make elevation on fill more costly than elevating on an open foundation or continuous foundation walls.

This house was elevated one foot above the base flood elevation of the Des Plaines River in North Libertyville Estates.

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. If the building is raised 2 feet, the front door would be three steps higher than before. If the building is raised 8 or more feet, the lower area can be wet floodproofed and used for parking and for storage of items that will not be damaged by flood waters.

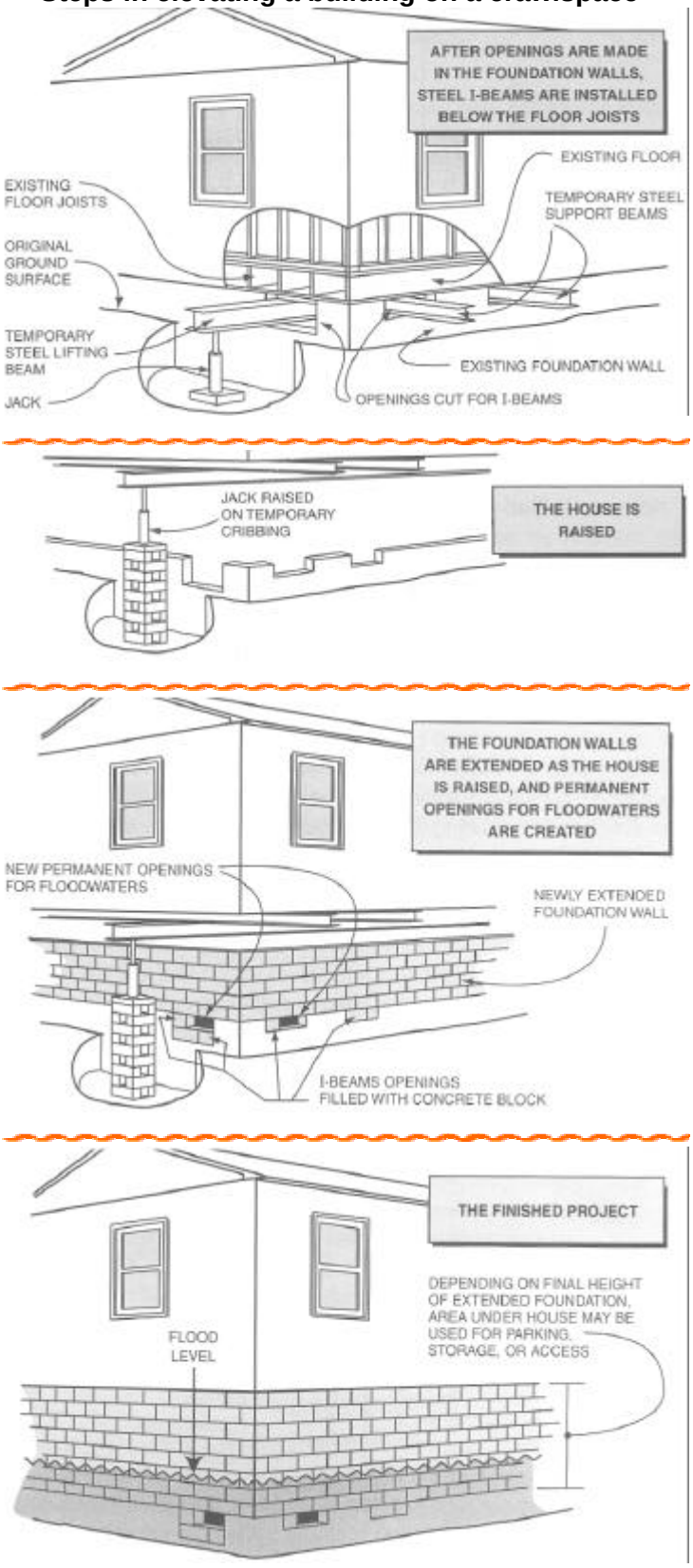
Raising a building above the flood level is cheaper than moving it and can be less disruptive to a neighborhood. Elevation has proven to be an acceptable and reasonable means of complying with NFIP regulations that require new, substantially improved, and substantially damaged buildings to be elevated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

As with relocation, the cost depends on the construction type (e.g., frame or masonry) and the type of existing foundation (e.g., basement, crawlspace, or slab-on-grade). It varies from $17 to $47 per square foot for elevating on an extended crawlspace as shown in the drawings on the next page.

Basements: Buildings with basements can be elevated in the same manner as illustrated on the next page for crawlspaces. However, 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.

Precautions: During a flood, the streets, utilities, and other infrastructure that serve a building will still be exposed to flood damage. The building may be isolated and without utilities, and therefore unusable. There will also be a risk to the occupants who may try to enter or leave the building during a flood. Another problem arises when newly created lower stories are used for storage of vulnerable items, which puts them at risk of flood damage.

Steps in elevating a building on a crawlspace



Source: *Homeowner's Guide to Retrofitting, FEMA 312, 1998, pages 93 - 94*

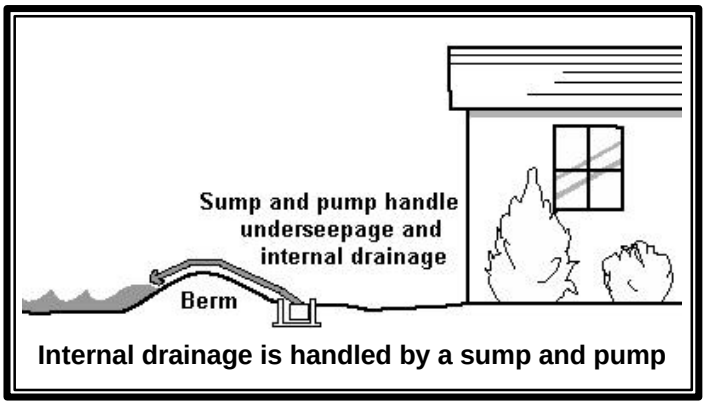
Local implementation: Homes have been elevated in the area for flood protection. The photo on page 5-4 shows one of four homes that have been raised in North Libertyville Estates to protect them from Des Plaines River flooding.

CRS credit: The Village would receive approximately 20 points for each building that is elevated to at least one foot above the base flood elevation. This would under Activity 530 (Retrofitting). Elevating a building above the flood level will also reduce the flood insurance premiums on that individual building.

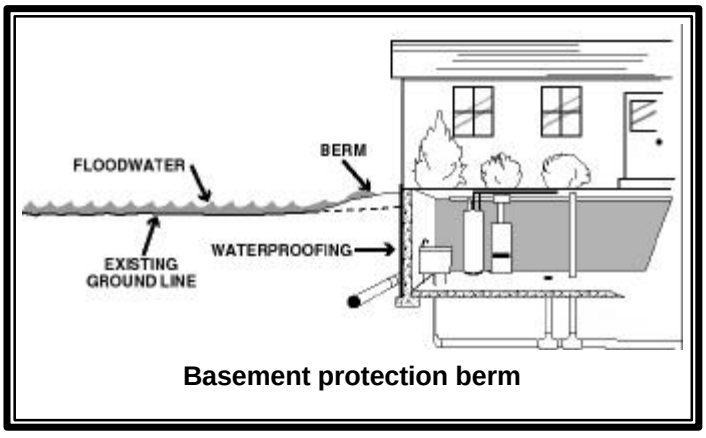
5.4. Barriers

Barriers keep surface floodwaters from reaching a building. A barrier can be built of dirt or soil ("berm") or concrete or steel ("floodwall"). The standard design for earthen berms is three horizontal feet for each vertical foot (3:1 slope).

As a result, an area six feet wide is the minimum needed for each foot in height. Floodwalls need less room, but are more expensive. Barriers must be placed so as not to create flooding or drainage problems on neighboring properties, nor can they be constructed in the floodway.



Internal drainage is handled by a sump and pump



Basement protection berm

Depending on how porous the ground is, if floodwaters will stay up for more than an hour or two, a barrier needs to handle leaks, seepage of water underneath, and rainwater that falls inside the perimeter. This is usually done with a sump and/or drain to collect the internal groundwater and surface water and a pump and pipe to pump the internal drainage over the barrier.

Basements: A variation on the barrier approach is the basement protection berm. Basements and the lower floors of split levels can be protected from surface water by construction of low walls around stairwells or using backfill. First, a waterproofing compound is applied to the walls. Walls are built up around the window wells and basement stairwells (without blocking basement windows that are needed for emergency exits). An earthen berm is placed against the side of the house. A subsurface drain and one or two correctly sized sump pumps are also needed. The drains and pumps can keep up with the seepage before it gets through the berm and reaches the basement walls.

Precautions. A barrier can only be built so high. It can be overtopped by a flood higher than expected. Being made of earth, it is 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.

During a flood, the streets, utilities, and other infrastructure that serve a building will still be exposed to flood damage. The building may be isolated and without utilities, and therefore unusable. There will also be a risk to the occupants who may try to enter or leave the building during a flood.

Openings are a concern with barriers

Some barriers have openings for driveways and sidewalks. Closing these openings is dependent on someone being available and strong enough to put the closure in place. Another precaution is to account for water in the sewer lines that may back up under the barrier and flood inside the building (see Section 5.7 on sewer backup protection).

Local implementation: Walls to protect against surface flooding can be found along the Des Plaines River. The illustration to the right shows one in Lincolnshire. Note that this owner has to close the opening at the driveway when the water rises.

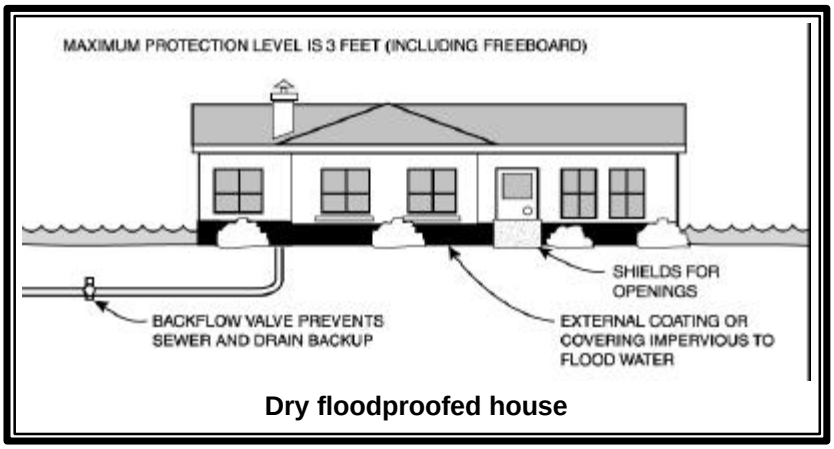
This floodwall is in Lincolnshire.

Basement protection berms have been used throughout the Chicago area. While there are no known examples in Gurnee, the flood mitigation questionnaire identified 24 buildings where sump pumps are used to manage high ground water levels outside the basement. Four property owner reported having regraded their yards to keep water away from the basement.

CRS credit: Credit for floodwalls, levees and berms that are located entirely on the owner's property is provided under Activity 530 (Retrofitting). Because this property protection measure is less secure than elevation, not as many points are provided.

5.5. Dry Floodproofing

This term covers several techniques for sealing up a building to ensure that floodwaters cannot get inside it. All areas below the flood protection level are made watertight. Walls are coated with waterproofing compounds or plastic sheeting. Openings (doors, windows, and vents) are closed, either permanently, with removable shields, or with sandbags.



Dry floodproofed house

Many dry floodproofed buildings do not look any different from those that have not been modified.

Dry floodproofing is only appropriate for buildings on concrete slab floors (without basements) and with no cracks. To ensure that the slab is watertight and sound, an engineering analysis is recommended. The maximum flood protection level for dry floodproofing is three feet above the slab. Deeper water will put pressure on the walls and slab floor that they are not built to withstand.

Precautions: During a flood, the streets, utilities, and other infrastructure that serve a building will still be exposed to flood damage. The building may be isolated and without utilities, and therefore unusable. There will also be a risk to the occupants who may try to enter or leave the building during a flood.

Closing the openings is dependent on someone being available and strong enough to put the closure in place. Another precaution is to account for water in the sewer lines that may back up under the barrier and flood inside the building (see Section 5.7 on sewer backup protection).

It is very tempting for the owner of a dry floodproofed building to try to keep the flood out if floodwaters get deeper than two or three feet. This can result in collapsed walls, buckled floors, and danger to the occupants.

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.

Local implementation: Three of the respondents to the flood mitigation questionnaire stated that they had waterproofed their walls and/or installed shields for their doorways.

NFIP/CRS

CRS credit: Credit for dry floodproofing is provided under Activity 530 (Retrofitting). Because this property protection measure is less secure than elevation, not as many points are provided.

5.6. Wet Floodproofing

Wet floodproofing means letting the water in and removing everything that could be damaged by a flood. There are several ways to modify a building so that floodwaters are allowed inside, but minimal damage is done to the building and its contents. These techniques range from moving a few valuable items to rebuilding the floodprone area.

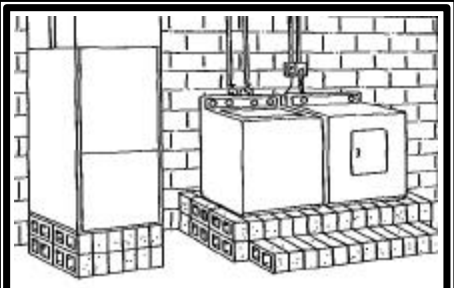
In the latter case, structural components below the flood level are replaced with materials that are not subject to water damage. For example, concrete block walls are used instead of wooden studs and gypsum wallboard. The furnace, water heater, and laundry facilities are permanently relocated to a higher floor. Where the flooding is not deep, these appliances can be raised on blocks or platforms.

The water heater was elevated in this wet floodproofed garage.

Wet floodproofing is not feasible for one-story houses because the flooded areas are the living areas. However, many people wet floodproof their basements, crawlspaces, garages, and accessory buildings simply by relocating all hard-to-move valuables, such as the furnace, heavy furniture and electrical outlets. Light or moveable items, like lawn furniture and bicycles, can be moved if there is enough warning. Fuse and electric breaker boxes should be located high and near a door in order to safely turn the power off to the circuits serving floodprone areas.

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.

Precautions: During a flood, the streets, utilities, and other infrastructure that serve a building will still be exposed to flood damage. The building may be isolated and without utilities, and therefore unusable. There will also be a risk to the occupants who may try to enter or leave the building during a flood.



Where flood depths are shallow, a few blocks can protect utilities and other valuable contents.

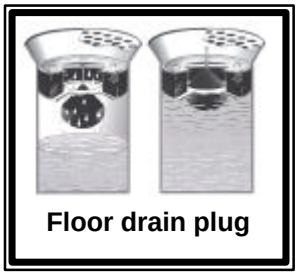
Moving contents is dependent on adequate warning and the presence of someone who knows what to do. Flooding a basement or garage where there is electricity, paint, gasoline, pesticides, or other hazardous materials creates a safety hazard. There will still be a need for cleanup, with its accompanying health problems.

Local implementation: In response to the flood mitigation questionnaire, nine people reported that they had moved things out of the basement or garage or otherwise elevated damage-prone contents.

CRS credit: Credit for wet floodproofing is provided under Activity 530 (Retrofitting). Because this property protection measure is less secure than elevation, not as many points are provided.

5.7. Sewer Backup Protection

Cross connections between the sanitary and storm sewers and infiltration and inflow can overload the sanitary sewers during a storm. Buildings that have downspouts, footing drain tile, and/or a sump pump connected to the sanitary sewer service may be flooded inside during heavy local rains. These should be disconnected. Rain water and surface water should be directed out onto the ground where it will flow away from the building.



Floor drain plug

Four other 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 are more secure, but more expensive ($3,000-$4,000). An overhead sewer keeps water in the sewer line during a backup. A backflow protection valve prevents backups from flowing into the building.

Local implementation: Three basement owners reported in the mitigation questionnaire that they had installed plugs or overhead sewers.

The Village's Sanitary Sewer Mitigation Program provides up to 85% of the cost (up to $2,500) for installation of a sewer backup protection measure. Recipients must be able to verify past damage. Since 1994, this program has funded 31 projects at an average cost to the Village of $1,550.

CRS credit: Credit for sewer backup protection is provided under Activity 530 (Retrofitting). Because this property protection measure is less secure than elevation, not as many points are provided.

5.8. Insurance

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. 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 insurable buildings and their contents damaged by a "general condition of surface flooding" in the area. Building coverage is for the structure. This includes all things that typically stay with the building when it changes ownership, including:

- Utility equipment, such as a furnace or water heater
- Wall-to-wall carpeting
- Built-in appliances
- Wallpaper and paneling

Ten percent of a residence's building coverage may apply to a detached garage or carport. Other appurtenant structures must be insured under a separate policy.

Contents coverage is for the removable items inside an insurable building. A renter can take out a policy with contents coverage, even if there is no structural coverage. Certain items are not insurable. These include:

- Items outside a building, such as fences, car ports, landscaping and driveways,
- Jewelry, artwork, furs and similar items valued at more than $250
- Finished structural parts of a basement, such as paneling and wall to wall carpeting
- Animals and livestock
- Licensed vehicles
- Money or valuable papers
- Contents in a basement

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.

In most cases, a 30-day waiting period follows the purchase of a flood insurance policy before it goes into effect. The objective of this waiting period is to encourage people to keep a policy at all times. People cannot wait for the river to rise before they buy their coverage.

Basements: There is limited coverage for basements and the below grade floors of bilevels and trilevels. The NFIP defines "basement" as "Any area of the building, including any sunken room or sunken portion of a room, having its floor below ground level (subgrade) on all sides.

Coverage under building or structural coverage is limited to specific items needed for the operation of the building, such as a furnace, water heater, clothes washer and dryer. There is very limited coverage for finishings, such as wallpaper and carpeting, and contents.

Cost: The tables below show the costs for a single family home located in the base floodplain with the standard $1,000 deductibles. Rates are lower for buildings that are elevated above the base flood level. Properties outside of the mapped floodplain with no history of flooding can be covered by an even less expensive "preferred risk policy."

Many insurance policies will only pay to repair the damage incurred. If damage is severe enough, the owner may have additional costs to bring the building up to current codes. Flood insurance now covers these costs (up to $20,000) when there is a flood. This is called "Increased Cost of Compliance" coverage and is automatically included in all policies.

Single Family Home on Slab or Crawlspace

Amount of coverage	Cost for coverage	Constants and fee	Annual premium
$100,000 structural coverage $40,000 contents coverage	$440 $230	$155	$825
$50,000 structural coverage $20,000 contents coverage	$340 $158	$155	$653

Single Family Home with Basement, Bilevels and Trilevels

Amount of coverage	Cost for coverage	Constants and fee	Annual premium
$100,000 structural coverage $40,000 contents coverage	$545 $230	$155	$930
$50,000 structural coverage $20,000 contents coverage	$365 $158	$155	$678

Local implementation: Flood insurance has been available in Gurnee since 1980. As of April 2001, there were 68 flood insurance policies in the Village, providing over $13 million in coverage. By participating as a Community Rating System, the Village can save residents some of those premiums.

About 2/3 of the policies are for properties in the mapped base floodplain. This means that *less than 40% of the properties in the mapped floodplain are protected with a flood insurance policy*. As noted in the table on page 2-2, these properties are nearly 5 times more likely to be hit by a flood than by a fire. It is apparent that the majority of floodplain residents do not have flood insurance coverage.

Type	Number	Coverage
1-4 Family	53	$8,142,000
Other residential	4	800,000
Small Business	0	0
Other	11	4,567,000
Total	68	$13,509,000

Flood insurance coverage in Gurnee

Source: FEMA, 2001

Basement backup insurance: The NFIP will cover seepage and sewer backup for an additional deductible provided there is a general condition of flooding in the area that was the proximate cause of the basement getting wet.

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. The cost varies from nothing to up to about $75 for a rider on your homeowner's insurance premium.

Other hazard insurance: Private insurance companies cover the other hazards that threaten Gurnee property owners. Tornado, wind, and winter storm coverage is part of most homeowner's policies. Separate endorsements are usually needed for earth movement (e.g., earthquake) coverage. Unlike flood insurance, there are no readily available statistics on how many homeowners policies or special hazard endorsements are in force in Gurnee.

CRS credit: There is no CRS 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.

5.9. Measures for Other Hazards

Property protections measures can be taken to protect buildings from hazards other than flooding and sewer backup. Here are the more common ones:

Tornado:

- Constructing an underground shelter or in-building "safe room" (which can be done for approximately $3,000)
- Securing roofs, walls and foundations with adequate fasteners or tie downs
- Strengthening garage doors and other large openings

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

Drought/heat:

- Adding insulation
- Installing water saver appliances, such as shower heads and toilets

Earthquake:

- Retrofitting structures to better withstand shaking.
- Tying down appliances, water heaters, bookcases and fragile furniture so they won't fall over during a quake.

Winter storms:

- Adding insulation
- Relocating water lines from outside walls to interior spaces
- Sealing windows
- Burying utility lines
- Installing/incorporating backup power supplies

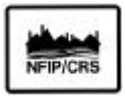
Thunderstorms:

- Installing lightning rods and lightning surge interrupters
- Installing storm shutters and storm windows
- Burying utility lines
- Installing/incorporating backup power supplies

Common measures: From the above lists, it can be seen that certain approaches can help protect from more than one hazard. These include:

- Strengthening roofs and walls to protect from wind and earthquake forces.
- Bolting or tying walls to the foundation protect from wind and earthquake forces and the effects of buoyancy during a flood.
- Adding insulation to protect for extreme heat and cold
- Anchoring water heaters and tanks to protect from ground shaking and flotation
- Burying utility lines to protect from wind, ice and snow.
- Installing backup power systems for power losses during storms (especially important for those basements that depend on sump pumps to prevent flooding)

Local implementation: Many residents have improved their homes' ability to withstand extremes in heat and cold with extra insulation, window sealing and other measures. Eight respondents to the floodplain residents' questionnaire reported that they have backup power systems. The Illinois Emergency Management Agency has funded several projects to retrofit schools and other public buildings for earthquake protection.



CRS credit: There is no CRS credit for property protection measures to protect a building from hazards other than flooding, local drainage and sewer backup.

5.10. Property Protection Criteria

To determine the appropriate property protection measure(s) for a building, information is needed about two factors: building type and condition and flood hazard. Because of the relatively low velocities and long warning time, the key factor in Gurnee is depth of flooding. The decision criteria are shown in the matrix on the next page.

These criteria were developed during the preparation of the Lake County flood mitigation and repetitive loss plans. They were endorsed by the Gurnee Flood Mitigation Planning Committee. They are for planning purposes and provide a margin of safety. Different

approaches may work for an individual building, after a closer review of its condition. Here is the rationale for these criteria:

Slab foundation: If the first floor is above the base flood elevation (depth is "< 0 feet"), then no measures are recommended (other than insurance for floods that exceed the base flood). If the base flood is less than 2 feet over the first floor ("<2 feet"), then a barrier to keep the shallow floodwaters away from the structure is the preferred approach. If there is no room for the barrier, then dry floodproofing would work.

For floods deeper than 2 feet over the first floor, an in-place retrofitting measure is not recommended. The most cost-effective flood protection approach will be to relocate the structure (or acquire and demolish it).

Property Protection Decision Matrix

Foundation	Base Flood Depth *	First Recommendation	Second Recommendation
Slab			
First floor	< 0 feet	Above BFE *	Above BFE *
First floor	< 2 feet	Barrier	Dry floodproof
First floor	≥ 2 feet	Relocate	Relocate
Crawlspace			
First floor	< –2 feet	Above BFE *	Above BFE *
First floor	< 0 feet	Wet floodproof	Barrier
First floor	≥ 0 feet	Elevate	Elevate
Basement			
Basement floor	< 0 feet	Above BFE *	Above BFE *
First floor	< 0 feet	Barrier/berm	Wet floodproof
First floor	≥ 0 feet	Elevate, fill in basement	Elevate, fill in basement
Bilevel/Trilevel			
Basement floor	< 0 feet	Above BFE *	Above BFE *
First floor	< 0 feet	Barrier/berm	Relocate
First floor	≥ 0 feet	Relocate	Relocate

* Base flood depth is the depth of the base (100-year) flood above the floor. A negative number ("<0") means that the floor is above the base flood elevation or "BFE."

Crawlspace foundation: Because ductwork and, sometimes, furnaces and air conditioning equipment are located in the crawlspace, a safety factor of two feet is used. The first floor must be two feet above the base flood elevation before the building is considered "above BFE.."

If the base flood does not go over the first floor, the crawlspace should be wet floodproofed (i.e., the furnace, ductwork, etc., should be moved to a higher level and the insulation should be made of water resistant material, such as Styrofoam). A less secure alternative is to construct a barrier, such as a berm, to keep water out of the crawlspace.

If the flood is deeper, that is, over the first floor, elevating the entire building is the recommended approach. This is the most effective way to protect a building and it is most economical for buildings on crawlspaces.

Basements: If the flood level does not go over the first floor, a building can usually be protected with a barrier or basement protection berm. This assumes that the barrier will not have to be more than 3 or 4 feet high. A less desirable alternative is to let the water into the basement, but wet floodproof the area. This alternative is recommended where the base flood level is more than three feet above grade, but below the first floor, as in a "raised ranch."

The only way to protect a building with a basement from flooding over the first floor is to elevate or relocate it. If elevated, the only safe thing to do is to fill in the basement.

Bilevels/Trilevels: These buildings are treated the same as buildings with full basements with one exception. It is assumed that valuables and contents can be evacuated from a basement and the area can be wet floodproofed. In the case of bilevels and trilevels, the area below grade level is not "expendable." It is the living area that will not survive intentional flooding. Therefore, if the water is expected to be over the first floor, the building can only be protected by relocating it out of the floodplain.

5.11. Retrofitting Recommendations

"Retrofitting" includes those property protection measures that alter a building in place. It does not include acquisition, relocation or insurance.

During the summer of 2001, French & Associates' staff surveyed all 111 buildings in the Village's Des Plaines River floodplain. Data collected included:

- Type of foundation and walls
- Building use
- Evidence of soil and maintenance problems
- Proximity to public open space
- First floor elevation

The flood hazard information for Gurnee is discussed in Chapter 2. For this review, the base flood elevation according to the 2000 Flood Insurance Study was used.

Each building was reviewed according to the criteria in the Property Protection Decision Matrix. A second on-site review confirmed that the recommended measures were appropriate. The results are displayed by cluster in the table below. It shows that of the 111 buildings in Gurnee's floodplain:

20 are above the base flood level
23 should be relocated,
18 could be retrofitted, but the owners will lose their basements
50 can be retrofitted in place with minimal disruption to the building

Recommended Property Protection Measures

Cluster	Above BFE	Relocate *	Elevate Bsmt *	Elevate Crawl	Barrier/ Berm	Wet Fldprf	Total
GV – Grove	7 ++				2	1	10
WG – West Grand	1	1			2		4
GS – Grade School		2				1	3
KE – Kilbourne/Emerald		2	10	6	1	1	20
DT – Downtown	1	9			3		13
EG – East Old Grand	2	2	6		6		16
MY – McClure Floodway		4	2		1	2	9
MG – McClure Fringe	7	4		1	8		20
FS – First Street	2				2	1	5
WS – West Street		2			1	2	5
BH – Brookhaven					6		6
Total	20	26	18	7	32	8	111

* Buildings identified for relocation or elevation and filling in the basement would also be candidates for acquisition.
++ Six buildings on Grove are considered above the base flood elevation, even though there are no flood elevations for the area.

5.12. Acquisition Recommendations

The table above shows that there are 44 buildings identified as appropriate for relocation and elevation and filling in the basement. As noted in Chapter 2's discussion on flood depths, the most severely affected clusters are Downtown and Kilbourne/Emerald. Those two clusters, plus the Grade School cluster, also have the most buildings that need the more expensive and disruptive property protection measures: relocation and elevation and filling in the basement.

In Downtown, for example, all but two of the buildings are on slab foundations, making in-place retrofitting inappropriate where flood depths are greater than two feet. Only four of the 13 buildings have flood depths less than two feet over the first floor. Those four could be protected in place, but the rest should be relocated.

These 44 buildings would also be technically appropriate for acquisition, but other factors must be considered before an acquisition decision is made. One concern is funding. The average estimated market value of the 44 properties is $170,000.

Another key concern is that there is a desire by the Committee as well as the Village's plans to preserve the Village Center. Either flood mitigation measures other than acquisition will be needed for this area or the acquired sites would be used to build new, flood protected commercial structures. State and Federal funds could not be used for the latter approach – these programs require that the acquired lots be kept forever as open space.

The Mitigation Planning Committee established the following criteria for determining whether a property should be purchased. They are listed in priority order.

- The owner must be willing to sell
- Repetitively flooded properties
- Buildings that are deteriorating or in an unsafe condition
- Properties in the floodway
- Properties with the deepest flooding over the first floor
- Public properties (e.g., school)

Except for the priorities related to willingness to sell, public buildings and the Village Center, the priorities set by the Committee are related to the flood threat. Those facing the greatest hazard (repetitive flooding, floodway and deepest flooding) should be purchased first. Those in a deteriorating condition are also those that should not be protected through an in-place retrofitting approach. The field survey only identified three such buildings.

Based on these criteria, an acquisition priority score was developed using the following formula:

- 3 points for having the first floor at least 3 feet below the base flood level (this is a measure of repetitive flooding – these buildings were flooded over their first floor in 1986)
- 1 point for being in a deteriorating or unsafe condition
- 1 point for being in the floodway
- 1 point for each foot of base flood depth
- 1 point for being a public property

In the case of bilevels and trilevels, the lowest floor is considered the first floor. The resulting scores are shown in the table on the next page. Property addresses are not listed and the Committee underwent its deliberations without knowing the impact on individual private properties.

Priority Scores: 44 Acquisition Candidates						
Cluster	**Base flood ≥3**	**Condition**	**Floodway**	**Base flood**	**Public property**	**Total score**
Grade School	3	0	1	7	1	12
McClure Floodway	3	0	1	7	0	11
McClure Floodway	3	0	1	7	0	11
Kilbourne/Emerald	3	0	1	6	0	10
Downtown	3	0	1	5	0	9
Downtown	3	0	1	5	0	9
McClure Floodway	3	0	1	5	0	9
Kilbourne/Emerald	3	0	0	5	0	8
Kilbourne/Emerald	3	0	1	4	0	8
Downtown	3	0	1	3	1	8
Downtown	3	0	1	4	0	8
Downtown	3	0	1	4	0	8
Kilbourne/Emerald	3	0	1	3	0	7
Kilbourne/Emerald	3	0	1	3	0	7
Kilbourne/Emerald	3	0	1	3	0	7
Downtown	3	0	1	3	0	7
Downtown	3	0	1	3	0	7
McClure Fringe	3	1	0	3	0	7
West Street	3	0	0	4	0	7
East Old Grand	3	0	0	3	0	6
East Old Grand	3	0	0	3	0	6
West Grand	0	0	1	2	1	4
Grade School	0	0	1	2	1	4
Kilbourne/Emerald	0	0	1	2	0	3
Downtown	0	0	1	2	0	3
Downtown	0	0	1	2	0	3
Kilbourne/Emerald	0	0	1	1	0	2
Kilbourne/Emerald	0	0	1	1	0	2
Kilbourne/Emerald	0	0	1	1	0	2
East Old Grand	0	0	0	2	0	2
East Old Grand	0	0	0	2	0	2
McClure Floodway	0	1	1	0	0	2
McClure Fringe	0	0	0	2	0	2
West Street	0	0	0	2	0	2
Kilbourne/Emerald	0	0	1	0	0	1
East Old Grand	0	0	0	1	0	1
East Old Grand	0	0	0	1	0	1
East Old Grand	0	0	0	1	0	1
McClure Floodway	0	0	1	0	0	1
McClure Fringe	0	0	0	1	0	1
McClure Fringe	0	0	0	1	0	1
Kilbourne/Emerald	0	0	0	0	0	0
East Old Grand	0	0	0	0	0	0
McClure Floodway	0	1	0	*–2*	0	–1

The scores range from –1 (first floor above the base flood elevation) to 12. The Grade School had the highest score, 12. Almost all the other high scoring properties are in the Kilbourne/Emerald, McClure Floodway and Downtown clusters.

This recommended priority list is for planning purposes only. It would be most useful if the Village were able to obtain enough funds to buy several properties. The list would then be used by the Village to determine which properties should receive the first offers. Until such funds become available, the current program of offering to purchase properties as they come up for sale should be followed. In either case, all acquisition projects should be voluntary.

Two other factors must be considered. The first is the criteria of outside funding agencies. The Illinois Emergency Management Agency, for example has given priority funding to residential and repetitively flooded properties.

The other factor is economy. If one building remains surrounded by public open space, it makes sense to purchase it (assuming the owner is willing), even though it may not be one of the 44 properties appropriate for acquisition.

Base flood elevation at the Grade School

Gurnee Grade School: In almost every formula, one building shows up as a top priority for attention. The Gurnee Grade School has the lowest opening and lowest main floor of all the buildings surveyed, 7.4 feet below the base flood elevation and 4 feet below the 10-year flood level. It is considered a bilevel because the lowest floor is four feet below grade. During the base flood, this floor would be flooded to nearly the ceiling.

The impact of past flooding on the School, is covered and illustrated on page 2-20. The problem is not just property damage. A flooded school has an adverse impact on the students, their education and their health. All residents of Gurnee pay the taxes needed to make the repairs after a flood. As an older masonry building, the School may be susceptible to damage from an earthquake.

The Property Protection Decision Matrix concludes that the first and second recommendations are both “relocate.” Given the type, size and weight of the structure, the only feasible approach for protection from the base flood is to demolish it and relocate the activities to a flood-free site. Three other approaches could be followed to protect from a lesser flood:

1. A barrier or berm could be built around the building,
2. The lower floor could be wet floodproofed, or
3. The lower floor could be filled in with sand.

These three approaches are much less expensive than acquisition and clearance. The first would allow full use of both floors and the second would allow for some use of the lower floor. However, when the building is flooded again, there will be a loss of class time, relocation of classes to another location for several months, and high clean up costs to ensure that there is no mold or other problems remaining in the areas where children will be.

These problems would not occur under the third approach, but the School District would lose the use of half the building.

A search of State and Federal funding programs found none that would help in this situation. Pre-disaster mitigation programs currently favor residences and repetitive loss properties. Post-disaster programs could help, but the School District will have to wait for the disaster damage before the funding is available to prevent such damage.

5.13. The Village's Role

Property protection measures are usually considered the responsibility of the property owner. However, the Village should be involved in all strategies that can reduce flood losses, especially acquisition. There are various roles the Village can play in encouraging and supporting implementation of these measures.

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 of this *Plan*.

Financial Assistance: Communities can help owners by helping to pay for a retrofitting project, just like they pay for flood control projects. 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 and other flood problems that arose from an inadequate public sewer or drain 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 more common outside funding sources are listed below. Unfortunately the first five are only available after a disaster, not before, when damage could be prevented. Following past disaster declarations, FEMA and/or the Illinois Department of Natural Resources have provided advice on how to qualify and apply for these funds.

Post-disaster funding sources

- Flood 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)
- FEMA's disaster assistance (for public properties)
- Small Business Administration disaster loans (for non-governmental properties)
- FEMA's Hazard Mitigation Grant Program

Pre-disaster funding sources

- FEMA's Flood Mitigation Assistance Program
- Community Development Block Grant
- Illinois Department of Natural Resources
- Lake County Stormwater Management Commission

Acquisition agent: The Village can be the focal point in an acquisition project. Most funding programs require a local public agency to sponsor the project. The Village could process the funding application, work with the owners, and provide some or all of the local share. In some cases, the Village would be the ultimate owner of the property, but in other cases the Forest Preserve District or other public agency could assume ownership and the attendant maintenance responsibilities.

Other Incentives: Sometimes only a little funding is needed to motivate a property owner to implement a retrofitting project. A flood insurance premium reduction will result if a building is elevated above the flood level. This reduction is not enough to take much of a bite out of the cost of the project, but it reassures the owner that he or she is doing the right thing. Other forms of floodproofing are not reflected in the flood insurance rates for residential properties, but they may help with the Community Rating System which provides a premium reduction for all policies in the community.

Other incentives to consider are programs to help owners calculate the benefits and costs of a project and a "seal of approval" for retrofitted buildings. The latter would be given following an inspection that confirms that the building meets certain standards. There are many other personal but noneconomic incentives to protect a property from flood damage, such as peace of mind and increased value at property resale.

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 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 is worth more than 50% of the value of the original building it is considered a "substantial improvement" (see item 5 in the box on page 4-11). The building must then be elevated or otherwise brought up to current flood protection codes.

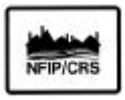
Another possible mandate is to require less expensive flood protection steps as a condition of a building permit. For example, many communities require upgraded electrical service as a condition of a home improvement project. If a person were to apply for a permit for electrical work, the community could 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: Public information programs are discussed in Chapter 9. The Town of Highland, Indiana, employed a financial assistance counselor after its flood in 1990. This person worked for several months helping property owners understand the various federal disaster assistance programs.

The Village and the Lake County Stormwater Management Commission have both acted as the acquisition agent for several buyout projects. Since the 1986 flood, Gurnee has purchased 14 properties in the Des Plaines River floodplain. Nine of these had buildings on them, 8 of which have been cleared. The ninth building is being rented out. The Mitigation Planning Committee strongly supports this effort as long as all purchases are from willing sellers.

The Village has funded sewer backup protection measures. This approach has been used by Des Plaines, Mount Prospect and South Holland which have received national recognition for their rebate programs to help property owners fund retrofitting projects to protect against surface flooding. In South Holland, if a project is approved, installed, and inspected, the Village will reimburse the owner 25% of the cost up to $2,500. Over 350 floodproofing and sewer backup protection projects have been completed under this program. Perhaps not surprisingly, contractors have become some of the best agents to publicize this program.

Some suburban communities have resale inspections which provide the buyer and the seller a list of recommended and/or required changes. All communities in the National Flood Insurance Program have the 50% substantial improvement requirement for floodplain properties.



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).

5.14. Conclusions

1. There are several ways to protect individual properties from flood damage. Each is appropriate in certain situations and each has advantages and disadvantages.

2. There are many ways to protect properties from other hazards. There are several measures that can protect properties from the effects of more than one hazard.

3. Property owners can implement some property protection measures at little cost, especially for sites in areas of low flood hazard. For other measures, such as relocation and elevation, the owners may need financial assistance.

4. Many people are not aware of the various ways they can protect their own property. There is a low level of awareness of the availability and coverage provided by flood insurance. There is probably a similar level of awareness of other hazard insurance.

5. Of the 111 buildings in the Des Plaines River floodplain, 20 are above the base flood elevation, 26 should be relocated, and 65 could be retrofitted in place.

6. Forty-four properties are appropriate for acquisition or relocation. Those in the Downtown cluster could be replaced with new commercial buildings protected from the base flood.

7. The Village can promote and support property protection measures through several activities.

5.15. Recommendations

1. Property owners should be advised of the property protection measures that can help them reduce flood losses and the effects of other hazards.

2. All acquisition projects should be voluntary. The Village should use its powers of eminent domain only when there are extenuating circumstances, such as code violations or the property is a health or safety threat to others.

3. As funds become available, the Village should acquire properties in the priority order recommended by the Flood Mitigation Planning Committee. In most cases the acquired properties should be cleared and kept as public open space. However, in the Downtown cluster, reuse of the land should be consistent with the Village Center plans and the Watershed Development Ordinance's provisions for floodplain development.

4. Where proposed for other purposes, such as the Village Center plan, utility lines should be buried to protect them from damage by wind, ice and snow.

5. The Village should pursue the following activities to encourage and support property protection measures taken by property owners

    a. Public information (reviewed in more detail in Chapter 9)
    b. Outside funding sources that can assist property owners fund property protection measures, especially after a disaster declaration.
    c. Expansion of the Village's Sanitary Sewer Mitigation Program to provide rebates or other low levels of financial assistance for surface flooding as well as sewer backup.

6. The Village's floodplain management regulations in the Building Code and Watershed Development Ordinance should be revised to mandate simple and inexpensive property protection measures, such as moving the electric service box above the base flood elevation, as a condition of a building permit, at time of resale and/or as a condition of financial assistance.

7. The Village should publicize projects that have been implemented by property owners in the past.

8. Special attention should be given to finding and funding a long-term solution to flooding of Gurnee Grade School.

5.16. 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 Committee, 1991.

5. *Flood Proofing: How to Evaluate Your Options*, U.S. Army Corps of Engineers, 1993.

6. *Floodproof Retrofitting: Homeowner Self-Protective Behavior, Shirley Bradway Laska*, University of Colorado, 1991.

7. *Floodproofed Sites in Illinois*, French & Associates, 1992.

8. *Guide to Flood Protection in Northeastern Illinois*, Illinois Association for Floodplain and Stormwater Management, 1997.

9. *Hazard Mitigation Guidebook for Northwest Communities*, Federal Emergency Management Agency, Region 10, 1998

10. *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding.* Federal Emergency Management Agency, FEMA-312, 1998.

11. *Ice Storm Mitigation,* FEMA –860-DR-Illinois, Illinois Emergency Management Agency, 1990.

12. *Local Flood Proofing Programs,* U.S. Army Corps of Engineers, 1994.

13. *Multi-Hazard Identification and Risk Assessment,* Federal Emergency Management Agency, 1997.

14. Responses to questionnaires submitted by Village residents, 2001.

15. *Taking Shelter from the Storm: Building a Safe Room Inside Your House,* Federal Emergency Management Agency, FEMA-320, 1998.

16. *Windstorm Mitigation Manual for Light Frame Construction,* Illinois Emergency Management Agency, 1997.

Chapter 6. Emergency Services

Emergency services measures protect people during and after a disaster. A good emergency services program addresses all hazards, not just flooding. At the state level, programs are coordinated by the Illinois Emergency Management Agency. The Lake County Emergency Management Agency (EMA) is operated through the County Sheriff's Department in Libertyville. Gurnee's EMA is staffed in the Fire Department.

Emergency services measures include the following:

6.1 Threat recognition
6.2 Warning
6.3 Response
6.4 Critical facilities protection
6.5 Post-disaster recovery and mitigation

6.1. Threat Recognition

Threat recognition is the key. The first step in responding to a flood, tornado, storm or other natural hazard is knowing that one is coming. Without a proper and timely threat recognition system, adequate warnings cannot be disseminated.

Floods: A flood threat recognition system provides early warning to emergency managers. A good system will predict 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 larger rivers, including the Des Plaines, the measuring and calculating is done by the National Weather Service which is in the U.S. Department of Commerce's National Oceanic and Atmospheric Administration (NOAA). Flood threat predictions are disseminated on the NOAA Weather Wire or NOAA Weather Radio. NOAA Weather Radio is considered by the federal government as the official source for weather information.

On smaller rivers, locally established rainfall and river gages are needed to establish a flood threat recognition system. The National Weather Service may issue a "flash flood watch." This means the amount of rain expected will cause ponding and other flooding on small streams and depressions. These events are so localized and so rapid that a "flash flood warning" may not be issued, especially if no remote threat recognition equipment is available.

In the absence of a gaging system on small streams, the best threat recognition system is to have local personnel monitor rainfall and stream conditions. While specific flood crests and times will not be predicted, this approach will provide advance notice of potential local or flash flooding.

Meteorological hazards: The National Weather Service is the prime agency for detecting meteorological threats, such as tornadoes, thunderstorms, and winter storms. As with floods, the Federal agency can only look at the large scale, e.g., whether conditions are appropriate for formation of a tornado. For tornadoes and thunderstorms, the county or municipalities can provide more site-specific and timely recognition by sending out spotters to watch the skies when the Weather Service issues a watch or warning.

Local implementation: On the Des Plaines River, the U.S. Geological Survey maintains the Russell and Gurnee gages. The former is located at the Russell Road bridge, just south of the Wisconsin state line. The latter is located at Route 120. The Gurnee gage's records are shown in the graph on page 2-4.

Real time stream data is reported on the Geological Survey's web site. The data can be accessed at http://il.water.usgs.gov/nwis-w/IL/. This tells the user *current* conditions. In addition, at these two gages, the Weather Service is able to issue a specific *prediction* of when and how high the river will crest (see example, below).

THE FOLLOWING RIVER FORECASTS ARE BASED ON OBSERVED PRECIPITATION AND FORECAST PRECIPITATION FOR THE NEXT 24 HOURS:

LOCATION	FLD STG	OBSERVED STG	DAY TIME	FORECAST 7AM WED	THU	FRI
DES PLAINES RIVER						
RUSSELL	07	9.5	TUE 6 PM	9.8	9.8	9.6
GURNEE	07	7.7	TUE 6 PM	8.9	10.3	10.8
DES PLAINES	05	2.3	TUE 6 PM	2.6	3.5	5.3
RIVERSIDE	06	4.7	TUE 8 PM	4.8	5.1	5.5

NOAA Weather Wire flood predictions, Tuesday, June 13, 2000

NOAA predicted a crest at the Gurnee gage at the 10.8 foot stage on Friday. See the graph on page 2-4 to relate stage to elevation above sea level. The actual crest was on Friday, at a stage of 10.5.

As the illustration above shows, Gurnee can receive up to three days advance notice of when the Des Plaines River will flood and how high it will go. Recent predictions have been accurate to within one-half foot.

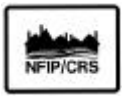
The NOAA Weather Wire is monitored by the Illinois and Lake County EMAs and Gurnee's dispatch center. Watches and warnings are transmitted to the Gurnee Fire Department, EMA and to all fire personnel via phone pagers. The Weather Channel also keeps viewers up to date on NOAA weather watches and warnings

The National Weather Service does not issue flood statements on smaller streams. Because there are no buildings in Gurnee's smaller floodplains, it would be hard to justify the expense of setting up a gage network to provide flash flood warnings on them.

There is a Lake County Public Emergency Notification System that uses tone activated police radios. The EMA can also pass threat information to affected communities and townships by telephone.

The County EMA has a formal organization of storm spotters. It conducts annual training of Village staff on how to spot hazardous weather conditions and tornadoes, but Village

staff are not detailed from their regular or emergency jobs to be spotters during a storm watch or warning.



CRS credit: Up to 40 points could be received for the flood threat recognition system based on the Gurnee gage.

6.2. Warning

After the threat recognition system tells the EMA that a flood 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 National Weather Service issues notices to the public using two levels of notification:

Watch: conditions are right for flooding, thunderstorm, etc.
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
- NOAA Weather Radio
- Commercial or public radio or TV stations
- Cable TV emergency news inserts
- Telephone trees
- Door-to-door contact
- Mobile public address systems

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. Outdoor warning sirens can reach the most people quickly (except those around loud noise, such as at a factory or during a thunderstorm), but they do not explain what hazard is coming and cannot be sounded unless a timely means of threat recognition exists. Radio and TV provide a lot of information, but people have to know to turn them on. Telephone trees are also fast, but can be expensive and do not work when phones lines are down.

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).

Local implementation: The Lake County EMA is responsible for disseminating warning information to the public and notifying key response personnel during an emergency. Communications are maintained with county and local agencies for the receipt of situation reports and monitoring the effects of, and response to, the emergency.

Emergency information is also disseminated through the local media. The primary source of emergency public notification for Lake County is through radio stations. WMAQ (AM-670) has been designated as the primary Emergency Broadcast Station for Lake County. WKRS (AM-1220) and WXLC (FM-102.3) in Waukegan are backup Emergency Broadcast Stations. Other Lake County area radio and television stations will provide the public with an alert signal and message to tune to WMAQ radio. Chicago radio and television stations also broadcast some emergency information.

The County has its own radio network for emergencies called the Radio Amateur Civil Emergency Services (RACES) that maintains a school warning system and can also tie into hospitals and nursing homes in an emergency. Lake County schools, businesses and a number of County agencies have installed 156.210 Mhz warning radio receivers for early notification.

Outdoor warning sirens have been installed in a number of locations throughout the county. A number of the designated sirens can be activated manually at the siren site during a disaster. Community EMA coordinators, fire chiefs, mayors and police chiefs are authorized to activate these systems. The siren is a signal to the public to turn televisions or radios to an emergency broadcast station for information and instructions on the type of protective actions that need to be taken.

One of the Village's sirens

The Gurnee Outdoor Warning System has twelve sites. These can be activated together or individually (when there is a very localized threat, such as a hazardous material spill). The sirens can emit signals and/or pre-programmed or live voice messages. They can be activated from any of the Village's fire or police stations. For example, in the case of a tornado, a siren is sounded. It is followed by a voice warning that tells people that a tornado is in the area and that they should seek shelter immediately, tune to WKRS radio, and not call 911 unless there is an emergency.

The Village is pursuing a grant that will fund NOAA Weather Radios for schools and other appropriate sites. It will consider starting a system with the cable TV company. The Emergency 911 Board is working on a reverse 911 system that will be able to call residents in affected areas and play pre-programmed warnings and instructions.

Gurnee's warning procedures are in its *Emergency Operations Plan's* Communications and Warning section. The communications office in the Police Department is authorized to activate the siren when tornadoes are sighted or when a tornado or severe thunderstorm watch or warning are received. The siren is activated for other hazards if authorized by the mayor, Village administrator, emergency manager or police or fire chief. Given the threat recognition lead times, this approach is sufficient for flooding and the other hazards.

NFIP/CRS

CRS credit: Community Rating System points are based on the number and types of warning media. The Village's siren and the County's Emergency Alert System are worth 25 points. There is a maximum of 60 points which can

be earned if the Village pursues the additional systems that are being considered. The Emergency Operations plan may need some revision to incorporate these approaches and qualify for these points.

6.3. 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:

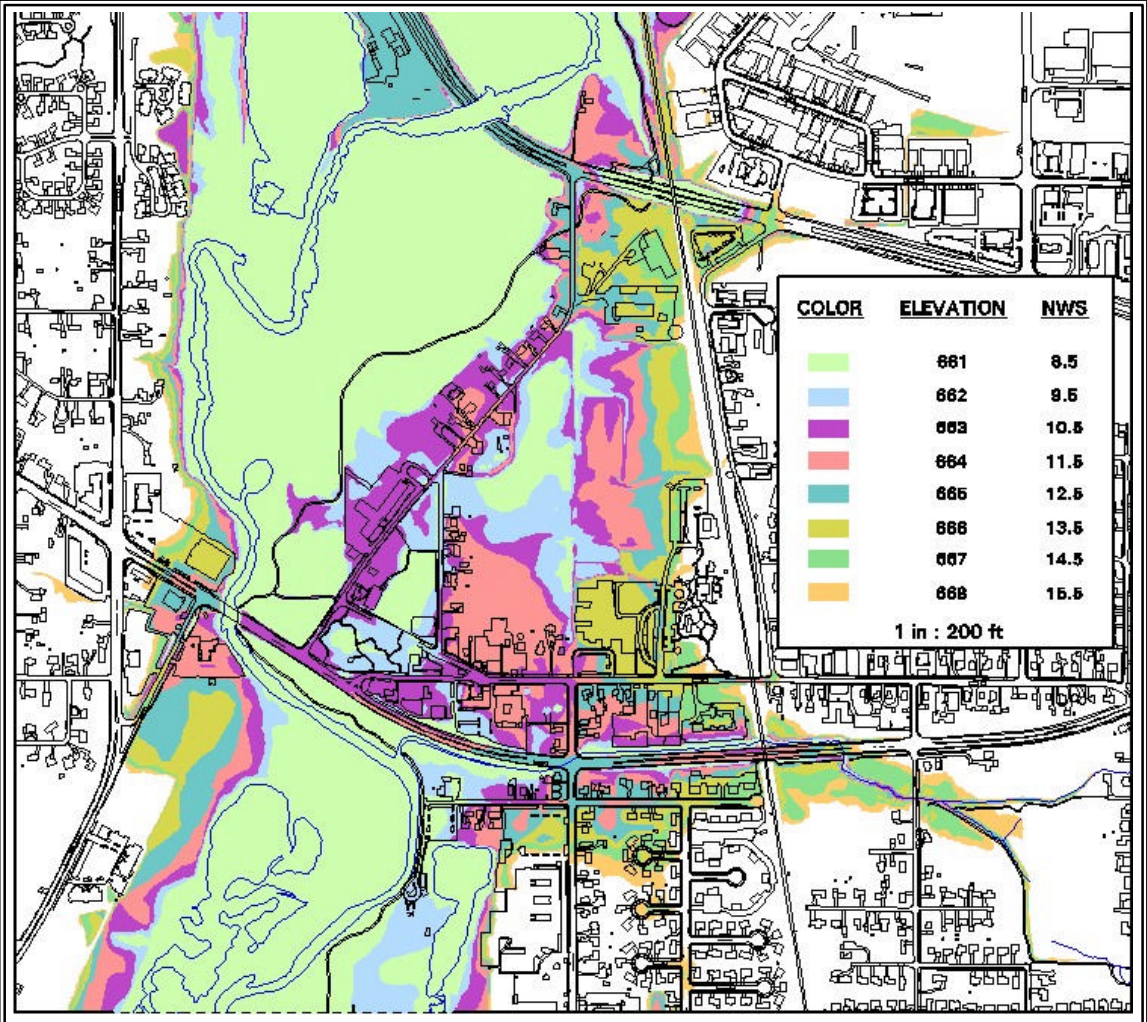
- Activating the emergency operations room (emergency management)
- Closing streets or bridges (police or public works)
- Shutting off power to threatened areas (utility company)
- Holding children at school/releasing children from school (school district)
- Passing out sand and sandbags (public works)
- Ordering an evacuation (mayor)
- Opening evacuation shelters (Red Cross)
- Monitoring water levels (engineering)
- Security and other protection measures (police)

An emergency action plan ensures that all bases are covered and that the response activities are appropriate for the expected threat. These plans are developed in coordination with the agencies or offices that are given various responsibilities.

Sandbag filling and distribution

Planning is best done with adequate data. One of the best tools is a flood stage forecast map that shows what areas would be under water at various flood stages (see example, next page). Emergency management staff can identify the number of properties flooded, which roads will be under water, which critical facilities will be affected, etc.. 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.

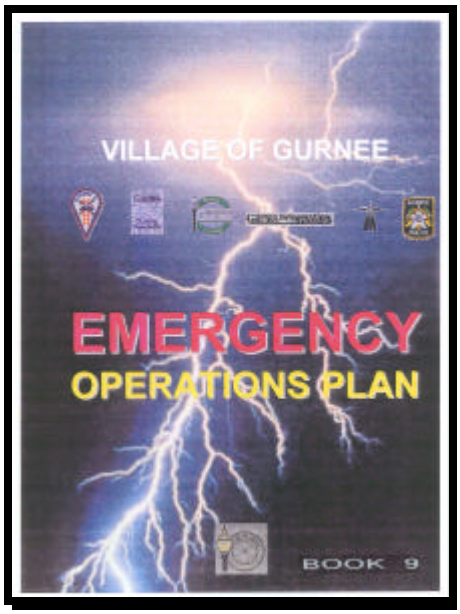
Emergency response plans should be updated annually to keep contact names and telephone numbers current and to make sure that supplies and equipment that will be needed are still available. They should be critiqued and revised after disasters and exercises to take advantage of the lessons learned and 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.



Flood Stage Forecast Map

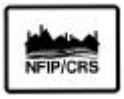
This map, developed by the Village's emergency manager and information systems office, shows which areas will go underwater at various elevations. These figures need to be related to readings at the Gurnee gage on Highway 120.

Local implementation: The *Village of Gurnee Emergency Operations Plan* presents procedures to be followed for all types of natural and technological hazards. It establishes the Incident Management System which assigns responsibilities during a disaster, such as communications, evacuation and public health.



This *Emergency Operations Plan* is kept updated each year, but it does not include special provisions for different hazards. It is a multi-hazard disaster response plan that has proven effective for response activities, such as area security, sheltering, and damage assessment.

A basis for a flood stage forecast map has been prepared for Gurnee (see previous page). A large map has been prepared that shows the area affected by the June 2000 flood. The data on these two maps can be related to the elevations at the Gurnee gage in order to quickly identify which properties are affected at different flood forecasts issued by the National Weather Service.



CRS credit: In its current configuration, the *Village of Gurnee Emergency Operations Plan* would not receive CRS credit. However, given the Village's geographic information capabilities and the relatively small floodplain, a flood-specific annex to complement the EOP would not be difficult to prepare and qualify for CRS points.

6.4. Critical Facilities Protection

"Critical facilities" are not strictly defined by any agency. Generally, they fall into two categories:

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

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 flood 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.

Most critical facilities have full-time professional managers or staff who are responsible for the facility during a disaster. These people often 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 flood warning, flood response planning, and coordination with community flood response efforts.

Local implementation: As discussed in Chapter 2, certain properties have been identified as critical facilities in Gurnee during a flood. These are shown in the table on the next page. The EMA keeps an up to date list of major facilities (schools, public facilities, etc.) and their contacts and phone numbers.

Several of the facilities, including the schools, Great America, and Gurnee Mills shopping center, have their own emergency response plans. Frequent contacts are made between the Fire Department and the facilities. The Fire Bureau inspects all critical facilities annually. Those considered "high hazard" because of volatile or hazard materials used in manufacturing are inspected at least four times each year.

Critical Facilities (Flood)			
Facility	**Concern**	**Owner/operator**	**Flood level ***
Fire Station #1	Public safety	Village of Gurnee	663.4
Police Station	Public safety	Village of Gurnee	663.8
Public Works office/garage	Flood fighting	Village of Gurnee	668.6
Water pumping station	Public health	Village of Gurnee	665.9
Wastewater treatment plant	Public health	North Shore Sanitary Dist.	670.0
Marathon gas station	Gasoline	Private	665.9
Warren Twp. High School	Gasoline	Township High School Dist.	
Dada's dry cleaning	Chemicals	Private	663.5
Bass Pro (outside Village)	Gasoline	Private	Not surveyed
U.S. 41/Skokie Highway	Transportation	Illinois DOT	653
State Route 132/Grand Ave	Transportation	Illinois DOT	660
Washington Street	Transportation	Village of Gurnee	665

* The flood level is the elevation at which water enters the facility. Roads to these facilities may be flooded at lower levels. Elevations are for the site. A flood stage forecast map can convert site elevations to National Weather Service flood stage predictions at the Gurnee gage. Building elevations from French & Associates' site surveys, June 2001. Highway and street elevations are approximate and were taken from contour maps.

The North Shore Sanitary District's treatment plant is located south of Washington Street, just off the map on page 2-3. The site was flooded during a construction project in 1986 (see photo), but water did not affect any operations. The low water entry point to the facility is 3 – 4 feet above the base flood elevation.

North Shore plant in 1986

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. Gurnee would receive 10 points for maintaining a current contact list. An additional 40 points are available if all the floodprone facilities developed their own flood response plans and coordinated them with the Village's response efforts.

6.5. Post-Disaster 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

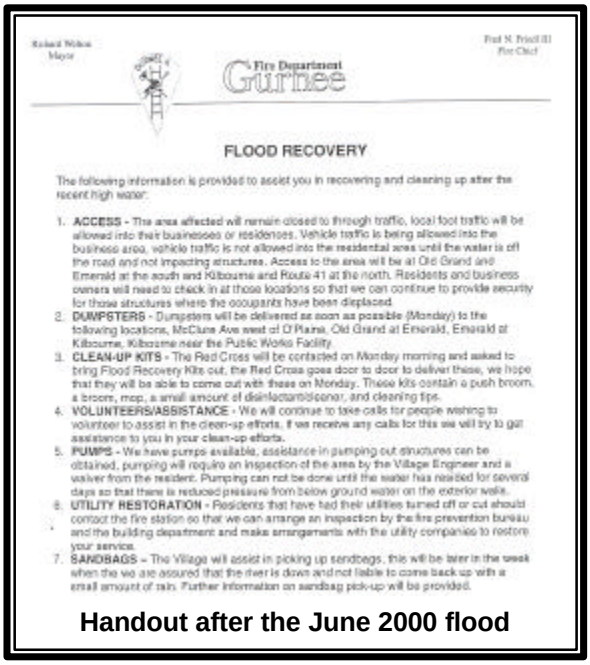
- Conducting a public information effort to advise residents about mitigation measures they can incorporate into their reconstruction work
- Evaluating damaged public facilities to identify mitigation measures that can be included during repairs
- Acquiring substantially or repeatedly damaged properties from willing sellers
- Planning for long term mitigation activities
- Applying for post-disaster mitigation funds

Requiring permits, conducting inspections, and enforcing the National Flood Insurance Program's (NFIP) substantial improvement/substantial damage regulations (see Section 4.5) can be very difficult for local, understaffed overworked offices after a disaster. If these activities are not carried out properly, not only does the municipality miss a tremendous opportunity to redevelop or clear out a hazardous area, it may be violating its obligations under the NFIP.

Local implementation: The Lake County Emergency Management Agency makes sure that Federal, State and County activities are implemented. This would include the County Health Department testing water supplies and food services that were affected.

The *Village of Gurnee Emergency Operations Plan* has sections for recovery and mitigation concerns, such as public information, public health, and damage assessment. They do not address specific hazards.

Following past floods, the Village has distributed public information materials. After the 1986 flood, the Village applied for disaster assistance to purchase a flooded house. However, there is no written procedure for these activities or special inspection instructions for flooded buildings.



Fire Department
Gurnee

FLOOD RECOVERY

The following information is provided to assist you in recovering and cleaning up after the recent high water:

1. **ACCESS** - The area affected will remain closed to through traffic, local foot traffic will be allowed into their businesses or residences. Vehicle traffic is being allowed into the business area, vehicle traffic is not allowed into the residential area until the water is off the road and not impacting structures. Access to the area will be at Old Grand and Emerald at the south and Kilbourne and Route 41 at the north. Residents and business owners will need to check in at those locations so that we can continue to provide security for those structures where the occupants have been displaced.
2. **DUMPSTERS** - Dumpsters will be delivered as soon as possible (Monday) to the following locations, McClure Ave west of O'Plaine, Old Grand at Emerald, Emerald at Kilbourne, Kilbourne near the Public Works Facility.
3. **CLEAN-UP KITS** - The Red Cross will be contacted on Monday morning and asked to bring Flood Recovery Kits out, the Red Cross goes door to door to deliver these, we hope that they will be able to come out with these on Monday. These kits contain a push broom, a broom, mop, a small amount of disinfectant/cleaner, and cleaning tips.
4. **VOLUNTEERS/ASSISTANCE** - We will continue to take calls for people wishing to volunteer to assist in the clean-up efforts. If we receive any calls for this we will try to get assistance to you in your clean-up efforts.
5. **PUMPS** - We have pumps available, assistance in pumping out structures can be obtained, pumping will require an inspection of the area by the Village Engineer and a waiver from the resident. Pumping can not be done until the water has receded for several days so that there is reduced pressure from below ground water on the exterior walls.
6. **UTILITY RESTORATION** - Residents that have had their utilities turned off or cut should contact the fire station so that we can arrange an inspection by the fire prevention bureau and the building department and make arrangements with the utility companies to restore your service.
7. **SANDBAGS** – The Village will assist in picking up sandbags, this will be later in the week when the we are assured that the river is down and not liable to come back up with a small amount of rain. Further information on sandbag pick-up will be provided.

Handout after the June 2000 flood

6.6. Conclusions

1. The flood threat recognition system for the Des Plaines River works, as do the threat recognition procedures for the other quick onset hazards, such as tornadoes and storms.

2. The warning procedures and media are effective for the hazards faced by the Village. More and redundant warnings help. Every warning should be accompanied by information on what people should do.

3. The slow onset of flooding in the past has allowed the Village to determine and implement response activities as the flooding occurs. A flood stage forecast map can be very helpful in identifying areas and facilities affected by a flood. One would be very useful during flood operations and even more useful in preparing pre-flood response plans.

4. The *Emergency Operations Plan* is a multi-hazard response plan and does not provide specific guidance for individual hazards. It has worked well during past disasters and emergencies.

5. Emergency response planning needs to include those critical facilities that will be affected by various types of hazards. Floodprone critical facilities could use annexes to help prepare them for flooding by the Des Plaines River.

6. The Emergency Operations Plan has guidance on Village recovery and reconstruction activities to be undertaken after a disaster. Detailed plans and procedures that coordinate these activities with public information activities and inspections of building repairs would better prepare the Village and property owners to quickly take advantage of post-disaster mitigation opportunities.

6.7. Recommendations

1. The Village should continue to follow its Emergency Operations Plan and critique and revise it after each emergency or disaster.

2. The Village should use its geographic information system (GIS) capabilities to prepare a formal flood stage forecast map for the Des Plaines River floodplain. It should tie site elevations to predicted flood levels at the Gurnee gage.

3. A Des Plaines River flood annex should be prepared as an annex to the *Emergency Operations Plan*. The flood annex would include:

    a. Maps that show areas and facilities affected at various flood levels
    b. Procedures that clarify when and how to issue a flood warning
    c. A specific list of flood response activities
    d. What critical facilities are affected by various flood levels
    e. What support is needed by the critical facilities

f. Procedures and public information materials for post-disaster building inspections and identification of mitigation opportunities
g. Resources needed to implement the planned actions

4. Given the relatively small number of buildings in the Des Plaines River floodplain, the Village should initiate a procedure of door-to-door warnings of predicted river flooding. Only those properties threatened by the predicted flood level need be warned. The procedure should include handouts on appropriate safety, health and property protection steps.

5. The Village should contact the floodprone critical facilities to help them develop flood annexes to their emergency response plans that are coordinated with and support the Village's plan.

6. The Village should implement a public information program to encourage residents and businesses to advise them of the warning procedures and messages and what to do when warnings are issued.

6.8. References

1. *CRS Coordinator's Manual*, Community Rating System, FEMA, 1999
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 Committee on Water Data, 1985
5. *Post-Flood Mitigation Procedures*, Village of South Holland, Illinois, 1997.
6. Village of Gurnee Emergency Operations Plan, Village of Gurnee, undated

Chapter 7. Structural Projects

Structural projects have traditionally been used by communities to control floodwaters. Structural projects keep flood waters away from an area. They are usually designed by engineers and managed or maintained by public works staff. Six approaches are reviewed in this chapter:

1. Reservoirs detention
2. Levees and floodwalls
3. Channel improvements
4. Crossings and roadways
5. Drainage and storm sewer improvements
6. Drainage system maintenance

Structural projects offer advantages not provided by other measures, but as shown below, they also have major 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.

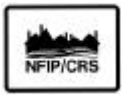
Since structural flood control is generally the most expensive type of mitigation measure in terms of installation costs, maintenance requirements and environmental impacts, a thorough alternative assessment should be conducted before choosing a structural project. In some circumstances smaller flood control measures may be included in a package of several recommended measures for a project area where non-structural measures would not be practical or effective.

Larger structural flood control projects have regional or watershed-wide implications and can be very expensive. Because of this, they are often planned, funded and implemented at a regional level by agencies, such as the Lake County Stormwater Management Com-

mission, the Illinois Department of Natural Resources Office of Water Resources, the U.S. Army Corps of Engineers, and the USDA Natural Resources Conservation Service. Much of these agencies' work has been coordinated over the past 25 years by the Resource Coordination Policy Committee, an informal organization of watershed steering committees and government agencies. Over the years, flood control studies have been conducted for the Des Plaines River and the following reports have been published:

- *Inventory and Analysis of Urban Water Damage Problems in Village of Gurnee,* U.S. Army Corps of Engineers, Chicago District, 1979.
- *Our Community and Flooding, A Report on the Status of Floodwater Management in the Chicago Metropolitan Area,* Resource Coordination Policy Committee, 1998.
- *Upper Des Plaines River Feasibility Report,* U.S. Army Corps of Engineers, Chicago District, 1999.

These reports, coupled with additional analyses by Lake County Stormwater Management Commission engineering staff, form the basis of the findings and recommendations in this chapter.



CRS credit: The draft 2002 *CRS Coordinator's Manual* has new credits for structural flood control projects. If adopted by FEMA, any of the first five measures reviewed in this chapter would be recognized. Credit will be based on the type of project, how many buildings are protected, and to what flood protection level. Up to 1,000 points will be possible.

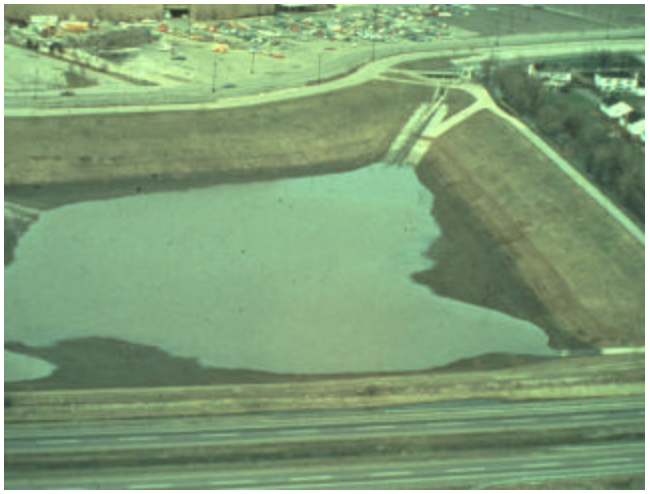
7.1. Reservoirs/Detention

Reservoirs control flooding by holding high flows behind dams or in storage basins. After a flood peaks, water is released or pumped out slowly at a rate that the river can accommodate downstream. The lake created may provide recreational benefits or water supply (which could help mitigate a drought).

Reservoirs are suitable for protecting existing development downstream from the project site. Unlike levees and channel modifications, they do not have be built close to or disrupt the area to be protected. Reservoirs are most efficient in deeper valleys where there is more room to store water, or on smaller rivers where there is less water to store. Building a reservoir in flat areas and on large rivers may not be cost-effective, because large areas of land have to be purchased.

In urban areas, some reservoirs are simply manmade holes dug to store floodwaters (see photo, next page). In some areas, costs have been reduced by using abandoned quarries as reservoirs. When built in the ground, there is no dam for these retention and detention basins and no dam failure hazard. Wet or dry basins can also serve multiple uses by doubling as parks or other open space uses.

On the other hand, reservoirs and detention basins can have the following disadvantages:



Regional detention basins are more common in Northeastern Illinois than in-stream reservoirs

- There is the threat of flooding the protected area should the reservoir's dam fail.
- There is a constant expense for management and maintenance of the facility.
- They may fail to prevent floods that exceed their design levels.
- 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.
- If not designed correctly, they may cause backwater flooding problems upstream.

Local implementation: There are no regional flood control reservoirs upstream of Gurnee. The Des Plaines River Steering Committee for the Resource Coordination Policy Committee did not propose any reservoir projects that would affect Gurnee.

The more recent Corps of Engineers' Upper Des Plaines River Feasibility Report evaluated the costs, benefits and impacts of:

- a dam across the river at Wadsworth,
- a dam on Mill Creek,
- 53 smaller "offsite reservoirs" or expansions of existing reservoirs on various tributaries, including Reservoir Site V, a sand and gravel pit north of Gurnee that would store 4,600 acre-feet of stormwater before it entered the main stem of the Des Plaines River, and
- 13 "lateral storage areas" (sites adjacent to a channel that store high flows).

The Corps conducted extensive analyses of the technical, economic and environmental impacts of the projects, both individually and in a variety of combinations with each other. These reviews eliminated the two dams, 50 of the offsite reservoirs and 10 lateral storage areas. In most cases, the cost of buying the land, building the facility and operating it over the years was more than the flood protection benefits. The report noted

> In the Upper Des Plaines River basin, the topography and level of development made it difficult to locate enough storage to provide a 100-yr level of protection. Desirable site characteristics include, but are not limited to: attainability by floodwaters, impervious soil conditions, and a low water table.

> …This analysis showed that in order to obtain maximum damage reduction, flow peaks must be reduced at the first damage site (Gurnee, Illinois) and the major damage site (Des Plaines, Illinois). The most effective means of accomplishing this would be to construct a 20,000 acre-ft capacity reservoir off the mainstem upstream of Gurnee, Illinois and approximately 10,000 acre-feet capacity reservoir off the mainstem between Gurnee and Des Plaines. (page J-3)

The plan now has three off line reservoirs and one lateral storage area. Only two of them are upstream of Gurnee: a lateral storage area that would utilize Sterling Lake in Van Patten Woods in Wadsworth (412 acre-feet) and a storage basin on the North Fork of Mill Creek (916 acre-feet). The larger Reservoir Site V was excluded after a more detailed examination of the costs and benefits.

The largest single item in the benefit-cost analyses was disruption of traffic by flooding: 72% of the flood damage in the study area was attributed to traffic detours and road repairs and only 28% to damage to buildings and their contents (Corps, 1999, page 26). While these projects may proceed, their main benefits will be to transportation in the area. The Corps reports that they will have a negligible impact on flood heights or properties in Gurnee.

7.2. Levees and Floodwalls

Probably the best known 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:

- Provision of compensatory storage (compensating for the floodwater storage that will be displaced by the levee)
- Internal drainage of surface flows from the area inside the levee.
- Cost of construction
- Cost of maintenance
- Barrier to river access and views
- Creating a false sense of security (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 placed along the river or stream edge degrade the aquatic habitat and water quality of the stream. They also are more likely to push floodwater onto other properties upstream or downstream. 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.

Local implementation: A nearby example of both a levee and floodwall is North Libertyville Estates. This is a subdivision of 140 homes constructed in the 1950s (prior to floodplain regulation). It is located on the south side of Buckley Road on the east bank of the Des Plaines River.

It took over 20 years for the Corps of Engineers to study and restudy the costs and benefits of a levee for the area. The permeable soils had to be accounted for with an impervious core. Internal drainage, loss of access due to street flooding, and septic system failure were also complications.

The levee was constructed in the fall of 1997. It required construction of a canal bypass and an extensive pumping system. It is calculated to only provide protection from up to the 40-year flood.

A combination levee and floodwall protects North Libertyville Estates from the Des Plaines River.

The Corps of Engineers' 1979 report for Gurnee concluded that:

> Feasibility of a low levee or raised street should be examined to protect adjacent areas from flooding by the river. The low level levee should run parallel to the river from the intersection of Washington Street with the river to U.S. Route 41. However, such a levee or street should be located in such a way that the existing floodway of the river is not restricted or obstructed. (page 20)

The Illinois Department of Natural Resources and the Corps conducted more detailed analyses of this proposal. The 1999 Corps' report includes "levee site 5," an 8,500 foot levee from Route 41 to Washington Street (page 57). It would be 1.1 to 8.5 feet high (page 57). However, the Corps concluded that it would have adverse impacts on flood storage and it would not be economically feasible (the costs would be much more than the flood protection benefits).

Further, as seen on the floodway map on page 2-9, it would be impossible to locate a levee to protect floodprone buildings without obstructing the floodway. The Village did not support the levee alternative for the following reasons: the Village would have to secure the land and rights of way, the Village would have to pay part of the non-Federal share, the levee would disrupt the waterfront area and obstruct view and access, and a levee was counter to the Village's approach to acquire floodprone properties. For all these reasons, levee site 5 did not receive Federal or local support.

7.3. Channel Improvements

Dredging

By improving channel conveyance, more water is carried away at a faster rate. Improvements generally include making a channel wider, deeper, smoother or straighter. Some smaller channels in urban areas have been lined with concrete or put in underground pipes.

Dredging is often viewed as a form of conveyance improvement. However, it has the following problems:

- Given the large volume of water that comes downstream during a flood, removing a foot or two from the bottom of the channel will have little effect on flood heights.
- Dredging is often cost prohibitive because the dredged material must be disposed of somewhere.
- Unless instream and/or tributary erosion are corrected upstream, the dredged areas usually fill back in within a few years, and the process and expense have to be repeated.
- 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.

Straightening, deepening and/or widening a stream or river channel, commonly referred to as "**channelization**" has traditionally been the common remedy for local drainage or flooding problems. Here are the concerns with this approach that need to be kept in mind:

Channel work

- 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.

On the other hand, properly sloped and planted channel banks are more aesthetically and environmentally appealing, and can prove cheaper to maintain than concrete ditches.

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. Where topography and land use are not favorable, a more expensive tunnel is needed.

Local implementation: The 1999 Corps study looked at dredging and channel improvements and concluded:

> The use of channel modifications has decreased primarily because of the potentially adverse environmental impacts…. The flat gradient of the Des Plaines River prohibits significant reduction of flood stages from localized channel improvements. The main obstacle to a localized channel modification plan in a very flat area, such as the Des Plaines River basin, is that floodwater will back up from whatever point the channel alternation plan stops. Therefore, a long reach of river must be dredged to obtain significant benefits….
>
> The 1961 State of Illinois flood control plan included dredging new channel dimensions from Hodgkins [southwest of Chicago]… upstream to Gurnee, Illinois. A modified version of this major channel modification plan was incorporated into the Reconnaissance study as Regional Alternative A. This option, at $107,184,000 in October 1988 costs, proved to be the most expensive of the regional options, and had a BCR [benefit/cost ratio] of 0.12, excluding real estate and mitigation costs; therefore, this plan was dropped from further consideration. (pages J-3 – J-4)

The Illinois Department of Natural Resources performed some preliminary modeling of a diversion of high flows from the Des Plaines River to Lake Michigan and estimated rough costs. There is a unique problem with this approach. Because it is used as a drinking water source and is subject to international treaties with Canada, Lake Michigan must meet high water quality standards. The U.S. Environmental Protection Agency indicated that the diverted water would need to be treated to the same level as wastewater discharge treatment levels. When the cost of adding the necessary water quality treatment was factored in, the project costs far outweighed the anticipated benefits. There is also a U.S. Supreme Court ruling that governs diversions of water into or out of Lake Michigan.

A Mitigation Planning Committee member proposed diverting local drainage flows from the east to a location south of Grand Avenue. A preliminary review by the Village Engineer concluded that improvements to the pipes and open drainageways could relieve properties in the Kilbourne/Emerald planning cluster from localized flooding during heavy rains. It can be explored in more depth in 1- 2 years when Kilbourne Avenue is slated for reconstruction. However, a drainage diversion project would not affect overbank flooding from the Des Plaines River.

7.4. Crossings and Roadways

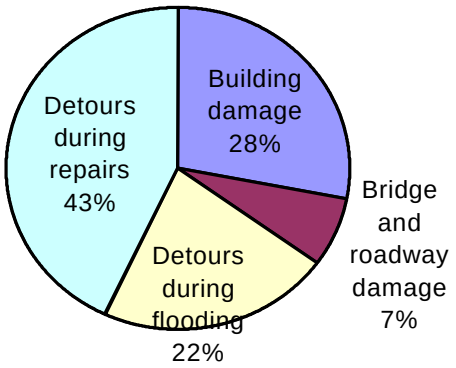
In some cases buildings may be elevated above floodwaters but access to the building is lost when floodwaters overtop local roadways, driveways, and culverts or ditches. Depending on the recurrence interval between floods, the availability of alternative access, and the level of need for access, it may be economically justifiable to elevate some roadways and improve crossing points.

For example, if there is sufficient downstream channel capacity, a small culvert that is constricts flows 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 1999 Corps of Engineers' feasibility study found that bridge constrictions on the Des Plaines River were minimal.

> Existing and baseline conditions modeling of flood flows identified no significant bridge-induced flow constrictions on this river. The maximum stage increase at a bridge was 1. I foot at Rockland Avenue during only the 100-year flood stage. Other bridges do not increase stages by more than 0.3 feet and most show between 0.0 and 0.1 feet head loss across the seven stage frequencies modeled.
>
> … Along the Des Plaines River, there are only 40 bridge crossings along an almost 70 mile river reach, significantly reducing bridge modification net benefits due to high costs and resulting in its being dropped as a feasible alternative. (page 31)

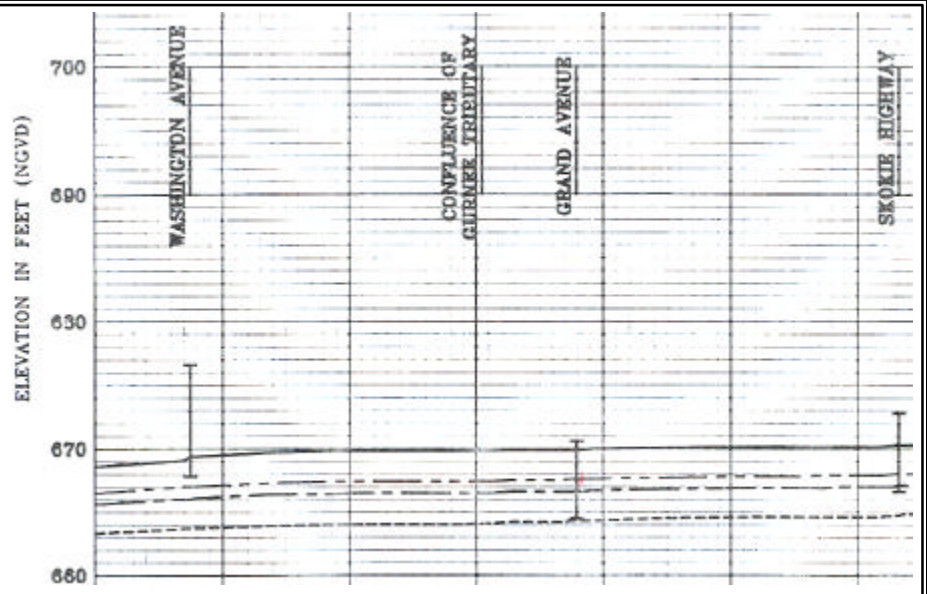
A review of the three bridges affecting the planning area reached a similar conclusion. As seen on the profile on the next page, the Skokie Highway and Grand Avenue bridges have no impact on the 10-, 50-, 100- and 500-year floods (the bridges are shown on the profile as a long letter "I"). The Washington Street bridge causes only a 0.4 foot surcharge at the 500-year flood level.



Des Plaines River flood damage
The 1999 Corps report attributed 72% of the damage from flooding on the Des Plaines to road and bridge damage and closures, but did not find a cost-effective bridge or road raise project in Gurnee.

The Corps study also looked at "road raises," i.e., projects to elevate road surfaces above the base flood level. It looked at the costs, which included reconstruction of the roadway, drainage, signs, etc. as well as the cost of increased travel time and detours during construction. For example, to elevate 1,100 feet of Grand Avenue would cost over $5 million.

The Corps found that the costs exceeded the benefits. For example, it would take months of traffic disruption and detours to modify a bridge that will be out for a week during a flood. The cost of construction and traffic disruption and delays was found to be greater than the flood protection benefits.



The Des Plaines River profile shows that the three bridges in the planning area have very little effect on flood heights.

7.5. Drainage and Storm Sewer Improvements

Man-made 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.

Drainage improvements do not have to be concrete channels. They can include measures to improve infiltration and water quality.

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. As shown in the photos below, these projects can have multiple benefits.

Local implementation: Many area communities have constructed local drainage system improvements. Gurnee has implemented various projects over the last decade to correct local problems. The improvements have made a difference during heavy local rains.

As noted in Chapter 4, the October 2000 Capital Improvement Program notes that there is no complete inventory of the stormwater management system and recommends that one be conducted. An inventory is also a requirement for an Environmental Protection Agency Phase II NPDES permit. After such an inventory is done, a multi-year drainage improvement and maintenance program can be established. This would have a major impact on the local drainage problems caused by heavy storms.

The Des Plaines River Watershed Management Board of the Lake County Stormwater Management Commission has a program that can fund drainage system improvements. The funding is awarded on a competitive basis as 50% cost-share funding for projects sponsored by communities. Funding applications are due each Fall.

7.6. 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.

Periodic inspections and debris removal are needed to prevent dams in streams

"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. Community Rating System credit for drainage system maintenance is dependent on published procedures that clearly identify what can be removed and what "debris" should be allowed to stay in natural channels.

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 generally often results in very little maintenance being accomplished.

Local implementation: In Gurnee, the Village, Park District, Lake County Highway Department and the Forest Preserve District have maintenance responsibility over drainageways under their jurisdiction.

In the case of detention ponds, a property owners' association or the owner is responsible for maintenance on residential developments or commercial properties. Detention ponds on public properties are maintained by the appropriate government jurisdiction.

The Gurnee Department of Public Works inspects known "hot spots" periodically and after major storms. Crews also respond to citizen complaints. There are no formal or published maintenance procedures for open channels. There are procedures for periodically cleaning Village-owned storm and sanitary sewers, which will be improved with the purchase of a "Vacall."

The Lake County Forest Preserve District owns most of the waterfront of the Des Plaines River in Gurnee. The District inspects the river channel in the Spring and the Fall and responds to calls (most of them from canoeists). District crews remove log jams and man-made debris, such as tires and shopping carts.

The main objective of the Forest Preserve District's program is to keep the channel clear for canoes, so while trash is removed, some natural materials are deposited on the banks. The crews are from the natural resource section, so they know which logs to leave for habitat and which to remove for navigation. However, inspections are not run during mid summer when flows are lowest.

The Lake County Stormwater Management Commission has developed "A Citizen's Guide for Riparian Area Management", which educates landowners about debris removal and riparian landscaping. SMC anticipates adopting stream maintenance standards in the future to provide guidance and consistency for maintenance in Lake County.


Riparian Area Management

A CITIZEN'S GUIDE

Successful Stream Management Practices

CRS credit: Up to 300 points are provided for a formal drainage maintenance program that includes the following:

- An inspection of the entire system is conducted at least once each year,
- An inspection is conducted after each storm that could adversely impact the drainage system,

- Inspections are conducted in response to citizen's complaints,
- Action is taken after an inspection identifies a need for maintenance or cleaning
- Specific problem sites are inspected and maintained differently or more frequently than other parts of the drainage system.
- If the community has an ongoing program, such as a capital improvements plan, to eliminate or correct problem sites.

7.7. Conclusions

1. Major structural flood control projects on the Des Plaines River, including reservoirs, dredging, channel improvements, a diversion, bridge modifications and road raising, have been examined by the Corps of Engineers and other agencies. The consistent conclusion is that either they would not impact Gurnee or they are too expensive when compared to the flood damage reduction benefits that they would produce.

2. A levee along the Des Plaines River has been examined, but preliminary benefit/cost analyses and the impact on flood storage have ruled out Federal funding. The Village of Gurnee had additional reasons to not support such a levee.

3. Local drainage and storm flooding (both in and outside the floodplain) would benefit from drainage system improvements and a formalized drainage maintenance program. One area that deserves attention is the Kilbourne/Emerald planning cluster.

7.8. Recommendations

1. The Village should not spend time and money pursuing large projects that the U.S. Army Corps of Engineers has determined to not be cost-effective or to have a major adverse impact on flooding or the environment. Such projects are not likely to be funded without Corps support, anyway.

2. The Village should implement the drainage system inventory scheduled in the Capital Improvements Program. When completed, a long term drainage and storm sewer improvement plan should be developed.

3. The Village should place a priority on analyzing the drainage that flows from the east to the Des Plaines River in order to reduce local flooding problems in the floodplain north of Grand Avenue.

4. The Village should prepare formal drainage system maintenance procedures that are coordinated with other agencies' maintenance programs and that are based on Community Rating System credit criteria and that fulfill requirements for an Environmental Protection Agency Phase II NPDES permit.

5. The Village should participate in continued Des Plaines River flood protection and water quality planning.

7.9. References

1. *CRS Coordinator's Manual*, Community Rating System, FEMA, 1999 (and July 1, 2001, draft)

2. *CRS Credit for Drainage System Maintenance*, FEMA, 1999

3. *Flood Insurance Study, Lake County, Illinois and Incorporated Areas*, Federal Emergency Management Agency, November 6, 2000.

4. *Inventory and Analysis of Urban Water Damage Problems in Village of Gurnee*, U.S. Army Corps of Engineers, Chicago District, 1979.

5. *Lake County Comprehensive Stormwater Management Plan*, Lake County Department of Planning, Zoning and Environmental Quality, 1990

6. *Our Community and Flooding, A Report on the Status of Floodwater Management in the Chicago Metropolitan Area*, Resource Coordination Policy Committee, 1998.

7. *Upper Des Plaines River, Illinois, Interim Feasibility Report and Environmental Impact Statement*, U.S. Army Corps of Engineers, Chicago District, 1999.

Chapter 8. Natural Resource Protection

Natural resource protection activities are generally aimed at preserving (or in some cases restoring) natural areas. In so doing, these activities enable the naturally beneficial functions of floodplains and watersheds to be better realized. These natural and beneficial floodplain functions include the following:

- Storage of floodwaters
- Absorption of flood energy
- Reduction in flood scour
- Infiltration that absorbs overland flood flow
- Groundwater recharge
- Removal/filtering of excess nutrients, pollutants, and sediments from floodwaters
- Habitat for flora and fauna
- Recreational and aesthetic opportunities

These measures are implemented by a variety of public and private parties ranging from local park districts, forest preserves and regulatory agencies to land developers and farmers. This section reviews six natural resource protection activities. Integrating these activities into mitigation programs will not only reduce the community's susceptibility to damage, but will also improve the overall environment.

1. Wetland protection
2. Erosion and sedimentation control
3. River restoration
4. Best management practices
5. Dumping regulations
6. Urban forestry

8.1. Wetland 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.

Wetlands

- Store large amounts of floodwater
- Reduce downstream flood peaks
- Reduce flood velocities
- Protect shorelines from erosion
- Filter water making it cleaner
- Are groundwater recharge and discharge sites
- Provide habitat for species that cannot live or breed anvwhere else

Wetlands are regulated by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency under Section 404 of the Clean Water Act. Before a "404" permit is issued, the plans are reviewed by several agencies, including the Corps and the U.S. Fish and Wildlife Service. Each of these agencies must sign off on individual permits. There are also nationwide permits that allow small projects that meet certain criteria to proceed without individual permits.

A 1993 study by the Illinois State Water Survey concluded that for every I percent increase in protected wetlands along a stream corridor, peak stream flows decreased by 3.7 percent.

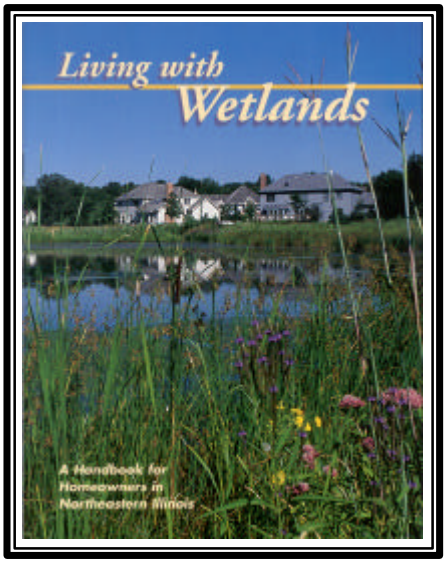
Generally, these agencies want to protect wetlands by preventing development that will adversely affect them. If a permit is issued, the impact of the development is typically required to be mitigated. Wetland mitigation can include creation, restoration, enhancement or preservation of wetlands. The appropriate type of mitigation is addressed in each permit.

If the mitigation action is to preserve or develop an equivalent or larger wetland on another site, there are two drawbacks. First, it takes many years for a new wetland to approach the same quality as an existing one. Second, a new wetland in a different location (especially if it's in a different drainage basin) will not have the same flood protection benefits as the original one did.

Another concern with Corps of Engineers wetland regulations, is that the Corps' jurisdiction is limited to wetlands that are connected to the "waters of the United States." A recent court ruling clarified this and limited the Corps' protection even more in small, isolated wetland areas. Many states and communities have their own wetland protection programs. They address the gaps in Federal regulations, particularly to cover smaller wetlands and unregulated activities.

Local implementation: Most wetlands in Lake County are subject to the Section 404 regulations. The Lake County Stormwater Management Commission has just amended its Watershed Development Ordinance to fill the recently created jurisdiction gap over isolated wetlands. The ordinances leaves wetland protection to the Corps of Engineers where it has jurisdiction. If the Corps does not have jurisdiction, then the Ordinance's provisions apply. The Ordinance would still enforce non-wetlands requirements (e.g., floodplain storage) in a Corps' jurisdictional wetland.

The wetlands in the planning area are shown on the map on page 2-22. Gurnee's Watershed Development Ordinance had a short section on wetlands, taken from the 2000 Stormwater Management Commission's model (Article IV, Section E). In October, 2001, it was revised to meet the latest Stormwater Management Commission amendment.



There are other ways to protect wetlands besides development regulations. Educating property owners and local officials on the benefits and methods of protecting wetlands pays off in later land use decisions. There are some excellent public information materials, such as "Living with Wetlands."

Publicly or privately funded restoration projects have been undertaken. One of the most important is the Des Plaines River Wetlands Demonstration Project which is discussed in the box on the next page. Gurnee is a downstream beneficiary of this work. The Emergency Management staff reports having already seen the benefits of this project in reduced flooding.

Wetlands Demonstration Project

The Des Plaines River Wetlands Demonstration Project is located five miles upstream from Gurnee. The following was taken from materials supplied by the manager, Wetlands Research, Inc., Wadsworth.

On 550 acres in northeastern Illinois, hydraulically-controlled experimental wetlands are being constructed where abandoned farm fields once stood. The rehabilitated ecosystems provide the ideal conditions for research into the natural processes of aquatic systems.

In addition to serving as a major research site, the project also demonstrates to the public and policy makers the multi-functional value of wetlands, transitional prairies and upland oak grove buffers. The site illustrates why wetlands have been called the most productive ecosystems on earth.

Approximately 3 miles of the upper Des Plaines River courses through the site, carrying contaminants from agricultural and urban runoff and from small treatment plants. Eighty percent of the 215-square-mile watershed is agricultural, contributing the herbicide atrazine in concentrations that, on occasion, exceed drinking water standards. The water also violates the state's standards for iron, copper and fecal coliforms. Based on the results of benthic surveys, the stream is classified as semi-polluted.

Turbidity is the primary water quality problem of the river. It delivers to the site more than 5,000 tons of suspended solids per year. The resulting turbidity prevents light from penetrating the water, inhibiting the growth of plants and the habitation of sight-feeding fish such as pike.

The efficiency of the experimental wetlands as watershed treatment systems, has been established. The observed changes in water quality are impressive: analyses indicate that the experimental wetlands trap more than 80 percent of the sediments and nutrients contained in the incoming river water. This research shows that to use constructed wetlands such as these to improve the water quality of an entire watershed would require converting only 2 to 4 percent of the land area to this use.

Further, the benefits of wetland restoration are readily apparent at the site. The river, once obscured by a wall of weedy vegetation, is now visible through a rehabilitated oak grove. Restored mesic prairies are increasing in diversity, thus supporting a wider variety of fauna species. Water rests on land that formerly was drained for farming.

The Des Plaines River Wetlands Demonstration Project is one of the nation's largest, systematic research sites dedicated to demonstrating how wetlands can be restored to solve pressing environmental problems. The Project’s restoration activities, research results and public education efforts will provide new and greatly needed information about how—and at what cost—wetland ecosystems can be re-established and used to manage this country's water and wildlife resources. This information will be applicable throughout the nation, wherever wildlife habitat, pollution abatement and flood storage are scarce and in demand.

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. Some of the Des Plaines River floodplain in the Village limits could qualify for this. There is no credit for relying on the Corps of Engineers' 404 regulations.

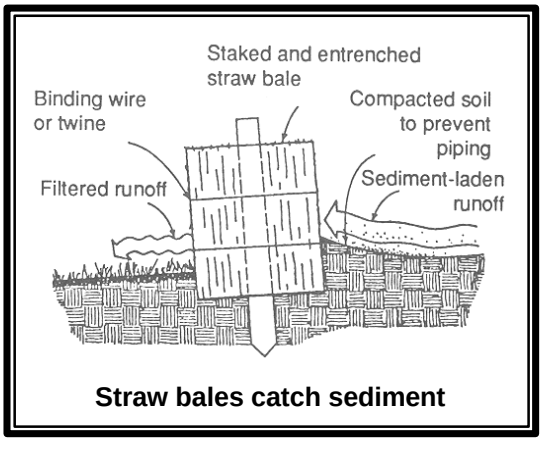
8.2. Erosion and Sedimentation Control

Farmlands and construction sites typically contain large areas of bare exposed soil. Surface water runoff can erode soil from these sites, sending sediment into downstream waterways. 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 in the water tends to 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. When channels are constricted and flooding cannot deposit sediment in the bottomlands, even more is left in the channels. The result is either clogged streams or increased dredging costs.

Not only are the drainage channels less able to do their job, but the sediment in the water reduces light, oxygen, and water quality and often brings chemicals, heavy metals and other pollutants. Sediment has been identified as the nation's number one nonpoint source pollutant for aquatic life.

There are two principal strategies to address these problems: minimize erosion and control sedimentation. 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.



Straw bales catch sediment

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 off 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.

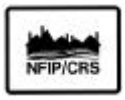
Erosion and sedimentation control regulations mandate that these types of practices be incorporated into construction plans. They are usually oriented toward construction sites rather than farms. The most common approach is to require applicants for permits to

submit an erosion and sediment control plan for the construction project. This allows the applicant to determine the best practices for the site.

Local implementation: Countywide minimum standards for soil erosion and sediment control are a significant component of the Lake County Stormwater Management Commission's Watershed Development Ordinance. Gurnee's ordinance includes all of the Commission's requirements (Article IV, Section B.1.j).

The Watershed Development Ordinance requires stabilization of disturbed areas within 14 days. Silt fences or straw bales are required of all projects that disturb between 5,000 square feet and one acre. Disturbing 1 – 5 acres requires a sediment trap while projects that disturb areas greater than 5 acres must have a sediment basin.

While the regulations meet or exceed area standards, the Lake County Stormwater Management Commission has identified enforcement as a problem. Enforcement is the municipalities' job and they do not always conduct all the needed inspections.



CRS credit: The Watershed Development Ordinance's erosion and sedimentation control provisions qualify for 35 points.

Proper enforcement of erosion and sedimentation control provisions is vital to keep channels clear.

8.3. River Restoration

There is a growing movement that has 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.

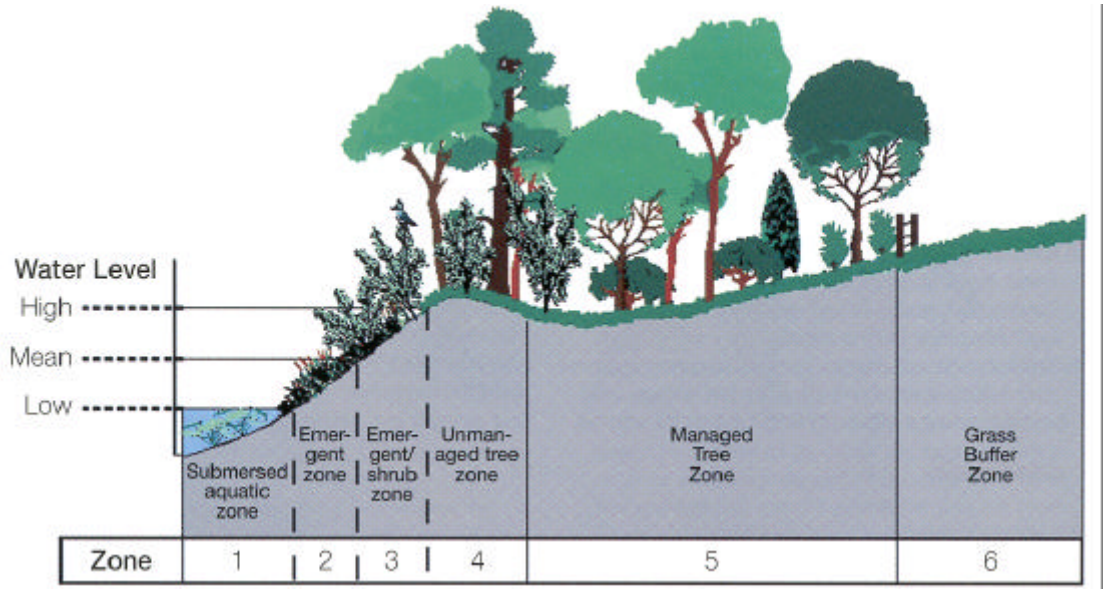
A key component of these efforts is to use appropriate native plantings along the banks that resist erosion. This may involve "retrofitting" the shoreline with willow cuttings, wetland plants, and/or rolls of landscape material covered with a natural fabric that decomposes after the banks are stabilized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

- Increases property value
- Prevents property loss due to erosion
- Provides recreational opportunities (hunting, fishing, bird watching)
- Reduces long term maintenance costs

The last bullet deserves special attention. 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.



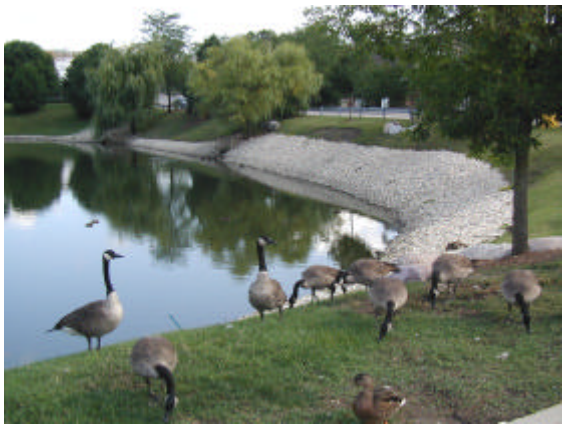
Aquatic and riparian buffer plant zones

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

Local implementation: There have been a few restoration projects in the area. Normally they were initiated as streambank stabilization projects. One on Flint Creek in Barrington and Lake Zurich was described in Protecting Nature in Your Community:

> The restoration objectives were to stabilize eroding channel banks and to remove excessive debris and non-native trees and shrubs that were shading out understory vegetation and blocking flows. After clearing undesirable woody vegetation, a combination of "soil bio-engineering" techniques were installed to stabilize the streambanks. Treatments ranged from vegetative stabilization in the least severe erosion zones, to the installation of evolving techniques…in combination with native vegetation and erosion blankets on more severely eroded banks…. All of the stabilized sites have successfully withstood severe flooding conditions. (page 51)

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.



A tale of two retention basins

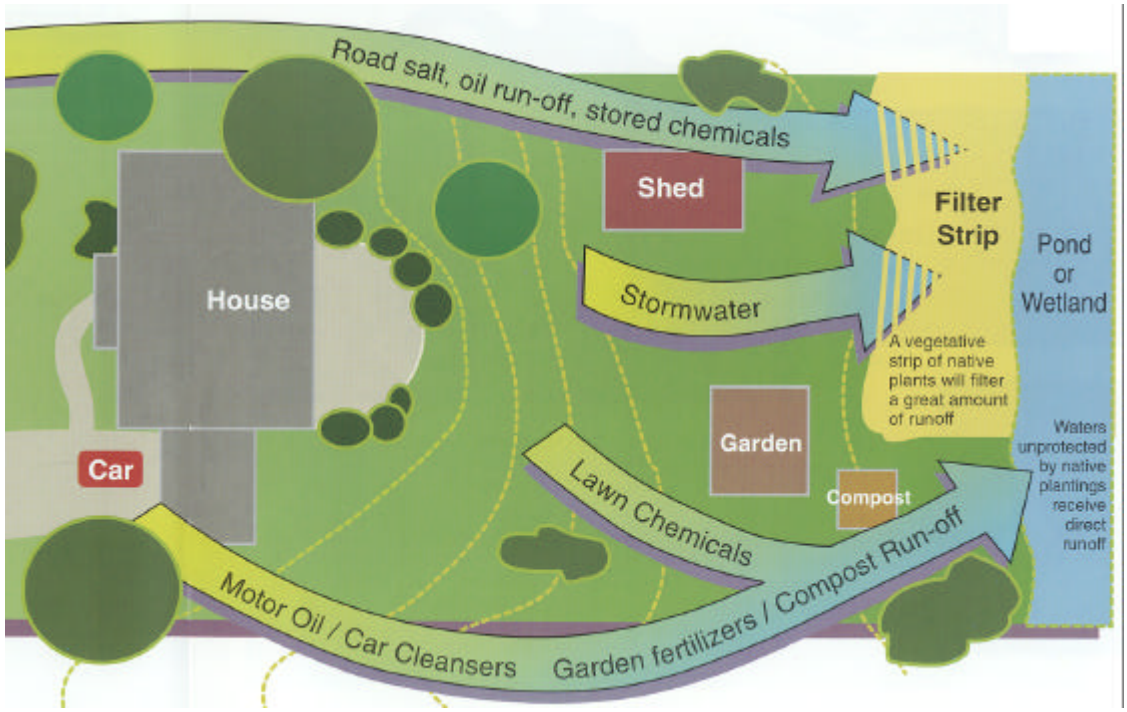
The basin on the left is in Libertyville. The traditional design used steep slopes and rock rip-rap to stabilize the shore line. The site is plagued with geese. The basin on the right is at the Gurnee Village Hall. Using natural plantings provides a more attractive setting and the tall grasses have kept geese away.

8.4. 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.

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). In addition to preventing increases in downstream flooding and minimizing water quality degradation, BMPs preserve beneficial natural features onsite, maintain natural base flows, minimize habitat loss, and provide multiple use of drainage and storage facilities.



Grass filter strips clean stormwater runoff and improve water quality.

Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois

BMPs can be implemented during construction and as part of a project's design to permanently address nonpoint source pollutants. There are three general ways they can do this:

- Avoidance: Setting construction projects back from the stream.
- Reduction: Preventing runoff that conveys sediment and other water-borne pollutants, such as planting proper vegetation and conservation tillage.
- Cleanse: Stopping pollutants after they are en route to a stream, such as using grass drainageways that filter the water and retention and detention basins that let pollutants settle to the bottom before they are drained.

In addition to improving water quality, BMPs can have flood related benefits. By managing runoff, they can attenuate flows and reduce the peaks after a storm. Combining water quality and water quantity measures can result in more efficient multi-purpose stormwater facilities. This is an example of a new approach called "alternative site design."

For example, stormwater management regulations require developers to build detention or retention basins to control runoff release rates. While the stormwater leaves a site at the same rate it did before development, the total volume of runoff is more. Downstream channels will carry more water over a longer period of time, which can lead to increased flooding and channel bank erosion.

BMPs that enhance the infiltration of stormwater will result in less volume of runoff. Such BMPs include using vegetated swales, filter strips, infiltration trenches, or permeable paving blocks instead of curbs, gutters, storm sewers and pavements.

Local implementation: Lake County's and Gurnee's Watershed Development Ordinances have BMP-related provisions. Article IV, Section B.1.h requires that the first amount of rainfall be detained on site. The first water to run off is the dirtiest and is known as the "first flush." Detaining it allows sediment to settle out, so cleaner water leaves the basin.

Article IV, Section B.1.i sets requirements for buffer areas adjacent to wetlands, lakes, ponds and streams that drain more than 20 acres. With a few minor exceptions,

> All buffer areas shall be maintained free from development including disturbance of the soil, dumping or filling, erection of structures and placement of impervious surfaces… (Section B.1.i (9))

Higher standards are required for areas adjacent to wetlands and streams that have been identified as important to water quality. These buffers act as filter strips (see illustration, previous page).

While these are the current Lake County Stormwater Management Commission regulations, they could be strengthened. Suggested changes include requiring deed restrictions on wetlands and buffers, increasing the minimum width of buffers, and modifying weed control ordinances to encourage landscaping with deep-rooted native vegetation. As with erosion and sedimentation control regulations, monitoring and enforcement of these regulations could be improved, too.

One of Illinois' best examples of alternative site design that uses a variety of BMPs is Prairie Crossing in nearby Grayslake. As reported in *Reducing the Impacts of Urban Runoff,* this development incorporates a variety of alternative design concepts. It

- uses roadside swales which drain to regional swales between housing clusters;
- utilizes extensive native landscaping and minimizes lawn areas;
- incorporates the drainage system into the natural landscape areas by discharging swales onto prairies, which discharge to wetlands, which discharge to a detention basin/lake;
- incorporates natural lake edge features into the detention design, resulting in an aesthetic and recreational amenity for the development; and
- uses clustering concepts to maximize common open space and natural areas.

CRS credit: The CRS provides up to 15 points for regulations that protect channel banks and lakeshores from development through setbacks or buffer zones.

8.5. 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 shopping carts, appliances and landscape waste 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 storm-water.

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 "nonobjectionable" 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.

Stream dumping public notice

Many people do not realize the consequences of their actions. They may, for example, fill in the ditch in their front yard not realizing that it is needed to drain street runoff. They may not understand how regrading their yard, filling a wetland, or discarding leaves or branches in a watercourse can cause a problem to themselves and others.

Therefore, a dumping enforcement program should include public information materials that explain the reasons for the rules as well as the penalties.

Local implementation: Other than a nuisance provision, the Village of Gurnee does not have specific ordinance language prohibiting dumping in channels, drainageways or wetlands.

NFIP/CRS

CRS credit: The CRS provides up to 30 points for enforcing a regulation that prohibits dumping in the drainage system.

8.6. Urban Forestry

The major damage caused by wind, ice and snow storms is to trees. Downed trees and branches break utility lines and damage buildings, parked vehicles and anything else that was under them

An urban forestry program can reduce the damage potential of trees. The cities in central Illinois are prone to ice storms and have initiated programs that select species that are resistant to ice and storm damage.


Trees are the first victims of ice storms

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 line rights-of-way. By having stronger trees, programs of proper pruning, and on-going evaluation of the trees, communities can prevent serious damage to their tree population.

Just as important to 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

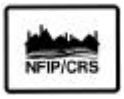
A properly written and enforced urban forestry plan can reduce liability, alleviate the extent of fallen trees and limbs caused by ice build-up, and provide guidance on repairs and pruning after a storm. Such a plan helps a community qualify to be a Tree City USA and obtain Urban Forestry grants

Local implementation: Gurnee is a Tree City USA. As such, it has agreed to have a tree board or department, a tree care ordinance, and a community forestry program. The Village Board of Trustees is the Village's tree commission. For the past year, there has been a full time Village Forester in the Public Works Department.

The Village has a tree preservation ordinance. This ordinance authorizes the Village to remove or trim those trees that become a public nuisance.

Commonwealth Edison inspects the utility lines every two years and conducts trimming every four years and when problems are found. The Village Forester reports that they do a good job cutting limbs to protect power lines, although the resulting trees are not necessarily good looking. The tree preservation ordinance calls for planting smaller trees in power line rights of way.

It can cost three times as much to put power lines underground. Therefore, this is only done when the Village or owner would pay for it or in new subdivisions (when the developer pays for it).



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.

8.7. Conclusions

1. Improving water quality and habitat, expanding open space, and improving the quality of life in Gurnee are goals of this *Plan*. Protecting natural resources, including wetlands and water quality, are important and effective measures to reach those goals.

2. A flood mitigation program can take advantage of interest in protecting wetlands and natural floodplain functions and utilize natural resource protection programs to support flood protection.

3. The current regulations on wetland protection, erosion and sediment control, and best management practices, have effective standards. However, there is a need to ensure that they are properly enforced.

4. There are excellent examples of wetland protection and river and shoreline restoration in the area that demonstrate the benefits of these measures.

5. The Village does not have an ordinance that prohibits dumping in wetlands or other parts of the drainage system.

6. The Village's urban forestry program is new, but appears to be on the right track.

8.8. Recommendations

1. The Village should monitor and publicize area wetland and river restoration projects. The retention basin at Village Hall should be promoted as a model example.

2. The Village should enact a stream and wetland dumping regulation.

3. The Lake County Stormwater Management Commission should review its Watershed Development Ordinance's standards for best management practices to see if they should be strengthened.

4. Village procedures should be reviewed to close any gaps in enforcement of existing ordinances.

5. The Village should continue to enforce the Watershed Development Ordinance. Inspections for stream dumping, protection of buffers, and erosion and sediment control regulations should be incorporated into other code enforcement and drainage system maintenance inspections and procedures.

8.9. References

1. *Banks and Buffers – A Guide to Selecting Native Plants for Streambanks and Shorelines*, Tennessee Valley Authority, 1997

2. *Best Management Practices Guidebook for Urban Development*, Northeastern Illinois Planning Commission, 1992.

3. Correspondence and communication with Wetlands Research, Inc., Wadsworth, Summer 2001.

4. *CRS Coordinator's Manual*, Community Rating System, FEMA, 1999.

5. *Environmental Consideration in Comprehensive Planning*, Northeastern Illinois Planning Commission, 1994.

6. *Illinois Hazard Mitigation Plan,* Illinois Emergency Management Agency, 2000.

7. *Living With Wetlands, A Handbook for Homeowners in Northeastern Illinois*, The Wetlands Initiative, 1998

8. *Protecting Nature in Your Community,* Chicago Wilderness and Northeastern Illinois Planning Commission, 2000.

9. *Reducing the Impacts of Urban Runoff - The Advantages of Alternative Site Design Approaches,* Northeastern Illinois Planning Commission, 1997.

10. *Stormwater management - The Benefits of Alternative Approaches*, South Suburban Mayors and Managers Association, 2000.

11. *Stream and Wetland Protection: A Natural Resource Management Priority in Northeaster Illinois,* Northeastern Illinois Planning Commission, 1991.

12. *Stream Corridor Restoration Principles, Processes and Practices*, Federal Interagency Stream Restoration Working Group, 1998. Copies available through the USDA Natural Resource Conservation Service.

13. *Watershed Development Ordinance*, Village of Gurnee, 2000

Chapter 9. Public Information

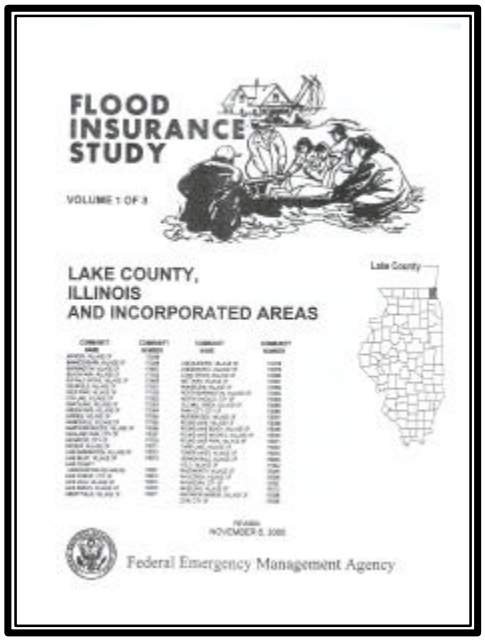
A successful hazard mitigation program involves both the public and private sectors. Public information activities advise property owners, renters, businesses, and local officials about hazards and ways to protect people and property from these hazards. These activities can motivate people to take protection steps and protect the natural and beneficial functions of floodplains and watersheds. Six measures are covered in this chapter:

1. Map information
2. Library and web sites
3. Outreach projects
4. Technical assistance
5. Real estate disclosure
6. Educational programs

9.1. Map Information

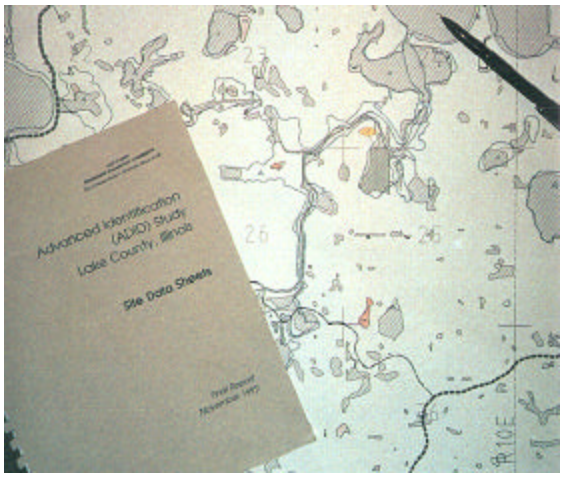
Many benefits stem from providing map information to inquirers. Residents and businesses who are aware of the potential hazards can take steps to avoid problems and/or reduce their exposure to flooding. Real estate agents and house hunters can find out if a property is floodprone and whether flood insurance may be required.

Flood maps have a wealth of information about past and potential flood hazards. However, they can be hard to obtain and many people have trouble reading maps. Therefore, communities that provide map information from FEMA's Flood Insurance Rate Maps (FIRMs) and Flood Insurance Study perform a valuable public information service. Communities 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 can 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 information is provided, community staff could also explain insurance, property protection measures and mitigation options that are available to property owners.

Users and inquirers need to remember that maps are not perfect; they display only the larger floodprone areas that have been studied. Some maps are based on data that are more than 20 years old. In some areas, watershed developments make even recent maps outdated. A map information service needs to remind inquirers that being outside the mapped floodplain is no guarantee that a property will never get wet.



Lake County wetland map

Local implementation: FIRMs are available to the public at the Gurnee Village Hall. The Engineering Department will help inquirers read the maps and obtain needed information, such as base flood elevations.

FIRMs are also available at the County Building and Zoning Department, and the Lake County Stormwater Management Commission. A guide to reading and interpreting these maps was produced and is distributed by Commission.

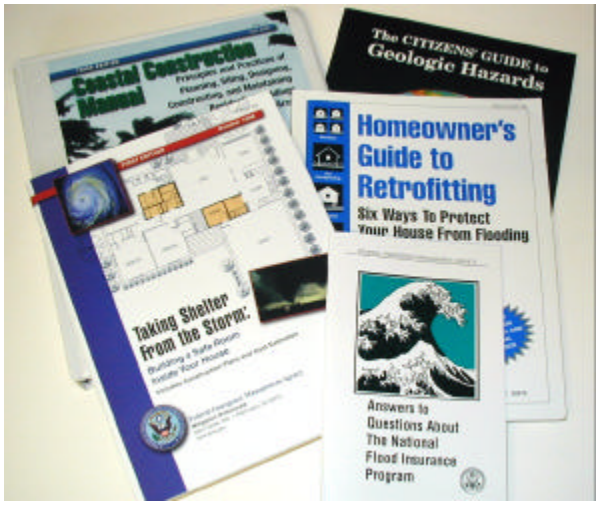
In 1998, the Stormwater Management Commission developed Lake County Flood Hazard Areas maps that show reported flood problems, including those not in the mapped floodplain. The Commission also has the Lake County Wetlands Inventory, topographic maps and the Hydrologic Atlas available for public access.

NFIP/CRS

CRS credit: The Community Rating System provides 140 points for providing map information to inquirers. The service must be publicized and the community must keep the maps up to date.

9.2. 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. Historically, libraries have been the first place people turn to when they want to research a topic. Interested property owners can read or check out handbooks or other publications that cover their situation. Libraries also have their own public information campaigns with displays, lectures, and other projects, which can augment the activities of the local government.



There are many references on hazard protection for property owners.

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 sties, there is almost no limit to the amount of up to date information that can be accessed by the user.

Local implementation: The Warren Newport Public Library is located close to the Des Plaines River floodplain. The library's catalog is available on its web site (www.wnpl.alibrary.com), making searches for references very handy.

A search under the subject heading of "flood" found six references. All them are pertinent to the community, but there are many more that could be made available, especially references on property protection. There was one reference on winter storms, 32 on tornadoes, and 60 on earthquakes (although many on the last two topics were fiction).

The Village's web site (www.gurnee.il.us) provides a wealth of information about community activities

The Village's web site has been used to keep users updated on the progress of the Mitigation Planning Committee. It also provides information on the Village's offices and activities, frequently asked questions, codes and ordinances, and links to other agencies in the County.

One particularly useful site in the Village's web site is the "Streetfinder." Users can enter a street name and find where it is on a Village map. If there were a floodplain overlay, users could quickly determine if a property was in or out of the floodplain. This could reduce staff time on map information to those instances when a site is close to the floodplain boundary.

The Lake County Stormwater Management Commission's web site (www.co.lake.il.us/smc) has information on stormwater management programs, reading flood maps, and a handbook on protecting a house from flood damage.

NFIP/CRS

CRS credit: The Community Rating System provides up to 30 points for having a variety of flood references in the local public library. The CRS is expected to grant municipal web sites a similar level of credit (up to 36 points) in 2002.

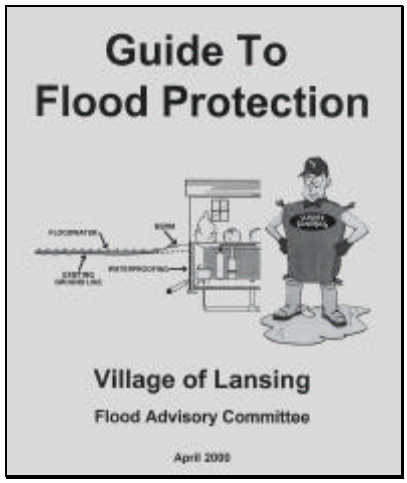
9.3. Outreach Projects

Mapping and library activities are not of much use if no one knows they exist. An outreach project can remedy this. Sending notices to property owners can help introduce the idea of property protection and identify sources of assistance.

Outreach projects are the first step in the process of orienting property owners to property protection and assisting them in 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.

The most effective types of outreach projects are mailed or otherwise distributed to floodprone property owners or to everyone in the community. Other approaches include the following:

- Articles and special sections in newspapers
- Radio and TV news releases and interview shows
- Hazard protection video for cable TV programs or to loan to organizations
- Presentations at meetings of neighborhood, civic or business groups
- Displays in public buildings or shopping malls
- Floodproofing open houses



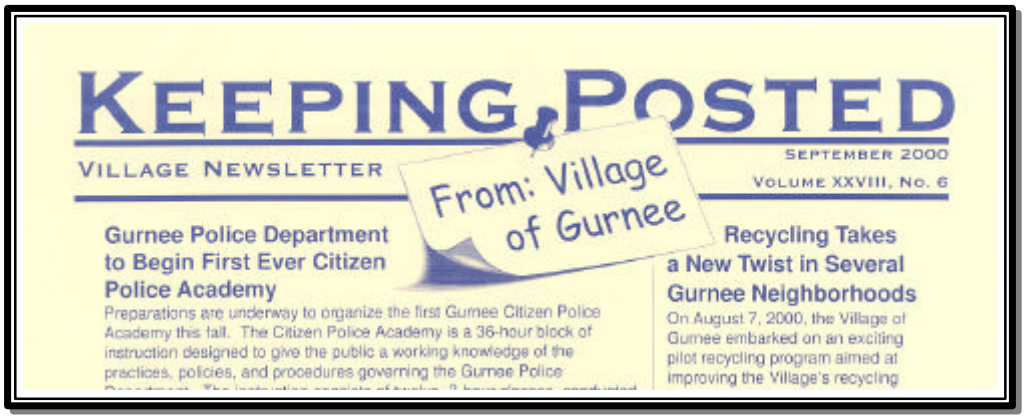
This is an example of a guidebook that is mailed to floodprone residents every year. It is part of a public information strategy which has adopted a mascot, Sammy Sandbag.

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.

Local implementation: The Village has a semi-monthly newsletter, "Keeping Posted," which has carried an article about the mitigation plan. It also has an e-mailing that has over 500 subscribers. This proved very helpful to keep people posted on things like road closures during the June 2000 flood. Both projects could have regular articles on hazard protection.

The Fire Department has a "Family Protection Program" booklet that covers the basics on protection from fires and natural hazards, including floods and tornadoes.

The Greater Chicago Chapter of 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.



KEEPING POSTED

VILLAGE NEWSLETTER

From: Village of Gurnee

SEPTEMBER 2000

VOLUME XXVIII, No. 6

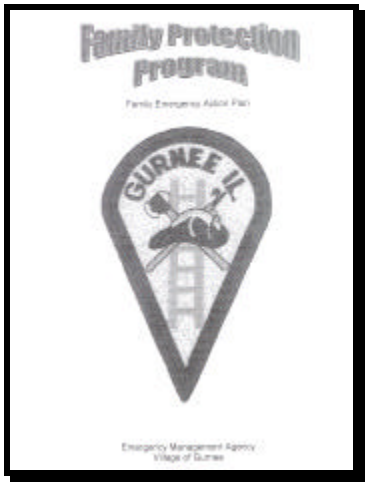
Gurnee Police Department to Begin First Ever Citizen Police Academy

Preparations are underway to organize the first Gurnee Citizen Police Academy this fall. The Citizen Police Academy is a 36-hour block of instruction designed to give the public a working knowledge of the practices, policies, and procedures governing the Gurnee Police

Recycling Takes a New Twist in Several Gurnee Neighborhoods

On August 7, 2000, the Village of Gurnee embarked on an exciting pilot recycling program aimed at improving the Village's recycling

The Lake County Stormwater Management Commission has sponsored annual "Flood Awareness Weeks" since 1997. This includes weeklong activities that were co-sponsored by various County departments and agencies involved in flood hazard awareness and response. A day-long workshop was held for planners, realtors and insurance agents.



Other events included an evening program for the general public that included several segments including an overview of the County's flood hazard; an introduction of all of the local players in flood response, flood protection and mitigation; and "where to go" or "who to call" for help.

NFIP/CRS

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.

9.4. Technical Assistance

While general information helps, most property owners do not feel ready to retrofit their buildings without help or guidance. Local building department staff 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.

Some building department or public works staff visit properties and offer suggestions. Most can recommend or identify qualified or licensed companies, an activity that is especially appreciated by owners who are unsure of the project or the contractor.

Village Flood Services

The Code Enforcement office in the municipal building (708/210-2915) provides the following:

- Information on whether a property is in a mapped floodplain and related flood insurance rate map data;
- Records of past flooding;
- Advice on how to protect a building from water problems;
- Guidance on the laws that govern construction and property improvements; and
- Site visits to view the cause and possible solutions to a problem.

Publicity for the services of the Village of South Holland, Illinois, Flood Assistance Coordinator

Technical assistance can be provided in one-on-one sessions with property owners or can be provided through seminars. For instance, seminars or "open houses" can be provided on retrofitting structures, selecting qualified contractors, and carrying out preparedness activities.

Local implementation: Engineering Department staff can make visits to sites to review local flooding or drainage problems and make recommendations on how they can be rectified. The Stormwater Management Commission provides advice and technical assistance to property owners associations, municipal governments and other local government units for areas that experience flooding on a watershed or regional scale. The Lake County Health Department provides technical guidance related to septic system failure and well contamination.

CRS credit: Up to 71 points are available for providing one-on-one flood protection assistance to residents and businesses and making site visits. The service must be publicized.

9.5. 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 any flood hazard.

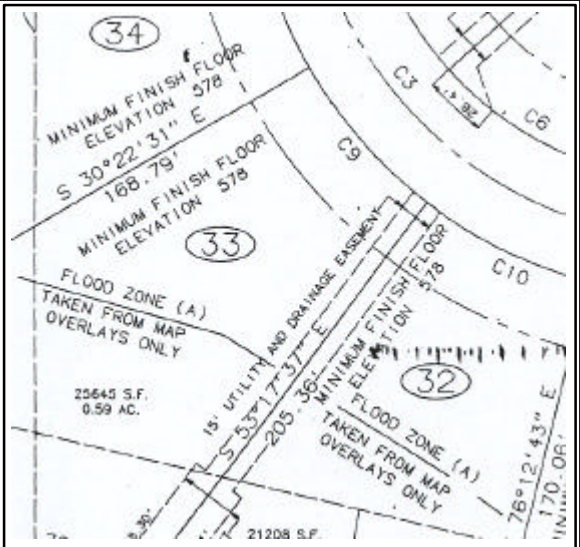
Federal law: Federally regulated lending institutions must advise applicants for a mortgage or other loan that is to be secured by an insurable building that the property is in a floodplain as shown on the Flood Insurance Rate Map.

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, which went into effect on October 1, 1994, 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, or if the seller is aware of a radon problem, a mine subsidence hazard, or 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.



Subdivision plat with flood hazard disclosure

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 a Special Flood Hazard Area (called an "Zone A" in the example to the left).

Local implementation: The Lake County Association of Realtors reports that local agents follow the legal requirements. The shortcoming of this approach is that it is dependent on the seller, not on an independent check of the flood map.

All Multiple Listing Service (MLS) entries read "Flood insurance may be required." This does not provide any help in disclosing the flood hazard. Even if Gurnee or Lake County wanted a change, the Service is a six county activity and many other real estate organizations would have to be convinced of the need to do it.

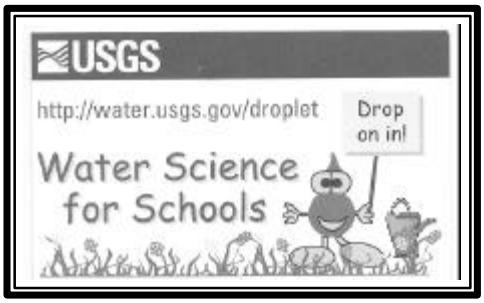
NFIP/CRS

CRS credit: Gurnee 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.

9.6. Educational Programs

A community's most important natural resource is its children. These future generations will inherit the resources, infrastructure and development left to them. They will also be facing the same natural forces that cause periodic flooding, tornadoes, storms and other hazards. These watersheds and floodplains will be theirs to farm, build on and care for.

Environmental education programs can teach children about natural hazards, the forces that cause them, the factors that cause problems, and the significance of protecting the natural and beneficial functions of watersheds and floodplains. These programs can be undertaken by schools, park and recreation departments, conservation associations, and youth organizations, such as the Boy Scouts, Campfire Girls and summer camps. An activity can be as involved as course curriculum development or as simple as an explanatory sign near a river.



Youth educational programs are not limited to children. Often adults learn about innovative concepts or new ideas from their children. If the children come home with an assignment for their new water quality monitoring project, the parents become interested in finding out about water quality monitoring.

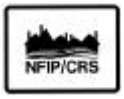
There are many programs that provide support and curriculum materials for school and other educational programs. These include web sites ("FEMA for Kids," USGS' "Water Science for Schools," etc.), posters, coloring books, games, and references. These items and, possibly, hands-on models where students can see the effects of different land use practices may be available through the local soil and water conservation district.

The Institute for Building and Home Safety is a nonprofit organization sponsored by insurance companies interested in reducing property losses from natural hazards. It has joined with the National Geophysical Data Center to sponsor a web site with a natural hazards quiz. It covers all hazards in addition to flooding.

Local implementation: There are several regional education support groups, like Project WET (Water Education for Teachers), Chicago Wilderness and the Chicago River Schools Network. These groups have a variety of interesting programs, but most of them are environmental programs that focus on protecting natural functions rather than protection of people from hazards.

The Lake County Soil and Water Conservation District has an Education Coordinator who works with students, youth groups and teachers. The District provides programs to schools on soil and water related issues. An Enviroscape model is available for loan to schools and environmental groups. This model teaches about water pollution and best management practices. Training programs and workshops for teachers and community leaders are available as well as a small grant program for youth environmental projects. To date, no specific projects have been conducted with Gurnee schools or organizations.

Grayslake's Prairie Crossing (see page 8–9) provides a handbook, "Living with Nature," and numerous educational opportunities for residents throughout the year. Homeowners are educated regarding the environmentally progressive aspects of the development and are encouraged to minimize use of chemicals, landscape with native plants, and minimize lawn area.



CRS credit: The Community Rating System credits educational activities under the outreach projects credits discussed on page 9-4.

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 Department 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.

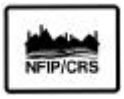
Take good care of yourself. Recovering from a flood is a big job. It is tough on both the body and the spirit and the effects a disaster has on you and your family may last a long time.

9.7. Public Information Program Strategy

After reviewing the possible and locally implemented public information activities covered in the previous sections, the Mitigation Planning Committee prepared a Public Information Program Strategy. Following the Community Rating System format, the strategy consists of the following parts:

a. The local flood hazard – discussed in Chapter 2 of this plan.
b. The flood safety and property protection measures appropriate for that hazard – discussed in chapters 2 and 5 and on the previous page.
c. The flood-related public information activities currently being implemented within the community including those by non-government agencies – discussed in sections 9.1 – 9.6.
d. Goals for the community's public information program – covered in Chapter 3.
e. The outreach projects that will be done each year to reach the goals
f. The process that will be followed to monitor and evaluate the projects.

The last two parts of the strategy are in Chapter 10. By incorporating all of the parts into this plan, the Village can implement a CRS-credited strategy with all of its other mitigation activities. Several exercises were conducted to identify the topics and media appropriate for the Village's situation. The results of these are in the Recommendations section, below.



CRS credit: The Community Rating System provides 100 points for a public information program strategy.

9.8. 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.

2. Most public information activities can be used to advise people about all hazards, not just floods.

3. Some of the public information activities can be implemented by Village staff. By making a few changes and formalizing its activities, the Village can earn nearly 500 points under the Community Rating System.

4. Other public information activities require coordination with other organizations, such as schools and real estate agents.

5. There are several area organizations that can provide support for public information and educational programs.

9.9. Recommendations

1. The following topics should be covered in public information activities. They are listed in priority order as recommended by the Mitigation Planning Committee.

   a. Status of projects and what the Village and other agencies are doing
   b. Retrofitting a house or a business to protect it from floods and other hazards
   c. Impact of flooding on the community, safety and health hazards

d. Emergency measures, evacuation, safety precautions for all hazards
e. Rules on building in the floodplain
f. Benefits of preserving and protecting wetlands and open space, beautifying the riverfront
g. Sources of assistance
h. Why it floods, history of flooding
i. Educating the public on the flooding problems facing Gurnee Grade School and the limitations of the flood protection alternatives.

2. The following media should be used to convey these messages. They are listed in priority order as recommended by the Mitigation Planning Committee.

   a. Village-wide newsletter
   b. Homeowner's flood protection handbook
   c. Technical advice from Village staff
   d. Mass mailing to all floodplain residents
   e. Visits to a home by Village staff
   f. Newspaper articles
   g. References available in the public library
   h. Park, Forest Preserve and School District educational programs

3. The Village's web site should include information and links to other sites to cover as many of the topics as possible. It should also include a system for users to determine the flood hazard for their properties.

4. The Village should develop these projects in close coordination with the Lake County Stormwater Management Commission, the Park, Forest Preserve, School and Soil and Water Conservation Districts, and the Red Cross.

9.10. References

1. *CRS Coordinator's Manual*, Community Rating System, FEMA, 1999.

2. *CRS Credit for Outreach Projects,* Federal Emergency Management Agency, 1999

3. *Floodproof Retrofitting: Homeowner Self-Protective Behavior*, Shirley Bradway Laska, University of Colorado, 1991.

4. *Protecting Nature in Your Community*, Chicago Wilderness and Northeastern Illinois Planning Commission, 2000.

5. *Stormwater Management Public Information Resource Guide,* South Suburban Mayors and Managers Association, 1999

Chapter 10. Action Plan

The culmination of this *Flood Mitigation Plan* is this Action Plan. The general direction of the overall program is outlined here. Specific activities pursuant to the general direction are detailed in Sections 10.1 – 10.3. These sections assign recommended projects and deadlines to the appropriate Village offices.

A plan is worthless if there is no instrument for ensuring that it is carried out. Accordingly, the creation of a Mitigation Committee is recommended to monitor the implementation of the *Plan*, report to the Village Board of Trustees on its progress, and recommend revisions to this *Plan* as needed. This is explained in section 10.4. Section 10.5 provides a proposed Board of Trustees resolution to put the Action Plan in effect.

The directions for the Village of Gurnee to follow to reduce its exposure to losses from floods and other natural hazards are spelled out in this *Flood Mitigation Plan*. The overall directions can be summarized under four general approaches

- Implement appropriate acquisition and retrofitting measures to protect buildings from flooding by the Des Plaines River.
- Improve and administer regulations on new construction throughout the community, with special emphasis on floodplain development and protection of natural resources.
- Respond to floods and other natural hazards before they reach threatened areas.
- Inform and involve the public in the implementation of this *Plan* and in protecting their own health, safety and property.

It should be noted that these approaches and activities focus on the natural hazards faced by the Village of Gurnee. There are other activities planned and underway in the Village and in the Des Plaines River floodplain, such as the Village Center plans to improve the downtown. These activities should incorporate hazard mitigation measures and they should be coordinated with the action items recommended in this chapter. For example, properties acquired to protect the buildings from flood damage should be reused to support the Village Center plans, economic development, tourism or expansion of open space or recreational facilities.

The action items in this chapter are for the Village of Gurnee. The Mitigation Planning Committee had two recommendations for other agencies:

- School District 56 should review the costs and benefits of the alternative ways to protect Gurnee Grade School. The Committee felt that the school should be either relocated to permanently protect it from the base flood or retrofitted to partially protect it from only the smaller, more frequent floods.
- The Lake County Stormwater Management Commission should review the Watershed Development Ordinance to determine if the standards for best management practices should be strengthened.

10.1. Program Action Items

General recommendations appear at the end of Chapters 4 – 9 for each of the six mitigation strategies. This section converts those general recommendations to specific action items. This section is organized according to the office that would be responsible for each action item. If more than one office is identified, the action item is listed under the lead agency.

For each action item, the action plan identifies the goal(s) and objective(s) from Chapter 3 that the action item supports and the recommendation(s) in Chapters 4 - 9 that are being implemented. The recommendations and the discussions in the earlier chapters provide more background and direction on these action items.

Following this section, Section 10.2 lists the public information action items and Section 10.3 reviews additional tasks needed to administer and support *Plan* implementation. Section 10.3 provides a matrix that summarizes the action items and the offices responsible for them.

Several action items refer to the Mitigation Committee. This *Plan* recommends creation of this organization upon adoption of the *Plan* by the Board of Trustees (Action Item 14).

Administration Department

Action Item 1. Acquisition Program

a. Description: The Village should acquire floodprone properties where appropriate.

- All acquisition projects should be voluntary. The Village should use its powers of eminent domain only when there are extenuating circumstances, such as code violations or the property is a health or safety threat to others.
- The Village should continue its policy of purchasing floodprone properties when they come up for sale.
- The priority ranking system explained in Section 5.12 should be used to help make efficient use of available funding.
- This work should be coordinated with the Village Center Plan update (Action Item 3).
- County, State and Federal funding sources should be pursued for those properties that should remain as permanent open space. Village funds should be used in the Village Center.

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b. Recommendation reference: Property protection: 5.15.2, 3, and 5.

c. Deadline: This is an ongoing activity.

d. Budget: Continue to fund at the current level.

Action Item 2. Retrofitting Support

a. Description: The Village should consider providing technical and financial support to property owners interested in retrofitting their properties to protect them from floods, sewer backup and other hazards.

- Village staff should become familiar with retrofitting techniques so they can provide advice and assistance on the technical aspects of property protection.
- The Sanitary Sewer Mitigation Program should be expanded to include retrofitting to protect from surface flooding.
- Buildings with the lowest Rapid Visual Screening scores for potential seismic hazards should be given a more detailed structural investigation.

b. Recommendation reference: Problem description: 2.12.12, Property protection: 5.15.1, 5, and 7, Public information: 9.9.1 and 2.

c. Deadline: Provide draft policies and procedures for funding projects to the Mitigation Committee by June 30, 2002.

d. Budget: Staff time plus an annual funding to be determined during the annual budget process.

Planning Department

Action Item 3. Village Center Plan

a. Description: The Comprehensive Plan, the Capital Improvements Program, and the Village Center Development Plan identify projects that would improve the Village Center. These plans and projects should be evaluated in light of the recommendations of this mitigation plan and an updated Village Center Plan should be prepared. It would address the following concerns:

- Property protection measures recommended for the Downtown and East Old Grand planning clusters.
- Connecting the riverwalk and open space areas to the Downtown.
- Relocation of the Police Department out of the Downtown and reuse of the site. If the building is not cleared, it should be retrofitted to protect it from flood damage.
- Burying utility lines for beautification and protection from wind, ice and snow.
- Improvements to and beautification of the Grand Avenue Corridor.
- The potential tourism benefits of utilizing the river and floodplain creatively.

b. Recommendation reference: Preventive: 4.8.2, 4.8.3, Property protection: 5.15.4.

c. Deadline: Provide a draft updated Village Center Plan to the Mitigation Committee by December 31, 2002.

d. Budget: Staff time.

Building & Zoning Department

Action Item 4. Development Regulations Administration

a. Description: The Watershed Development and Zoning Ordinances and the Building Code protect existing development in the floodplain from increased flooding due to new construction and will help protect new development from the impacts of flooding and other natural hazards. They also help protect wetlands, shorelines and water quality. Several activities are included in this action item:

   - Continue to enforce these regulations.
   - Review the inspection and enforcement procedures to determine if changes are needed to ensure complete compliance with the Village's requirements.
   - Regulatory staff should become familiar with the National Flood Insurance Program's Increased Cost of Compliance to ensure that this mitigation funding source will be available to those flooded properties that qualify.
   - Assist the Fire Department in developing procedures for post-disaster building inspections and mitigation (Action Item 8).
   - Develop close coordination procedures with State and County highway offices to promote information transfer on proposed work in the floodplain.

b. Recommendation reference: Preventive: 4.8.1, Property Protection: 5.15.5, Emergency Services: 6.7.3, Natural Resource Protection: 8.8.4 and 5.

c. Deadline: Conduct the review and report to the Mitigation Committee by June 30, 2002.

d. Budget: Staff time.

Action Item 5. Development Regulations Provisions

a. Description: Review the Watershed Development and Zoning Ordinances and the Building Code to determine appropriate amendment language to:

   - Mandate simple and inexpensive property protection measures, such as moving the electric service box above the base flood elevation, as a condition of a building permit and/or at time of resale.
   - Initiate stream and wetland dumping regulations.

b. Recommendation reference: Property Protection: 5.15.6, Natural Resource Protection: 8.8.2 and 3.

c. Deadline: Provide draft language to the Mitigation Committee by June 30, 2002.

d. Budget: Staff time.

Fire Department

Action Item 6. Flood Annex

a. Description: Continue to follow the Emergency Operations Plan and critique and revise it after each emergency or disaster. Prepare an annex to the Emergency Operations Plan that uses the Flood Stage Forecast Map to:

- Identify areas affected and resources needed at various predicted flood levels.
- Determine flood warning procedures and provisions for door-to-door notification to floodplain properties.
- Determine special warning or response needs of floodprone critical facilities.
- Guide routing of traffic in the most efficient manner.
- Include procedures and public information materials for post-disaster building inspections and identification of mitigation opportunities (with support from the Building & Zoning Department).

b. Recommendation reference: Emergency Services, 6.7.1, 3, 4. and 5.

c. Deadline: Provide a draft annex to the Mitigation Committee by January 31, 2002.

d. Budget: Staff time.

Engineering Department

Action Item 7. Floodplain Map

a. Description: Obtain the data from FEMA for the Digital Flood Insurance Rate Map for Lake County. Incorporate the data into the Village's geographic information system. Request that the official FEMA floodplain map be revised where contours differ from the mapped floodplain boundaries. This work may be facilitated if the Village or the Stormwater Management Commission signed a Cooperative Technical Partnership agreement with FEMA.

b. Recommendation reference: Problem description: 2.12.4, Preventive: 4.8.4

c. Deadline: Submit a corrected map to the Federal Emergency Management Agency by March 31, 2002.

d. Budget: Staff time.

Action Item 8. Flood Stage Forecast Map

a. Description: Prepare a formal flood stage forecast map for the Des Plaines River floodplain. It should tie site elevations to predicted flood levels at the Gurnee gage.

b. Recommendation reference: Emergency Services, 6.7.2

c. Deadline: Provide the map to the Emergency Manager by March 31, 2002.

d. Budget: Staff time.

Action Item 9. Drainage System Improvements

a. Description: Implement the drainage system inventory scheduled in the Capital Improvements Program. When completed, develop a long term drainage and storm sewer improvement plan with a priority on analyzing the drainage basin that drains from the east to the Des Plaines River.

b. Recommendation reference: Structural Projects, 7.8.2 and 3

c. Deadline: Complete the inventory by December 31, 2002.

d. Budget: Inventorying the system: Staff time. Modeling priority basins to design appropriate improvements: Dollar amounts to be determined during the annual budget process (for the eastern half of the Village, where the need is greatest).

Public Works Department

Action Item 10. Drainage System Maintenance

a. Description: Prepare formal drainage system maintenance procedures that are coordinated with other agencies' maintenance programs and based on Community Rating System credit criteria.

b. Recommendation reference: Structural Projects, 7.8.4

c. Deadline: Provide draft procedures to the Mitigation Committee by March 31, 2002 (to be included in the Community Rating System application (Action Item 15)).

d. Budget: Staff time.

10.2. Public Information Strategy

These two action items are listed separately to facilitate credit under the Community Rating System (CRS).

Public Information Office

Action Item 11. Technical Information

a. Description: In cooperation with the Mitigation Committee, ensure that the following technical information activities are implemented:

- Stocking the Warren Newport Public Library with property protection references.
- Links on the Village's web site to river levels, predicted flood levels, references and sources of assistance.

- A guidebook for property owners
- Site visits to advise residents and businesses on how to protect their properties

b. Recommendation reference: Property protection: 5.15.1, 5, and 7, Public information: 9.9.1, 2 and 3.

c. Deadline: Draft the materials in time for the Community Rating System application (Action item 15)

d. Budget: Staff time.

Action Item 12. Outreach Projects

a. Description: In cooperation with the Mitigation Committee, ensure that the following outreach projects are implemented:

- Articles for the Village newsletter
- An annual mailing to all floodplain properties (to include flood and hazard data collected by the building surveys)
- Articles and news releases
- Educational activities for school and recreation programs

These projects should cover the following topics:

- Status of projects and what the Village and other agencies are doing
- Retrofitting a house or a business to protect it from floods and other hazards
- Impact of flooding on the community, safety and health hazards
- Emergency measures, evacuation, safety precautions for all hazards
- Rules on building in the floodplain
- Benefits of preserving and protecting wetlands and open space, beautifying the riverfront
- Sources of assistance
- Why it floods, history of flooding
- Educating the public on the problems with protecting Gurnee Grade School from flood damage

b. Recommendation reference: Property protection: 5.15.1, 5, and 7, Public information: 9.9.1, 2, 3 and 4.

c. Deadline: Draft the articles and annual mailing in time for the Community Rating System application (Action item 15)

d. Budget: Staff time plus funding to be determined during the annual budget process-for annual printing and mailing expenses.

Action Plan Summary				
Office	**Action Item**		**Deadline**	**Budget**
Administration	1	Acquisition Program	Ongoing	Current levels
	2	Retrofitting Support	6/30/02	$TBA/year
Planning	3	Village Center Plan	12/31/02	Staff time
Building & Zoning	4	Regulation Administration	6/30/02	Staff time
	5	Regulation Provisions	6/30/02	Staff time
Fire	6	Flood Annex	6-31-02	Staff time
Engineering	7	Floodplain Map	3/31/02	Staff time
	8	Flood Stage Forecast Map	3/31/02	Staff time
	9	Drainage Improvements	12/31/02	Staff time + $TBA
Public Works	10	Drainage Maintenance	3/31/02	Staff time
Public Information	11	Technical Information	4/30/02	Staff time
	12	Outreach Projects	4/30/02	Staff time + $TBA/yr
Board of Trustees	13	***Plan*** Adoption	12/31/01	Staff time
Mitigation Committee	14	Program Oversight	Ongoing	Staff time
Village Administrator	15	Community Rating System	4/30/02	Staff time

10.3. Administrative Actions

This section reviews the additional action items that are needed to administer and support the recommendations of the two previous sections. As such, some are not related to specific goals, objectives or mitigation recommendations in the previous chapters.

Village Board of Trustees

Action Item 13. *Plan* Adoption

a. Description: Adopt this *Flood Mitigation Plan* by passing the resolution in Section 10.5. The resolution creates the Mitigation Committee which is described in Section 10.4. The Mayor should appoint its members at the time the resolution is passed.

b. Deadline: December 31, 2001

c. Budget: Staff time.

Mitigation Committee

Action Item 14. Program Oversight

a. Description: Monitor implementation of the Action Plan and report on progress and recommended changes to the Mayor and Board of Trustees.

- The format of the report is described in the resolution in Section 10.5. An annual evaluation of the plan's implementation is required for credit under the Community Rating System.
- A public information subcommittee should be created to monitor and evaluate the public information strategy.

b. Deadline:

- September 1 each year: Submit the annual evaluation report to the Mayor and Board of Trustees. This timing coincides with the plan evaluation report that must be submitted by October 1 for CRS credit.
- September 1, 2006: A five year update is required for continuing credit of this *Plan* under the Community Rating System

c. Budget: Staff time.

Village Administrator

Action Item 15. Community Rating System

a. Description: Submit an application for a flood insurance premium rate discount under the Community Rating System. The application should include all activities currently being implemented by the Village and other agencies. Identify additional activities that could be implemented in order to receive the next higher classification.

b. Deadline: Submit the application by April 30, 2002.

c. Budget: Staff time.

10.4. Mitigation Committee

Floods have often been compared to fires: communities that face these hazards adopt both preventive measures, such as building code standards, and emergency measures to respond to the hazard when it occurs. One important difference is that every community has a fire chief – one person who administers fire prevention and fire fighting activities – while no community has a flood chief.

This *Plan* recommends that the Village create a permanent body that would assume the role of the flood chief. The proposed Mitigation Committee would assess the progress of the Village's flood mitigation activities, i.e., the action items recommended by this *Flood Mitigation Plan*.

The Committee would be created by passage of the resolution in the following section. It would be an official advisory board to the Mayor and Board of Trustees. It would be composed of members of the public who have an interest in flooding, other natural hazards, and community improvement and the Village staff who work on those issues. Hopefully, much of the membership would be drawn from those who worked on this *Plan*.

The size of the Committee does not have to be fixed. If more people are interested and want to work on the issues, the Committee could be expanded to accommodate them. A public information subcommittee is also proposed. Its members would not necessarily have to be members of the full Committee.

The Chair of the Committee would be appointed by the Mayor. That person could be drawn from either the public members or the Village staff. Both approaches have been used in other communities and they both can work.

Staff support would be provided to the Committee by the appropriate Village staff members in the same way that staff support was provided to prepare this *Plan*. Consultants may also provide support.

The Committee would not have any powers over Village staff or other committees or commissions. It would be purely an advisory body. Its primary duty is to collect information and report to the Mayor, the Board of Trustees, and the public on how well this *Plan* is being implemented. Other duties include reviewing mitigation proposals and hearing resident concerns about flood protection and related matters.

The Mitigation Committee would be, in effect, the Village's flood and hazard mitigation conscience. The resolution charges it with seeing the *Plan* carried out and recommending changes that may be needed. While it has no formal powers, its work should act as a strong incentive for the offices responsible for the action items to meet their deadlines.

The Committee should meet at least quarterly during the first years. There will be plenty of activities to monitor and review. As more and more new initiatives evolve into routine tasks, the workload will reduce. The Committee should eventually tackle mitigation issues related to tornadoes, earthquakes, and other hazards facing Gurnee. The resolution allows for this flexible approach.

10.5. Plan Adoption Resolution

The following draft resolution is recommended for adopting this *Flood Mitigation Plan* and establishing the Mitigation Committee.

Resolution No. ____

Whereas the Village of Gurnee has been faced with overbank flooding and drainage problems over the years that have flooded buildings, closed businesses, disrupted traffic, and presented a general public health and safety hazard; and

Whereas the Village of Gurnee has been faced with threats to life and safety and property damage from tornadoes, ice and snow storms, severe heat and drought, thunderstorms and lightening and is in an earthquake-prone area; and

Whereas the Village's Flood Mitigation Planning Committee has prepared a recommended *Flood Mitigation Plan* that reviews the Village's options to protect people and reduce damage from flooding and other hazards; and

Whereas the recommended *Flood Mitigation Plan* has been widely circulated for review by the Village's residents and federal, state and regional agencies and has been supported by those reviewers;

Now, therefore, be it resolved that:

1. The *Flood Mitigation Plan* is hereby adopted as an official plan of the Village of Gurnee.

2. The Mitigation Committee is hereby established as a permanent advisory body.

    a. The Committee members and its Chair shall be appointed by the Mayor, subject to the approval of the Village Board of Trustees.

    b. Resident Committee members shall serve two year terms with one-half of the members' terms expiring each year.

    c. The schedule of Committee meetings shall be posted in appropriate places. All meetings of the Committee shall be open to the public.

3. The Committee shall meet as often as necessary to prepare or review mitigation activities and progress toward implementing the *Flood Mitigation Plan*. It shall meet at least once each year to review the status of ongoing projects.

4. By January 31 each year, the Committee shall prepare an annual evaluation report to the Mayor and Village Board of Trustees on the *Mitigation Plan*. The report will cover the following points:

    a. A review of the original plan.

    b. A review of any floods that occurred during the previous calendar year.

    c. A review of the action items in the original plan, including how much was accomplished during the previous year.

    d. A discussion of why any 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 approval by this Board of Trustees as amendments to the adopted plan.

5. The Committee should not restrict itself to only flood hazard mitigation. As time and interests become available, it should also investigate mitigation measures appropriate for tornadoes, earthquakes, and other hazards facing Gurnee.

6. The Village Administrator is charged with supervising the implementation of the plan's recommendations within the funding limitations provided by the Village Board

of Trustees or other sources. The Administrator shall give priority attention to those action items recommended by the *Flood Mitigation Plan* with the earliest deadlines.

7. The Village Administrator shall name a staff member as Community Rating System (CRS) Coordinator for the Village. The CRS Coordinator shall be the main point of contact for all matters relating to the CRS. He or she is responsible for submittal of all documentation needed for the application, verification and annual recertification.

ADOPTED this the _____ day of _____, 2001

_____

Clerk of the Village of Gurnee, Illinois

APPROVED this the _____day of_____, 2001

_____

President of the Village of Gurnee, Illinois