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CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE

November 11, 2011

SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

CITY OF MILWAUKEE DEPARTMENT OF PUBLIC WORKS

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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 282, 2nd Edition

CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE

Prepared by the

Southeastern Wisconsin Regional Planning Commission

In Cooperation with the

City of Milwaukee Department of Public Works

November 2011

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Chapter I

INTRODUCTION AND BACKGROUND

INTRODUCTION

In January 2003, the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and the City of Milwaukee Department of Public Works agreed to cooperatively prepare an all hazards mitigation plan for the City of Milwaukee. The plan was designed to be consistent with the guidelines of the Wisconsin Department of Military Affairs, Division of Emergency Management, and the Federal Emergency Management Agency (FEMA). The plan utilized an "all hazards" mitigation approach which the Wisconsin Division of Emergency Management and FEMA recommend as an option to single hazard mitigation planning. As such, consideration was given to many hazard conditions, including flooding; lakeshore bluff failure episodes; severe weather conditions, including wind storms, tornadoes, periods of extreme heat or cold, and winter storms, as well as certain other human-induced or technical hazards. While the plan considered all of the potential hazards, it was recognized that only limited mitigative actions would be feasible for some of these hazards, since they are not site-specific or repetitious in nature.

This initial planning effort was focused upon activities which are most directly related to the City of Milwaukee government operations. However, because of the importance in developing a partnership approach to coordinate emergency mitigation programs, the plan also incorporated consideration of programs involving other agencies, units of government, and private interests both inside and outside of the boundaries of the City of Milwaukee.

The original City of Milwaukee all hazard mitigation plan was adopted and approved by the City in 2005. The plan was prepared by the staffs of the City of Milwaukee Department of Public Works and the Southeastern Wisconsin Regional Planning Commission. In preparing the plan, the City involved all appropriate City and Milwaukee County departments as needed. The planning was coordinated with the related activities of other concerned units and agencies of government and was developed under the guidance of the City of Milwaukee All Hazards Mitigation Plan Steering Committee, which was created by the City specifically for plan development purposes and was comprised of elected and appointed officials, agency and business representatives, and citizens from throughout the City knowledgeable in hazard mitigation matters.

The mitigation planning requirements of 44 *Code of Federal Regulations,* Section 201.6 (d) (44 CFR 201.6(d)) require that local hazard mitigation plans must be reviewed; updated to reflect changes in development, progress in local mitigation efforts, and changes in priorities; and reapproved every five years for local jurisdictions to be able to receive hazard mitigation funding. Thus, in November 2010, the City of Milwaukee and SEWRPC began preparation of an update of the initial hazard mitigation plan. The updated plan was prepared by the staffs of the City of Milwaukee Department of Public Works, the City of Milwaukee Office of Emergency Management and

Homeland Security, and SEWRPC. In preparing the updated plan, the City involved all appropriate City departments as needed. In addition, the planning was coordinated with the related activities of other concerned units and agencies of government and was developed under the guidance of the City of Milwaukee All Hazards Mitigation Plan Steering Committee, which was created by the City specifically for plan development purposes and, once again, is comprised of elected and appointed officials, agency and business representatives, and citizens from throughout the City knowledgeable in hazard mitigation matters.

In assembling the City of Milwaukee All Hazard Steering Committee, the City Department of Public Works and the City Office of Emergency Management and Homeland Security sought representatives of law enforcement; the City's fire, public works, and community development departments; the County emergency management office and transit system; the Milwaukee Metropolitan Sewerage District; interested nongovernmental organizations; and the health care community.

For more complete details on the level of participation of local citizens and community groups in the technical advisory committees, public involvement process, and the summary of minutes for each meeting, see Appendix A.

The procedures utilized in the plan are based upon guidance provided by the FEMA and the Wisconsin Department of Military Affairs, Division of Emergency Management.[1] As such, the plan is consistent with the requirements and procedures defined in the Disaster Mitigation Act of 2000. The analysis includes three components: 1) profile and analysis of hazard events, 2) inventory of vulnerability assessment of community assets, and 3) development of hazard mitigation strategies.

OVERVIEW OF STUDY AREA

The City of Milwaukee is located in southeastern Wisconsin, and covers about 96 square miles as shown on Map 1. There are all or parts of six major river systems within the City, including the Milwaukee River, Menomonee River, Kinnickinnic River, Root River, Oak Creek, and the Lake Michigan direct drainage area encompassing a total of about 620 acres of inland surface waters. The City's natural resource base is primarily located among the environmental corridors associated with the main stems of these river systems, as well as the Lake Michigan shoreline.

Much of the land in the City is urban in character with residential land uses comprising the largest area. In addition, commercial and industrial land uses comprise a significant portion of the City's area. The majority of the City is developed and population centers can be found throughout the entire City. Urban area redevelopment activities are ongoing in several areas of the City.

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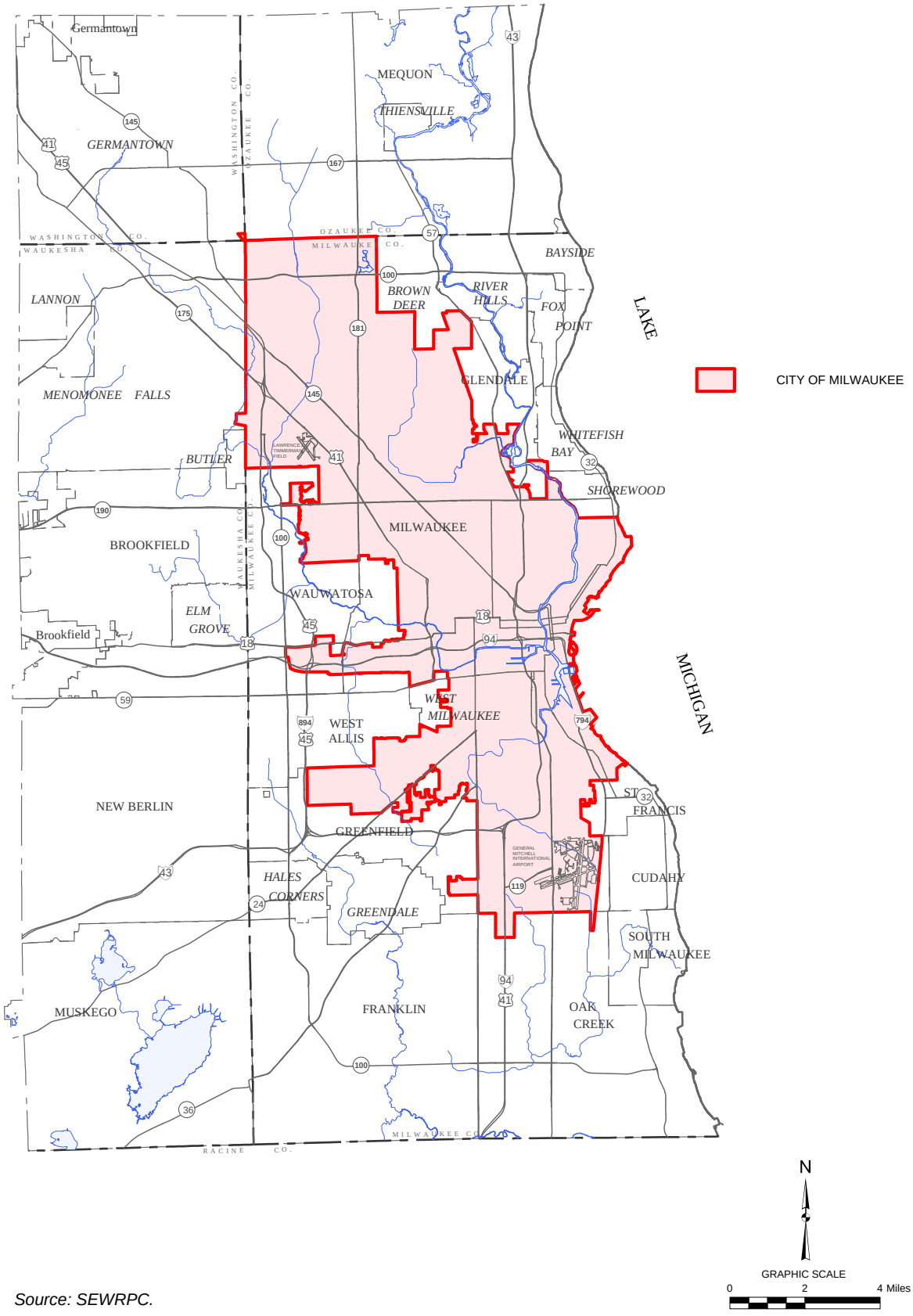
[1]*Federal Emergency Management Agency*, State and Local Mitigation Planning How-to Guide, *"Understanding Your Risks, Identifying Hazards and Estimating Losses," Publication No. FEMA 386-2, August 2001; Federal Emergency Management Agency*, Local Multi-Hazard Mitigation Planning Guidance, *July 1, 2008; See also Federal Emergency Management Agency*, State and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000, *July 11, 2002.*

Map 1

LOCATION OF THE CITY OF MILWAUKEE



Source: SEWRPC.

RELATIONSHIP OF HAZARD MITIGATION PLANNING TO EMERGENCY OPERATIONS PLANNING

The focus of this planning effort is upon hazard mitigation measures. Such measures generally involve lasting, often permanent, measures designed to reduce the exposure to, probability of, or potential loss from hazardous events. Such measures tend to focus on actions related to where and how to build structures, education to reduce losses or injury, and programs to improve the safety of identified hazard areas. A hazard mitigation plan outlines the strategy for mitigating the hazards potentially impacting a county or municipality.

The mitigation plan should be distinguished from, but compatible with, an emergency response or operations plan. Such a plan is defined as a plan which describes how people and property will be protected in disaster and disaster threat situations; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies, and other resources available for use in the disaster; and outlines how all actions will be coordinated. Numerous such plans have been developed at the jurisdictional level, and often involve mutual assistance and cooperation agreements between local units of government in adjoining municipalities, both within and outside of the City of Milwaukee. Emergency response or operations is not directly considered in the planning program described herein. Plans for mitigating hazards are related to emergency operation activities involving short-term recovery decision-making, since such activities may highlight prospects for implementation of a mitigation strategy aimed at reducing long-term risk to human life and property.

With regard to the distinction between mitigation planning and emergency response or operations planning, the following definitions are noted for further clarification:

- **Emergency Response or Operations Services**—The actions of first responders, such as firefighters, police, and other emergency services personnel at the scene of a hazard event. The first responders take appropriate action to contain the hazard, protect property, conduct search and rescue operations, provide mass care, and ensure public safety. (Not the subject of the current planning program.)

- **Hazard Mitigation**—Sustained actions or projects taken to reduce or eliminate long-term risk from hazards and their effects.

- **Mitigation Plan**—The document that identifies results from the systematic process of identifying hazards and evaluating vulnerability, identify goals, objectives and actions to reduce or eliminate the effects of identified hazards, and sets forth an implementation plan for carrying out the actions. (The subject of the current planning program.)

SCOPE AND PURPOSE OF PLAN

This update of the initial 2005 City All Hazard Mitigation Plan is a City Level Plan and is intended to set forth the most appropriate, feasible, and effective hazard mitigation strategy for the City of Milwaukee. However, the scope of this plan is countywide for some aspects of the plan and inclusive of the local units of government adjacent to the City, where appropriate. The plan complements, refines and focuses the *State Hazard Mitigation Plan of Wisconsin*[2] on local conditions and hazards likely to occur or be experienced within the City of Milwaukee.

[2]*Wisconsin Emergency Management*, State Hazard Mitigation Plan of Wisconsin, *December 2008.*

While it is acknowledged that the City can be affected by hazardous incidents that occur outside of the City jurisdiction, the degree of impact—in terms of property damage, injury, and loss of life, and ability of the City to respond—is significantly limited, and frequently unquantifiable. Thus, while some hazards, such as weather-related events, can extend over a wide area, some affect the City of Milwaukee only tangentially, and many result in site-specific impacts. Those that are site-specific in their impact may be best addressed within local level hazard mitigation plans and through local action. Nevertheless, where appropriate, areas of cooperation between jurisdictions have been noted, especially with respect to hazards, such as flooding, for example, which commonly affect entire river basins, as well as the specific communities located within them. Generally, for the purposes of this plan, hazard mitigation, as well as emergency response planning at the local and subregional levels is beyond the scope of this document.

The City of Milwaukee Hazard Mitigation Plan was developed in 2003 through 2005 and updated in 2010 and 2011 through a collective effort under the guidance of the City of Milwaukee All Hazards Mitigation Plan Steering Committee, which was created by the City specifically for plan development purposes. That committee is comprised of elected and appointed officials knowledgeable about, and directly involved in, hazard mitigation matters. The membership, formation, and active participation of the Steering Committee is documented in Appendix A of this report. In addition to formation and active participation of the Steering Committee, the plan development process included the following steps:

- Collation and review of all pertinent reports relating to the hazard mitigation activities in the City of Milwaukee;
- Inventory mapping and analysis of hazards pertinent to the City of Milwaukee;
- Identification of the facilities and ongoing programs related to hazard mitigation;
- Assessment of the vulnerability of the City assets to each hazard;
- Identification of and prioritization of needed facilities and programs;
- Consideration of issues relating to neighboring municipalities and units of government likely to be affected or influenced by natural hazards within the City of Milwaukee;
- Development and evaluation of alternatives to address the identified needs;
- The development of plan recommendations and an implementation plan;
- Development of a public informational and educational program and program of public consultation to guide the plan development and implementation program, including a prioritization of the recommended plan elements; and
- Adoption of a strategy for monitoring and refining the plan.

Additional activities conducted as a part of the updating process include:

- Collation and review of all pertinent reports relating to the hazard mitigation activities in the City of Milwaukee since adoption of the initial plan;

- Review of materials developed as a part of the comprehensive planning process for the City of Milwaukee;[3]

- Review and updating of inventories developed for the initial plan;

- Review and updating of hazard and risk assessments;

- Review of implementation activities; and

- Review and updating of plan recommendations and the initial implementation plan.

PLAN MAINTENANCE AND IMPLEMENTATION ACTIVITIES

Outreach Activities

Since the adoption of the initial City of Milwaukee hazard mitigation plan, the City has conducted outreach activities to educate the public about emergency preparedness, including hazard mitigation. As part of these activities, the City Office of Emergency Management and Homeland Security makes information on hazards, emergency preparedness, and travel conditions available to the public through its pages on the City of Milwaukee's website. These web pages provide links to preparedness information provided by the Milwaukee Health Department, the Milwaukee County Office of Emergency Management, the American Red Cross, the Wisconsin Department of Transportation, the Wisconsin Division of Emergency Management, the National Weather Service, and FEMA. The City Office of Emergency Management and Homeland Security also provides news releases related to emergency preparedness, including hazard mitigation, to local media organizations. These news releases are also available on the City's website.

The City also provides outreach through its television facility, City Channel 25, which can be accessed through Time Warner Cable, AT&T U-verse, and directly through the internet. This station broadcasts meetings of the Common Council, Council committees, City boards, and commissions as well as other informational programming on City activities and services. Much of its programming is archived at the City Clerk's Legislative Research Center, which can be accessed through the internet.

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[3]*City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Citywide Policy Plan, *March 2010; City of Milwaukee Department of City Development,* Market Study, Engineering, and Land Use Plan for the Menomonee River Valley, *October 1998; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Fond du Lac and North—A Plan for the Area, *March 2004; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near West Side—A Plan for the Area, *March 2004; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: The Third Ward—A Plan for the Neighborhood, *May 2005; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Washington Park—A Plan for the Area, *June 2006; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Northwest Side—A Plan for the Area, *January 2008; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: An Area Plan for the Southeast Side, *October 2008; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near South Side—A Plan for the Area, *May 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Northwest Side—A Plan for the Area, *July 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near North Side—A Plan for the Area, *December 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Southwest Side—A Plan for the Area, *December 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: West Side—A Plan for the Area, *December 2010; and City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Downtown—A Plan for the Area, *October 2010.*

Implementation Activities

Since the adoption of the initial hazard mitigation plan, the City of Milwaukee and other entities with implementation responsibilities have conducted several projects and activities to implement recommendations of the plan.

Implementation of Measure to Mitigate Flooding and Associated Stormwater Drainage Problems

Preservation of Environmentally Sensitive Areas and Open Space

Relative to the plans recommendations related to the preservation of environmentally sensitive areas and open space, the MMSD Greenseams program has acquired 2,254 acres of floodlands and environmentally sensitive lands, including 108 acres within in the City of Milwaukee.

Floodland Management Measures in the Kinnickinnic River Watershed

The City of Milwaukee replaced the 6th Street bridge along the Kinnickinnic River. This project was completed in 2010 at a cost of $2.8 million. Related to this, MMSD will conduct a bank stabilization project on about 1,000 feet of channel in the Kinnickinnic River between 6th Street and Chase Avenue. It is expected that this project will be completed by summer 2011.

The Milwaukee Metropolitan Sewerage District (MMSD) is currently proceeding with removal of the concrete lining from the reach of the Kinnickinnic River between S. 6th and S. 27th Streets. Stakeholder involvement and preliminary design efforts for this project began in 2007. This project involves removal of 12,000 linear feet of concrete channel; replacement of four road bridges and four pedestrian bridges; widening and lowering of the floodplain overbank; restoration of the channel; and acquisition and deconstruction of 82 residences and one commercial building that are currently within the floodplain. MMSD is currently verifying their estimate that approximately 320 structures are located within the one-percent-probability floodplain in this project reach. As of January 2011, 20 residences have been acquired by MMSD and two have been deconstructed.

Wilson Park Creek was remodeled as part of a Milwaukee County floodplain mapping project being conducted by the Milwaukee County Automated Land Information System (MCAMLIS) Steering Committee, MMSD, and SEWRPC. MMSD is pursuing improvements to Wilson Park Creek to eliminate flooding. The improvements include four culvert improvements (S. 30th Street, S. 27th Street, W. Howard Avenue, S. 5th Street), offline storage at the Central Steel and Wire facility, concrete removal from W. Euclid Ave. to S. 20th Street and from S. 6th Street to S. 2nd Street, and channel rehabilitation near the Central Steel & Wire facility.

Floodland Management Measures in the Menomonee River Watershed

In 2007, MMSD completed the Hart Park Project along the Menomonee River to reduce the risk of flooding in the Cities of Milwaukee and Wauwatosa. As part of this project, 80 formerly floodprone residences and business in the area east of the Hart Park stadium were acquired, demolished, and removed; the area of the park was expanded from 20 acres to 50 acres; a system of earthen levees, concrete floodwalls, and road grade raises was installed to contain the one-percent-annual-probability flood; the overbank north of the channel was excavated to provide floodwater storage and conveyance; and a gravity flow interior drainage system was constructed to convey stormwater from the “protected” side of the levee/floodwall system to the River.

In 2010, the MMSD essentially completed the Milwaukee County Grounds detention basin project in the City of Wauwatosa. This basin will store potential floodwaters from Underwood Creek and slowly release them to the Menomonee River. It will provide flood relief benefits downstream in the Cities of Milwaukee and Wauwatosa. It is expected that the basin will become operational in 2011.

Floodland Management Measures in the Milwaukee River Watershed

Flood control planning by MMSD for the mainstem of the Milwaukee River is ongoing.

Floodland Management Measures in the Oak Creek Watershed

As of February 2011, SEWRPC was assisting the MMSD in a revision of its watercourse system plan for the Oak Creek Watershed. This study includes the North Branch of Oak Creek in the City of Milwaukee.

Secondary Plan Element
As part of its Map Modernization program, FEMA incorporated the City of Milwaukee Flood Insurance Study (FIS) information into a countywide FIS that became effective on September 26, 2008.

Private Property Inflow and Infiltration Reduction Program
In 2010 and 2011, the MMSD drafted a policy to reduce I/I In an effort to further reduce sanitary sewer backups into basements and sanitary sewer overflows both caused primarily by infiltration and inflow (I/I) into the sanitary sewer system. Infiltration is stormwater and groundwater that may enter the sanitary sewer system through such sources as defective pipes, pipe joints, connections or leaking manholes. Clearwater inflow to the sanitary sewer is stormwater from foundation drains, connected downspouts, catch basins, and leaking manhole covers. With the assistance of the Technical Advisory Team comprised of public works, engineering, and/or administrative staff from the MMSD's 28 member communities, a program was developed to fund projects to reduce I/I from the privately owned components of sanitary sewerage systems. As of April 2011, it was proposed that the program provide $151 million over a period of ten years for design, inspection and activities to remove I/I from private sources. Funding of the program is based on the equalized value of the municipality. Each member community, including the City of Milwaukee, would control how the funds are used (within the eligible cost guidelines) and municipal staff could be responsible for managing the work. The program would fund activities such as foundation drain disconnection; sewer lateral repair or replacement; and design, planning, and investigation costs.

This program will assist the City in addressing the existing deficiencies in the private portion of the sewerage system. The City's sewerage system would benefit from this program by reducing flows within the system. City residents would benefit from the improvement of their laterals and increased protection from basement backups. The City is responsible for maintaining or reducing its flows to the MMSD. This will assist the flow reduction effort by becoming part of the City's long-term maintenance program.

Implementation of Measures Related to Other Hazards
In 2007, the Milwaukee Fire Department began a carbon monoxide (CO) metering program to enable firefighters to evaluated concentrations of CO within buildings during fire calls. In November 2007, the Department equipped all of its truck companies with single-gas CO meters. With financial assistance from five local businesses, the Department was able to equip its engine companies with these meters in March 2008. This has given the Department's firefighters and paramedics the capability to detect CO gas within 15 to 30 seconds of arriving on a scene and should reduce injuries and fatalities related to CO gas poisoning.

The Milwaukee Fire Department conducts a number of public residential, school, and workplace fire safety, extinguisher, and evacuation programs. In 2009, the Milwaukee Fire Department educated almost 312,000 people on fire safety through these programs. In addition, as part of its Firefighters Out Creating Urban Safety (F.O.C.U.S.) program, the Department has installed over 4,000 smoke detectors in residences since adoption of the initial hazard mitigation plan. The Department has installed over 20,000 smoke detectors since the inception of F.O.C.U.S. in 1991.

PLAN DEVELOPMENT REVIEW PROCESS AND ADOPTION

As previously noted, the initial City of Milwaukee all hazards mitigation plan was prepared under the guidance of a City advisory Steering Committee comprised of local official representatives, including representatives, such as police departments, fire departments, and the MMSD. The Steering Committee met four times during the plan preparation period to provide input on the types of hazards to be considered, and the appropriate mitigation strategies, and to review the draft report chapters with the report chapter then being refined to reflect the comments and recommendations of the Steering Committee (see Appendix A).

Members of this Steering Committee included representatives from agencies that serve both the City and the County, including Milwaukee County Emergency Management staff, and in the case of MMSD staff, serving a jurisdiction that extends beyond the County boundary. In effect, the City of Milwaukee Hazard Mitigation Plan is an extension of the aforementioned Milwaukee County Pre-Disaster Mitigation Plan which developed resources

and information to assist Milwaukee County residents, organizations, local government, and others in the promotion of sound public policy designed to protect citizens, critical facilities, infrastructure, private property, and the environment from natural hazards. The County Plan offered the opportunity for members of neighboring communities within and adjacent to the City of Milwaukee, to provide input into hazard mitigation planning within the context of the County as a whole. The City of Milwaukee Hazard Mitigation Plan and review process continued this involvement of persons and organizations representing jurisdictions and interests that extended beyond the City boundary, including County staff and MMSD staff on the Steering Committee.

Following completion of the City plan in draft form, a public informational meeting was held in conjunction with a City Committee meeting to provide the opportunity to review and provide input on the plan as part of the planning process. The plan was introduced to the Public Safety Committee on March 16, 2005, for Committee review. On April 21, 2005, the plan was formally presented to the City of Milwaukee at the Public Safety Committee meeting, which was broadcast live on television (City Channel 25), and online at *www.milwaukee.gov/channel 25*. Copies of the report were also provided to City officials for adoption of the plan and advising them of the need for such action in order to retain future eligibility for mitigation funding for the Hazard Mitigation Grant, the Pre-Disaster Mitigation Program, and other FEMA or related programs administered by the Wisconsin Department of Military Affairs, Division of Emergency Management. In addition, the plan was provided to all neighboring communities in order to continue the coordination of hazard mitigation activities as provided by the use of the Milwaukee County plan as a framework for the City plan. The City of Milwaukee Common Council formally adopted the plan at its May 3, 2005, meeting.

This hazard mitigation plan update was also prepared under the guidance of a City advisory Steering Committee comprised of local official representatives, including representatives of City Departments, such as the police, fire, community development, and public works departments; County departments and agencies, including the County emergency management office and transit system; the MMSD; interested nongovernmental organizations; and the health care community. The Steering Committee met three times during the plan preparation period to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review the draft report chapters. Those chapters were then refined to reflect the comments and recommendations of the Steering Committee (see Appendix A).

As draft chapters of the plan report were completed, copies were placed in downloadable form on the SEWRPC website and a webpage was provided on the SEWRPC website on which members of the public could ask questions and submit comments on the draft plan update.

Following completion of the updated City plan in draft form, a public informational meeting was held in conjunction with a City Committee meeting to provide the opportunity to review and provide input on the updated plan as part of the planning process. The plan was introduced to the Public Safety Committee on _____ __, ____ for Committee review. On _____ __, ____, the plan was formally presented to the City of Milwaukee at the Public Safety Committee meeting, which was broadcast live on television (City Channel 25), and online at *www.milwaukee.gov/channel 25*. Copies of the report were also provided to City officials for adoption of the updated plan and advising them of the need for such action in order to retain future eligibility for mitigation funding for the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, and other FEMA or related programs administered by the Wisconsin Department of Military Affairs, Division of Emergency Management. In addition, the updated plan was provided to all neighboring communities in order to continue the coordination of hazard mitigation activities as provided by the use of the Milwaukee County plan as a framework for the City plan. The City of Milwaukee Common Council formally adopted the plan at its _____ __, ____ meeting.

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Chapter II

BASIC STUDY AREA INVENTORY

INTRODUCTION

Information on certain pertinent natural and built features and aspects of the study area is an important consideration in sound hazard mitigation planning. Accordingly, the collection and collation of definitive information regarding basic demographic characteristics, existing and planned land use, surface water and Lake Michigan shoreline system characteristics, utility systems, critical community facilities, and existing hazard management programs constitute an important step in the planning process, since sound alternative plans cannot be formulated and evaluated without an in-depth knowledge of the relevant conditions in the study area.

CIVIL DIVISIONS

The geographic extent and functional responsibilities of civil divisions and special-purpose units of government are important factors to be considered in hazard mitigation planning, since these local units of government provide the basic structure of the decision-making framework, within which hazard issues must be addressed. The boundaries of the City of Milwaukee and its surrounding municipalities are shown on Map 2. This includes eighteen municipalities within Milwaukee County, including Bayside, Brown Deer, Cudahy, Franklin, Fox Point, Glendale, Greendale, Greenfield, Hales Corners, Oak Creek, River Hills, Shorewood, South Milwaukee, St. Francis, Wauwatosa, West Allis, West Milwaukee, and Whitefish Bay. In addition, Map 2 shows several neighboring municipalities in Ozaukee, Washington, and Waukesha Counties.

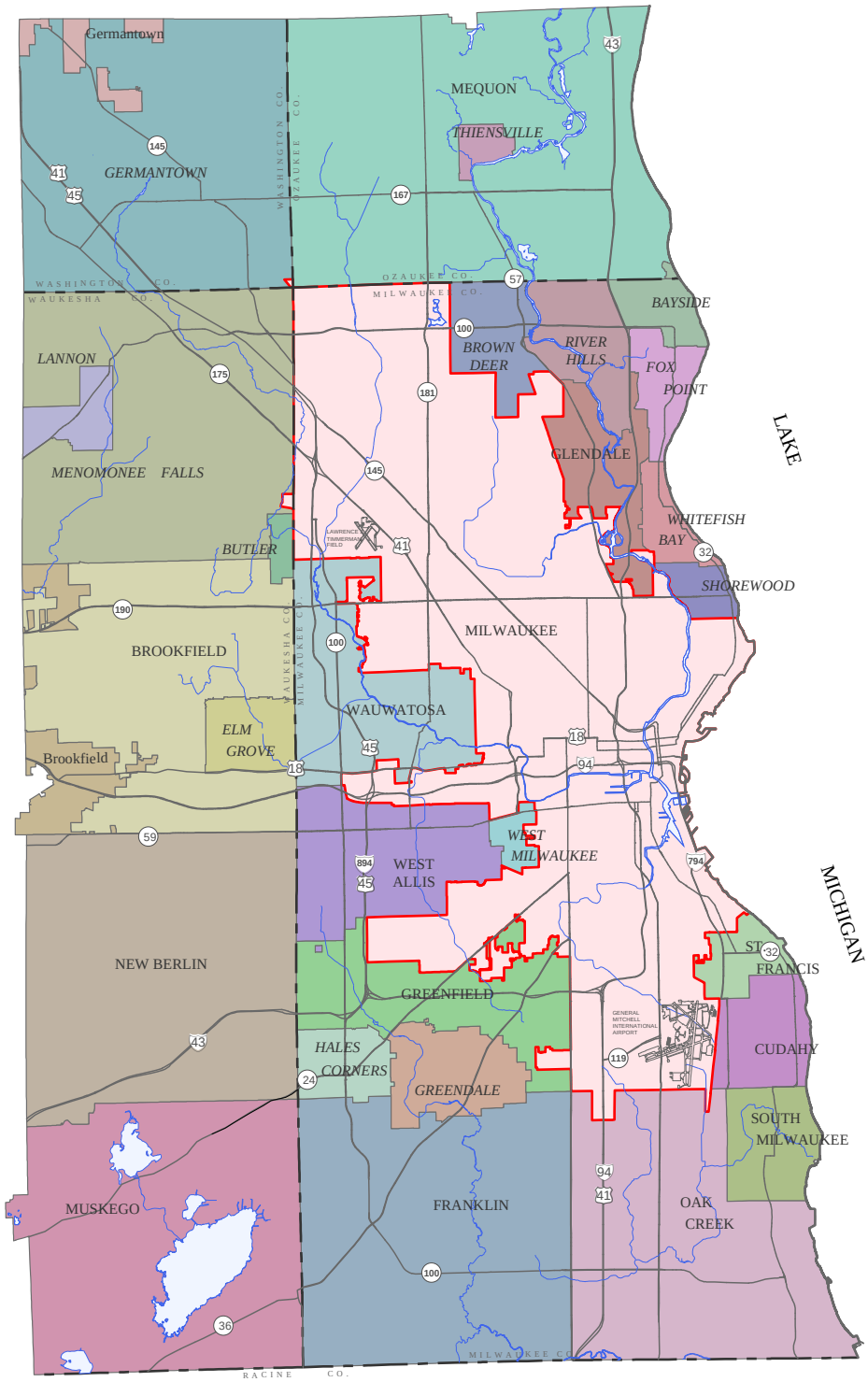
DEMOGRAPHIC AND ECONOMIC CHARACTERISTICS

Population

The area that is now the City of Milwaukee was first included in the Federal census in 1850. Historical population levels in the City of Milwaukee are provided in Table 1. Population growth in the City of Milwaukee from 1850 to 2010 is graphically summarized in Figure 1. In 1850, the City of Milwaukee had a resident population of about 20,000. The City's population rose from 1850 through 1880, and then began to increase at a greater rate until 1930, when population growth rate slowed. The population growth continued to climb until 1960 when it reached a peak of just over 740,000. From that time, it has slowly declined. The City of Milwaukee is the most populous community in Milwaukee County, with 594,833 residents, or about 63 percent of the County's population, in 2010. The population distribution by census block in the year 2010 ranges up to more than 2,300 persons per census block, while most of the City of Milwaukee is dominated by densities of 50 to 300 persons, as shown on Map 3.

Map 2

CIVIL DIVISION BOUNDARIES FOR THE CITY OF MILWAUKEE AND ENVIRONS



Source: SEWRPC.

Table 1

HISTORICAL RESIDENT POPULATION LEVELS IN THE CITY OF MILWAUKEE: 1850-2000

Year	Population	Change from Preceding Census	
		Absolute	Percent
1850	20,061	- -	- -
1860	45,246	25,185	55.66
1870	71,440	26,194	36.67
1880	115,587	44,147	38.19
1890	204,468	88,881	43.47
1900	285,315	80,847	28.34
1910	373,857	88,542	23.68
1920	457,147	83,290	18.22
1930	578,249	121,102	20.94
1940	587,472	9,223	1.57
1950	637,392	49,920	7.83
1960	741,324	103,932	14.02
1970	717,099	-24,225	-3.38
1980	636,212	-80,887	-12.71
1990	628,088	-8,124	-1.29
2000	536,974	-31,114	-5.21
2010	594,833	-1,141	-0.36

Source: U.S. Bureau of the Census and SEWRPC.

Households

Trends in the number of households in the City of Milwaukee are shown in Table 2. The City experienced an increase in the number of new households between 1970 and 1980, with a slight decline from 1980 through 2010. For most of that period, the rate of decrease in the number of households has been less than the rate of population decrease. Between 1980 and 2000, the number of households decreased by 4.0 percent, compared to a population decrease of 6.2 percent. Between 2000 and 2010, the number of households in the City decreased by about 0.8 percent, which represents a slightly faster rate of decrease than the 0.4 percent decrease in the population. The differences between these rates suggest that the number of persons per household decreased between 1980 and 2000 and increased slightly between 2000 and 2010.

Employment

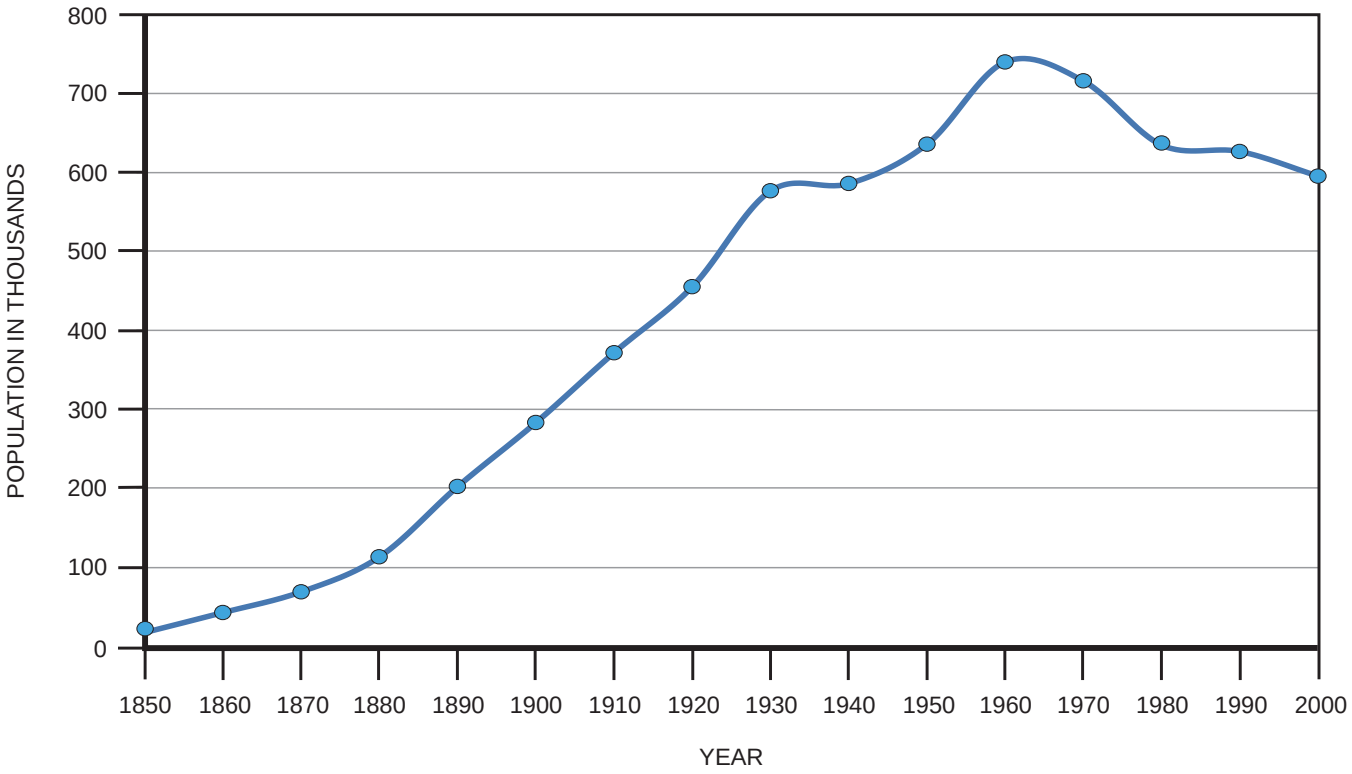
Trends in job growth in Milwaukee County are set forth in Table 3. The data in the table are presented through the year 2000, which is the most recent year for which data are available. The jobs are enumerated at their location and the data thus reflect the number of jobs within the County, including both full- and part-time jobs. It should be noted, however, according to the 2000 census, approximately 42,600 employed Milwaukee County residents worked outside the County, and 1,420 worked outside of the State. As indicated in Table 3, between 1970 and 2000, employment growth was significant in the County, with a 16 percent increase in the number of jobs, from 524,900 to 624,600.

Property Value

The value of the real estate and personal property in a community reflects the upper end of the potential for property damages in each community. The equalized value of personal property in the City of Milwaukee is estimated to be $28,508,575,200 for 2010, for residential, commercial, and manufacturing as shown in Table 4.

Figure 1

HISTORIC POPULATION LEVELS IN THE CITY OF MILWAUKEE: 1850-2000



Source: U.S. Bureau of the Census and SEWRPC.

LAND USE

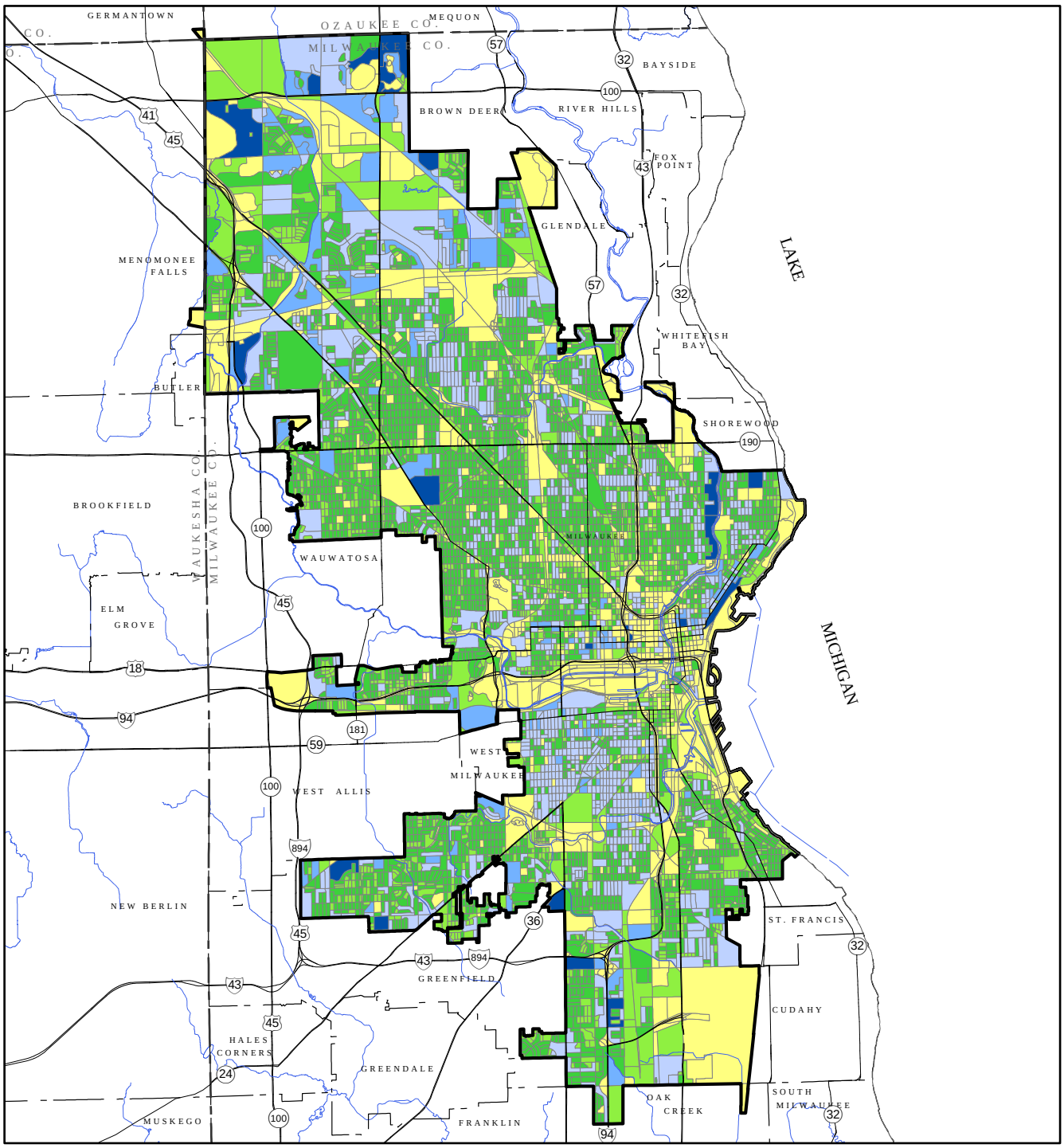
Land use is an important determinant of the potential impact a particular hazard may have, and of potential strategies which may be taken to mitigate the hazard impacts. Accordingly, an understanding of the amount, type, and spatial distribution of urban and rural land uses within the City should be considered in the development of a sound hazard mitigation plan. This section presents a description of the land uses in the City of Milwaukee. SEWRPC staff is currently updating the land use inventories in the Region to reflect 2010 land uses. This process will not be finished in time for 2010 data to be included in this plan update. Updated 2010 land use will be available for the next update of the plan.

Land uses in the City of Milwaukee in 2000 are set forth on Map 4 and in Table 5. Urban land uses occupied about 84 square miles, or about 87 percent of the City in 2000. Intensive urban development, including commercial, industrial, and multi-family residential development, is located throughout the City, notably along the IH 94, and IH 43 corridors. Much of the single-family residential development surrounds the urban centers. Residential development is the largest single component of urban land uses, encompassing about 33 square miles, or about 34 percent of urban land use.

Land uses categorized as transportation, communication, and utilities constituted the second largest urban land use category in 2000, encompassing about 27 square miles, or about 28 percent of the City. Major arterial highways serving the County include IH 43, USH 41 and USH 45, which traverse the County in a north-south

Map 3

POPULATION DISTRIBUTION BY CENSUS BLOCK FOR THE CITY OF MILWAUKEE: 2010



NUMBER OF PEOPLE IN EACH CENSUS BLOCK

	0		131-300
	1-50		301-750
	51-130		GREATER THAN 750

N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: U.S. Bureau of the Census and SEWRPC.

Table 2

NUMBER OF HOUSEHOLDS IN THE CITY OF MILWAUKEE: 1970-2000

Year	Number of Households in the City of Milwaukee	Change from Preceding Census	
		Number	Percent
1970	236,981	- -	- -
1980	241,818	4,837	2.0
1990	240,540	-1,278	-0.5
2000	232,188	-8,352	-3.6
2010	230,221	-1,967	-0.8

Source: U.S. Bureau of the Census and SEWRPC.

Table 3

NUMBER OF JOBS IN MILWAUKEE COUNTY: 1970-2000

Year	Number of Jobs in Milwaukee County	Change from Preceding Census	
		Number	Percent
1970	524,900	- -	- -
1980	581,700	56,800	9.8
1990	613,300	31,600	5.2
2000	624,600	11,300	1.8

Source: U.S. Bureau of Economic Analysis and SEWRPC.

Table 4

EQUALIZED VALUE OF REAL ESTATE PROPERTY IN THE CITY OF MILWAUKEE: 2010

	Equalized Value 2010		
City of Milwaukee	Land	Improvements	Totals
Residential	$2,321,265,700	$15,497,915,500	$17,819,181,200
Commercial	1,527,368,200	8,413,548,400	9,940,916,600
Manufacturing	157,539,300	590,938,100	748,477,400
Total	$4,006,173,200	$24,502,402,000	$28,508,575,200

Source: State of Wisconsin Department of Revenue.

direction; IH 894 which provides a bypass, and IH 94, IH 794, and STH 18, which traverse the City in a generally east-west direction. Other uses in the transportation, communications, and utilities category within the City include four major railway freight service lines and two airports that serve the public.

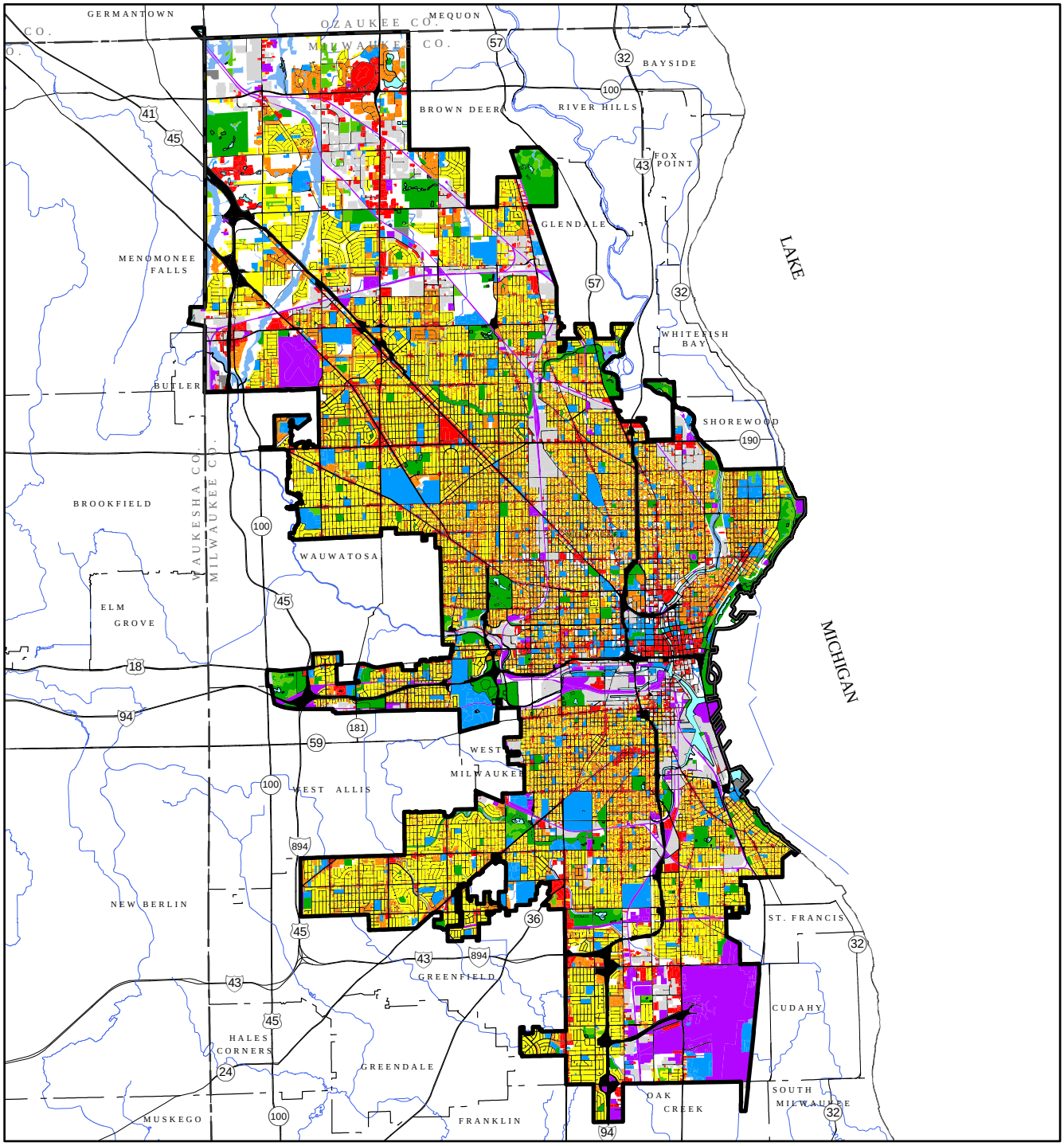
SURFACE WATER RESOURCES AND FLOOD HAZARD AREAS

Surface water resources, consisting of streams and lakes, form a particularly important element of the natural resource base. Surface water resources provide recreational opportunities, influence the physical development of the City, and enhance its aesthetic quality. Major streams are defined as those which maintain, at a minimum, a small continuous flow throughout the year except under unusual drought conditions. Within the City of Milwaukee, these include all, or portions, of the Kinnickinnic River, Root River, Menomonee River, Oak Creek, and Milwaukee River and their major tributaries. A sixth watershed encompasses those areas adjacent to Lake Michigan which drain directly into Lake Michigan through intermittent streams. Aside from Lake Michigan, no other major lakes (those over 50 acres) exist in the City of Milwaukee. Map 5 illustrates the watershed boundaries of the six major streams systems that lie partly within the City of Milwaukee.

The City of Milwaukee lies entirely east of a major subcontinental divide that roughly bisects the Southeastern Wisconsin Region. The entire City is therefore tributary to the Great Lakes-St. Lawrence River drainage system. Except for those portions of the City that are located either 1) within the portion of the Lake Michigan direct

Map 4

EXISTING LAND USE IN THE CITY OF MILWAUKEE: 2000



- SINGLE-FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- EXTRACTIVE AND LANDFILL
- TRANSPORTATION, COMMUNICATION, AND UTILITIES (OTHER THAN ROADS AND HIGHWAYS)
- ROADS AND HIGHWAYS
- GOVERNMENT AND INSTITUTIONAL
- RECREATIONAL
- AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS
- WOODLANDS
- WETLANDS
- SURFACE WATER

N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: SEWRPC.

Table 5

LAND USE IN THE CITY OF MILWAUKEE: 2000

Land Use Category	Square Miles	Percent of Subtotal	Percent of City	Total Acres
Urban				
Residential	32.9	39.1	34.0	21,022
Commercial	5.5	6.5	5.7	3,506
Industrial	6.4	7.6	6.6	4,106
Transportation, Communication, and Utilities	27.1	32.2	28.0	17,359
Governmental and Institutional	6.8	8.1	7.1	4,370
Recreational	5.4	6.4	5.6	3,467
Subtotal	84.1	100.0	87.0	53,830
Nonurban				
Agricultural	0.8	6.3	0.8	483
Woodlands	1.0	7.9	1.0	648
Wetlands	1.4	11.1	1.4	865
Water	0.9	7.1	1.0	591
Other (includes landfill, extractive, and unused lands)	8.5	67.5	8.8	5,455
Subtotal	12.6	100.0	13.0	8,042
Total	96.68	- -	100.0	61,872

Source: SEWRPC.

drainage area or 2) within the Oak Creek and Root River watersheds, all stormwater runoff within the City ultimately enters Lake Michigan at the mouth of the Milwaukee River. Within the Oak Creek and Root River watersheds, runoff from the City proceeds out of the City in southern and southeastern directions.

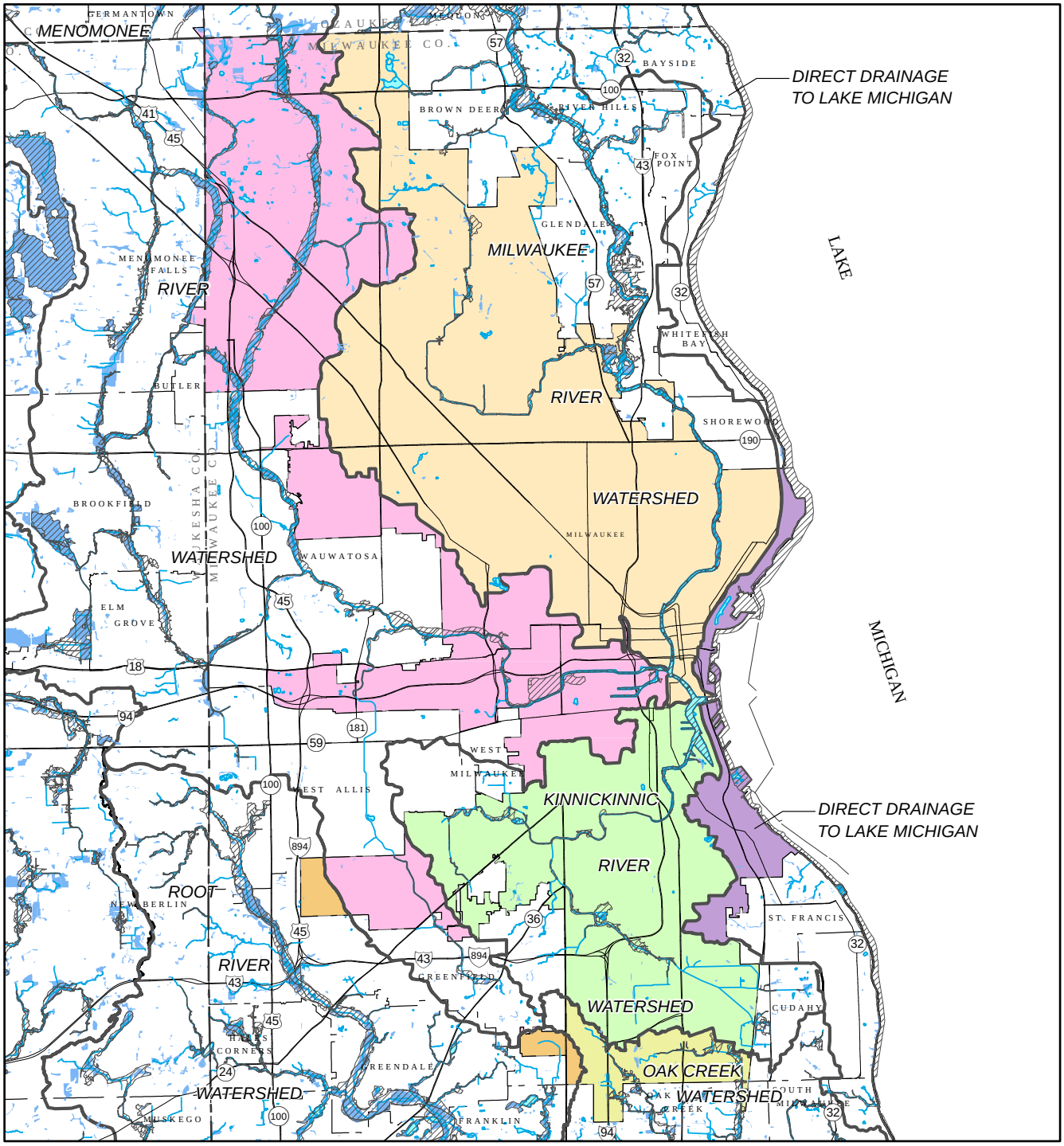
Floodlands are the wide, gently sloping areas contiguous to, and usually lying on both sides of, a stream channel. For planning and regulatory purposes, floodlands are normally defined as the areas, excluding the stream channel, subject to inundation by the one-percent-annual-probability (100-year recurrence interval) flood event. There is a 1 percent chance of this event being reached or exceeded in severity in any given year. Floodland areas are generally not well suited to urban development, not only because of the flood hazard, but also because of the presence of high water tables and, generally, of soils poorly suited to urban uses. Floodland areas often contain important natural resources, such as high-value woodlands, wetlands, and wildlife habitat and, therefore, constitute prime locations for parks and open space areas.

Floodlands identified by the City of Milwaukee, the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and the Federal Emergency Management Agency (FEMA) are shown on Map 5. During 2003 and 2004, the flood hazard areas for Lincoln Creek, the Milwaukee River, and portions of the Menomonee River within the City of Milwaukee were updated under a floodland map updating program being conducted cooperatively by the Milwaukee County Automated Mapping and Land Information System (MCAMLIS) Steering Committee, the Milwaukee Metropolitan Sewerage District (MMSD), and SEWRPC. This updated mapping and the supporting analyses are reflected in a FEMA Digital Flood Insurance Rate Map (DFIRM) dated September 26, 2008. The updated mapping is also being considered in project planning involving lands in the vicinity of the floodplain of these watercourses.

Excluding surface water in lakes and existing stream channels, approximately three square miles, or about 3 percent of the total area of the City, are located within the 1 percent-annual-probability floodplain. A consideration in flood hazard mitigation is the potential for increased flooding due to dam failures. Since there are several major and minor dams in the City of Milwaukee, future evaluation of floodplain areas related to dam failure should also be considered.

Map 5

SURFACE WATERS, WETLANDS, AND FLOODPLAINS IN THE CITY OF MILWAUKEE AND ENVIRONS


MENOMONEE
RIVER
WATERSHED
MILWAUKEE
RIVER
WATERSHED
KINNICKINNIC
RIVER
WATERSHED
ROOT
RIVER
WATERSHED
OAK CREEK
WATERSHED
DIRECT DRAINAGE
TO LAKE MICHIGAN
DIRECT DRAINAGE
TO LAKE MICHIGAN
LAKE
MICHIGAN
GERMANTOWN
MILWAUKEE CO.
MENOMONEE FALLS
BUTLER
BROOKFIELD
WAUWATOSA
ELM GROVE
WEST ALLIS
WEST MILWAUKEE
NEW BERLIN
GREENFIELD
HALES CORNERS
GREENDALE
FRANKLIN
MILWAUKEE CO.
WAUKESHA CO.
MILWAUKEE
BAYSIDE
BROWN DEER
RIVER HILLS
FOX POINT
GLENDALE
WHITEFISH BAY
SHOREWOOD
ST. FRANCIS
CUDAHY
OAK CREEK
SOUTH MILWAUKEE
MILWAUKEE
MILWAUKEE

All of the floodplain areas have been mapped on large-scale topographic maps compiled at a scale of one inch equals 200 feet, with a contour interval of two feet. The floodplain map is available as a digital file layer on the MCAMLIS cadastral mapping system which covers the entire City and the rest of Milwaukee County.

LAKE MICHIGAN SHORELINE EROSION HAZARD AREAS

Shoreline erosion and bluff stability conditions are important considerations in planning for the protection and sound development and redevelopment of lands located along the Lake Michigan shoreline. Shoreline erosion and bluff stability conditions in southeastern Wisconsin were surveyed in 1977[1] and 1997,[2] and in the City of Milwaukee in 1978[3] and 1982.[4] In addition, bluff stability conditions were surveyed in Lake Park in 2002.[5] Such conditions can change over time since they are related, in part, to changes in climate, water levels, the geometry of the onshore beach and nearshore areas, the extent and condition of shore protection measures, the type and extent of vegetation, and the type of land uses in shoreland areas, among other related factors. As of December 2010, water levels in Lake Michigan were about 19 inches below the long-term month of December average.[6] While these water levels have the effect of reducing the shoreline erosion due to scour at the base, there are other situations where the shoreline can be negatively affected by low levels. In addition, the cyclic nature of the Great Lakes water levels indicates that a return to higher lake levels may occur in the future.

The 1997 Lake Michigan coastal erosion and bluff stability study in southeastern Wisconsin included evaluations of lands along the Lake Michigan shoreline in Kenosha, Racine, Milwaukee, and Ozaukee Counties that directly affect, or are directly affected by shoreline erosion, bluff recession, and storm damage processes. This relatively narrow strip of land along the Lake Michigan shoreline extends approximately 89 miles from the Wisconsin-Illinois state line to the Ozaukee-Sheboygan county line, including about seven miles in the City of Milwaukee. For analytical purposes, the Lake Michigan shoreline was divided into 17 reaches, including three reaches within, or partially within, the City of Milwaukee, as shown on Map 6. These reaches were selected so as to have relatively uniform beach and bluff characteristics. These reaches generally correspond to those utilized in the aforereferenced 1977 shoreline erosion study, with some refinement to reflect current conditions.

During 1995, field surveys were conducted to measure the geometry of the bluff slope at 192 sites in southeastern Wisconsin, including several sites within, or adjacent to, the City of Milwaukee. These measurements provided a basis for site-specific assessments of the bluff conditions at the selected locations. In addition, beach and nearshore lakebed conditions were measured for selected sites in Milwaukee.

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[1] *D.M. Mickelson, L. Acomb, N. Brouwer, T.B. Edil, C. Fricke, B. Haas, D. Hadley, C. Hess, R. Klauk, N. Lasca, and A.F. Schneider, Shore Erosion Study, Technical Report,* Shoreline Erosion and Bluff Stability Along Lake Michigan and Lake Superior Shorelines of Wisconsin, *Wisconsin Coastal Management Program, February 1977.*

[2] *SEWRPC Technical Report No. 36,* Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin: 1995, *December 1997.*

[3] *J.P. Keillor and R. DeGroot,* Recent Recession of Lake Michigan Shorelines in the City of Milwaukee, Wisconsin, *University of Wisconsin Sea Grant Program, 1978.*

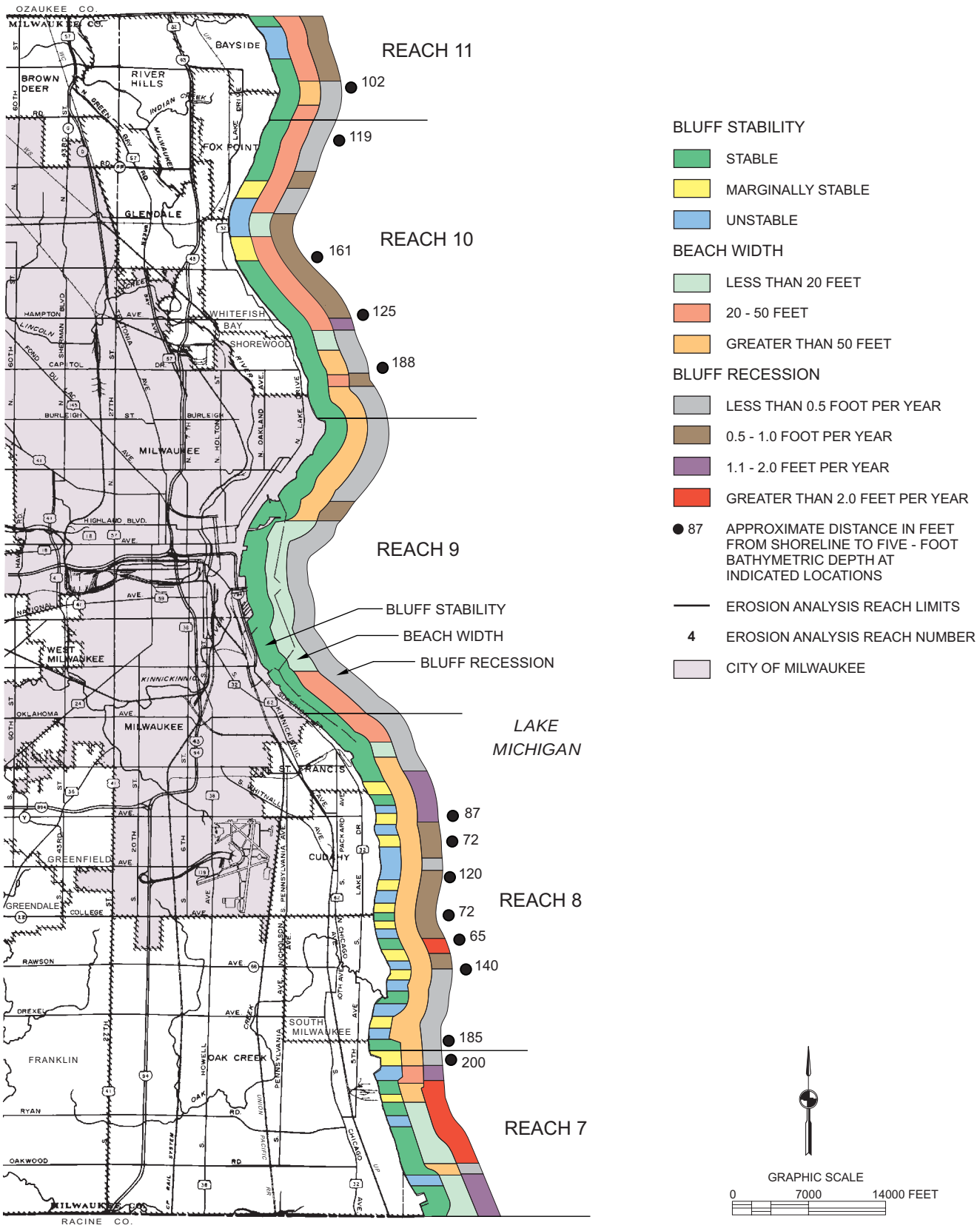
[4] *SEWRPC Community Assistance Planning Report No. 163,* A Lake Michigan Coastal Erosion Management Study for the City of Milwaukee, Wisconsin, *October 1989.*

[5] *SEWRPC Memorandum Report No. 156,* Lake Park Bluff Stability and Plant Community Assessment: 2003, Milwaukee County, Wisconsin, *September 2004.*

[6] *U.S. Army Corps of Engineers,* Monthly Bulletin of Lake Levels for the Great Lakes, *January 2011.*

Map 6

SUMMARY OF LAKE MICHIGAN SHORELINE EROSION AND BLUFF STABILITY ANALYSES IN MILWAUKEE COUNTY: 1995



Source: T.B. Edil, D.M. Mickelson, J.A. Chapman, and SEWRPC.

Based upon the data collected and the assessment and analysis of that data, bluff stability and shoreline erosion conditions were developed and are summarized graphically on Map 6. Within the City of Milwaukee, the bluffs were generally found to be stable based upon conditions during the 1995 survey.

In 2002, bluff stability conditions were assessed within Lake Park in the City of Milwaukee.[7] While the bluff stability analysis conducted as part of this study found that most bluffs in the Park were stable, it concluded that bluffs in the southern portion of the Park were marginally stable and less stable than bluffs in the other portions of the Park. In addition, this study found evidence of active recession of the bluffs in the southern portion of the Park, including evidence of top recession.

The current Lake Michigan shoreline conditions indicate relatively stable conditions for the most part in areas where shoreline development exists within the City of Milwaukee. However, there is the potential for shoreline and bluff erosion to impact structures over time. In addition, during severe climatic conditions, such as high water levels or saturated ground conditions, large episodic bluff erosion events could occur. Accordingly, these conditions are an important consideration in the City hazard mitigation planning and are also an important element in the County Pre-Disaster Mitigation Plan.[8]

TRANSPORTATION SYSTEM

The transportation system provides the basis for movement of goods and people into, out of, through, and within the City of Milwaukee. An efficient transportation system is essential to the sound social and economic development of the City, the County, and the metropolitan area. An understanding of the existing transportation system is also a factor to be considered in the preparation of a hazard mitigation plan for the City. Accordingly, this section presents a brief description of existing transportation facilities in the City of Milwaukee. Included are descriptions of the existing arterial street and highway system, public transit facilities, railway facilities, and airport facilities.

Arterial Streets and Highways

The arterial street and highway system serving the City of Milwaukee is relatively densely spaced, with major arterials occurring at about one mile intervals in both the north-south and east-west directions.

Public Transit Facilities

Milwaukee County Transit System

Milwaukee County provides a local fixed-route bus service, the Milwaukee County Transit System (MCTS). The system includes many routes throughout the City and County, with several routes to destinations in neighboring Waukesha County, and express freeway service to Ozaukee County. MCTS, in association with American Logistics Taxi, American United Taxicab Services, First Transit, and Transit Express, also provides paratransit services, which are designed to provide door-to-door transportation for disabled individuals who are unable to use the City's fixed-route bus service.[9]

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[7] *SEWRPC Memorandum Report No. 156,* op. cit.

[8] *Milwaukee County Emergency Management,* Milwaukee County, Wisconsin, Pre-Disaster Mitigation Plan, *June 2010 (draft).*

[9] *The contractors providing paratransit service change regularly based on annual awarding of contracts.*

Regional Bus Service
Commuter bus service between downtown Milwaukee and outlying counties is provided by MCTS, as well as other public and private agencies. MCTS manages Ozaukee County Transit and the Express line. The Waukesha Metro Transit system connects with MCTS at certain locations in Waukesha County. Wisconsin Coach Lines and Badger Bus Lines provide commuter transit service between certain destinations in southeastern Wisconsin and Milwaukee.

Railway Facilities
Currently, railway freight service is provided within the City of Milwaukee by four major railway companies operating active mainline railway lines. As shown on Map 7, the Union Pacific Railroad maintains the greatest length of track with a network that traverses the City in both north-south and east-west directions. The Canadian Pacific Rail System, formerly known as the Soo Line, provides freight service over a line emanating from Chicago, which traverses the City from the south to the north, and with an east-west line that emanates from the central City to the west. The Canadian National Railway (formerly the Wisconsin Central, Ltd.) and the Wisconsin and Southern Railroad both have lines that originate in northern portions of the City, in a northwest-southeast direction. The Canadian National Railway also provides freight service over a north-south line, originating in a northern section of the City. Several short spur lines serve joint uses or private facilities within the City. An intercity passenger rail service operated by Amtrak utilizes the Canadian Pacific Railway line. This service, which operates between Milwaukee and Chicago, has a stop in the Village of Sturtevant, Racine County, and near General Mitchell International Airport.

Airports
The City of Milwaukee has two airports which serve the public—General Mitchell International Airport and Lawrence J. Timmerman Field. Both are owned and operated by Milwaukee County. General Mitchell International Airport is a medium-hub airport, and is the largest in Wisconsin. The airport hosts 10 airlines, and approximately 450 departures and arrivals occur each day. Currently, about 56 cities are served nonstop or direct from Mitchell International. Located on Milwaukee's northwest side, Timmerman Field serves private and corporate aviation. Public and private airports and airfields in the area are shown on Map 8. In addition to these, there are several heliports and helipads in and adjacent to the City of Milwaukee. Heliports that are located at hospitals are denoted on the map.

Port of Milwaukee
The Port of Milwaukee is the largest port in the State of Wisconsin. Milwaukee began as a Great Lakes port in the year 1835,[10] and the Port has been an integral part of the City throughout its development. It is managed by a Board of Harbor Commissioners, and serves as a regional transportation and distribution center. Its primary market includes Wisconsin, northern and western Illinois (including the City of Chicago) and eastern Minnesota, including the "Twin Cities" of Minneapolis/St. Paul. The Port is also capable of cost-effectively reaching Iowa, the Dakotas, Nebraska, Missouri and Indiana; and the western Canadian Provinces of Alberta, Saskatchewan, and Manitoba. The Port also houses a passenger ferry service that travels between the Port of Milwaukee and Muskegon, Michigan, daily during the spring, summer, and fall.

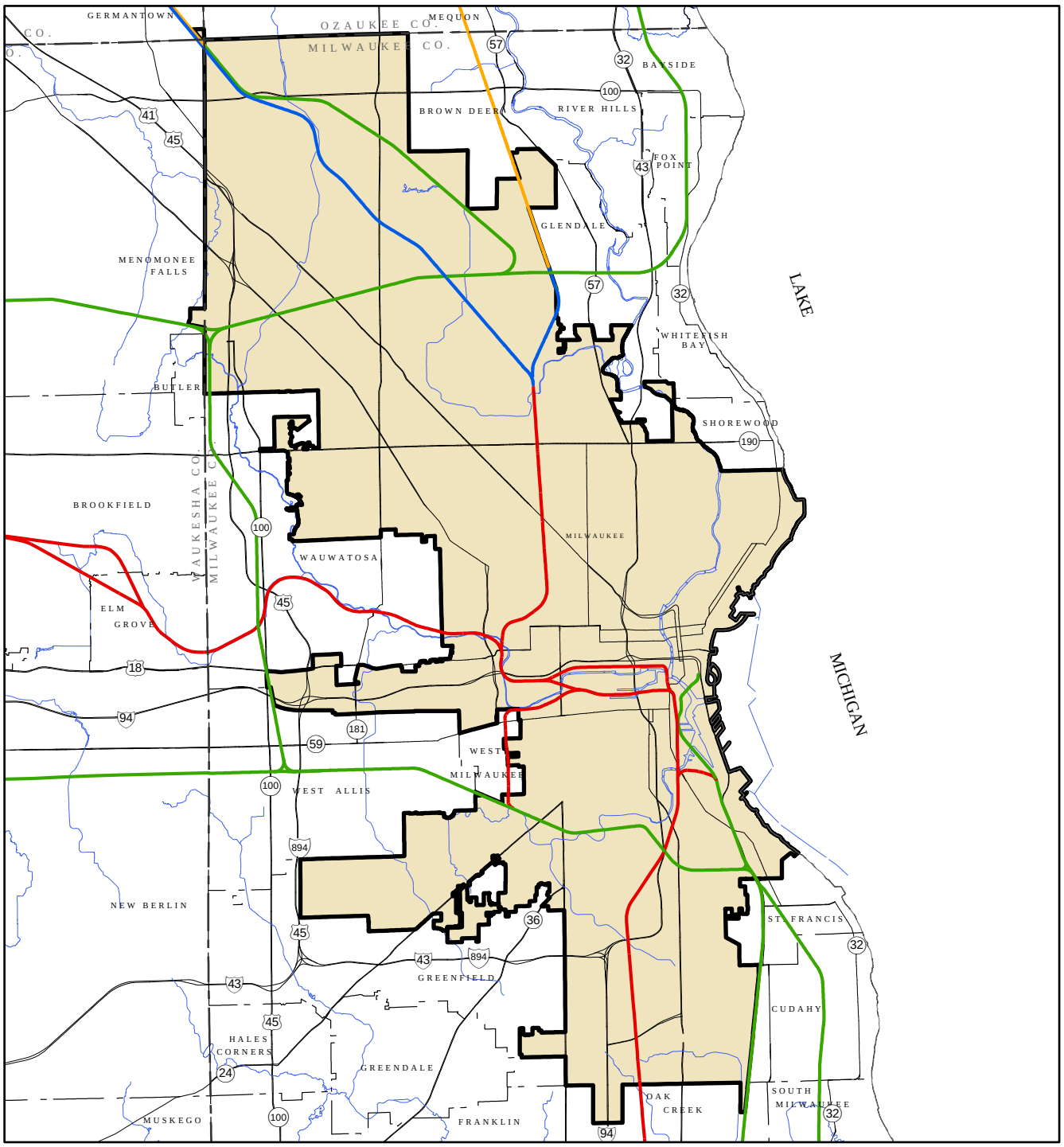
The Port maintains a heavy lift dock and facilities, which allow it to handle a diverse mix of general cargoes, including steel, forest products, bagged materials, heavy machinery, farm and construction machinery, dry and liquid bulk, among others. The Port handles an average annual tonnage of approximately 3.64 million short tons.[11] The Port offers a variety of distributive services, including but not limited to, warehousing, sorting, recouping,

[10]*The Port of Milwaukee, 2323 S. Lincoln Memorial Drive, Milwaukee, WI 53207,* http://www.port.mil.wi.us, http://www.port.mil.wi.us/directory.htm#RAILROADS, *2004.*

[11]*Wisconsin Department of Transportation,* Economic Impact of Wisconsin's Commercial Ports, *December 2010.*

Map 7

COMMON CARRIER FREIGHT LINES IN THE CITY OF MILWAUKEE: 2009

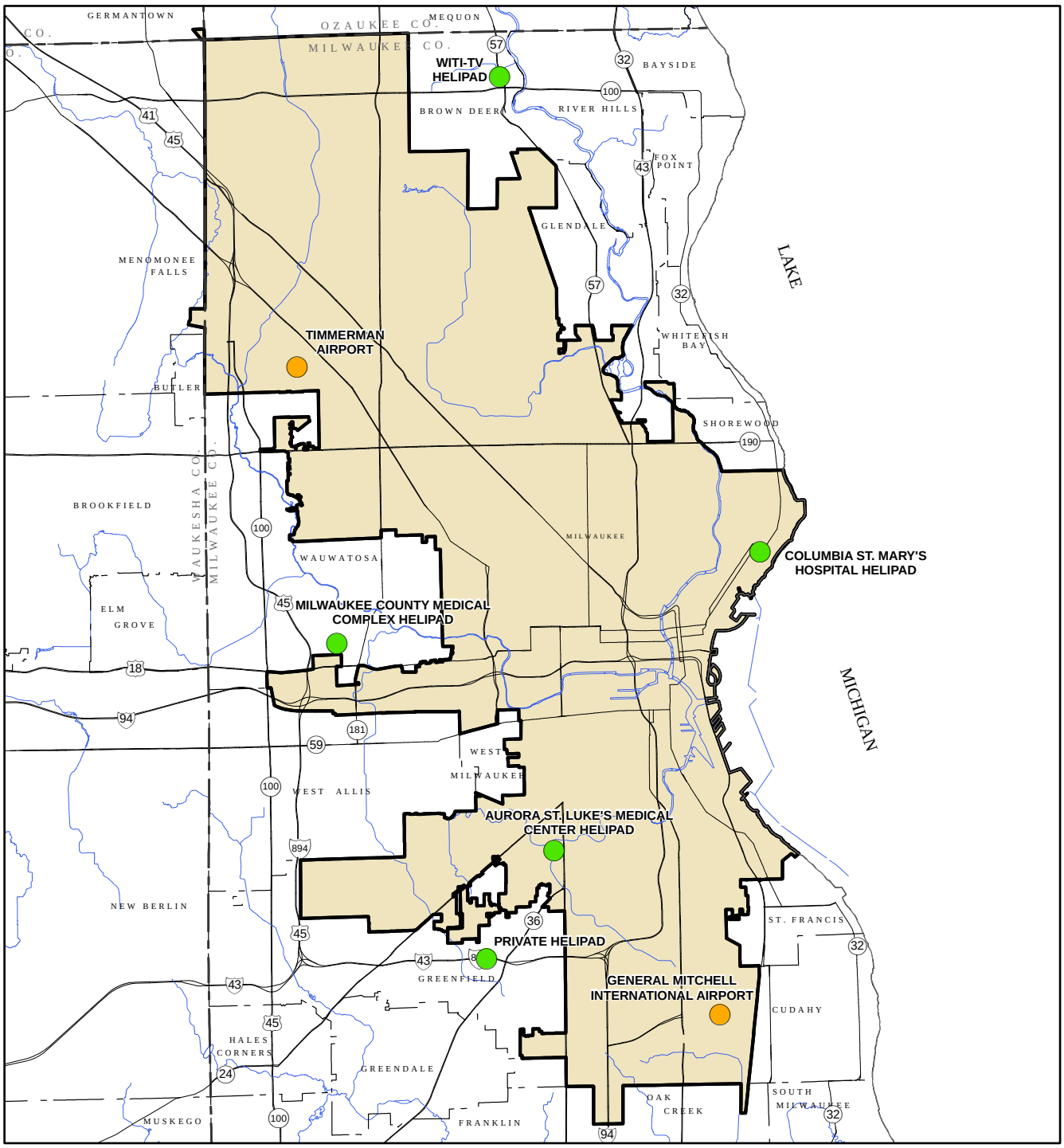


Source: SEWRPC.

FINAL DRAFT

Map 8

AIRPORTS AND HELIPADS IN THE METROPOLITAN MILWAUKEE AREA: 2010



Source: SEWRPC.

decanning, palletizing, container stripping, and stuffing for the transference of shipments between rail, truck, and ship. The Port owns and maintains rail track within its boundary, and both the Union Pacific Railway and Canadian Pacific Railway retain access. Its location adjacent to IH 794 allows for easy entrance and egress of trucks. The location of the Port of Milwaukee is shown on Map 9.

UTILITY SYSTEMS

Utility systems are among the most important and permanent elements of urban growth and development, as urban development is highly dependent upon utility systems providing electricity, natural gas, communications, water, and sewerage service. Because of this reliance, utility systems are an important consideration in hazard mitigation planning.

Public Water Supply Systems

As of 2010, nearly all of the City relied on the public water supply as its water supply source for domestic, commercial, and industrial use. The only portions of the City that are not served are small areas in the northwest that are undeveloped. As a division of the Department of Public Works of the City of Milwaukee, Milwaukee Water Works provides most of the public water supply for the City. The City of Milwaukee Department of Public Works operates two water treatment plants utilizing Lake Michigan as a source of water supply that, combined, pump an estimated average of 106 million gallons per day (mgd).[12] These plants provide nearly the entire source of supply for the City. Some small uses of groundwater also exist.

The protection of the public water supply facilities from potential contamination is a consideration for hazard mitigation planning. As such, well head protection planning and protection and monitoring of water supply intake, treatment, storage, and distribution systems is a potential plan element.

Sanitary Sewer Service Systems

Nearly all of the developed land within the City of Milwaukee is served by public sanitary sewer service. The City of Milwaukee owns and operates its own sanitary and combined sewer systems. That system is connected to the MMSD sewerage system through a network of interceptor sewers, known as the Metropolitan Interceptor Sewer (MIS) system. The sewage is conveyed through the MMSD sewerage system to either one of two wastewater treatment plants, the Jones Island plant or the South Shore plant.

Private Utilities

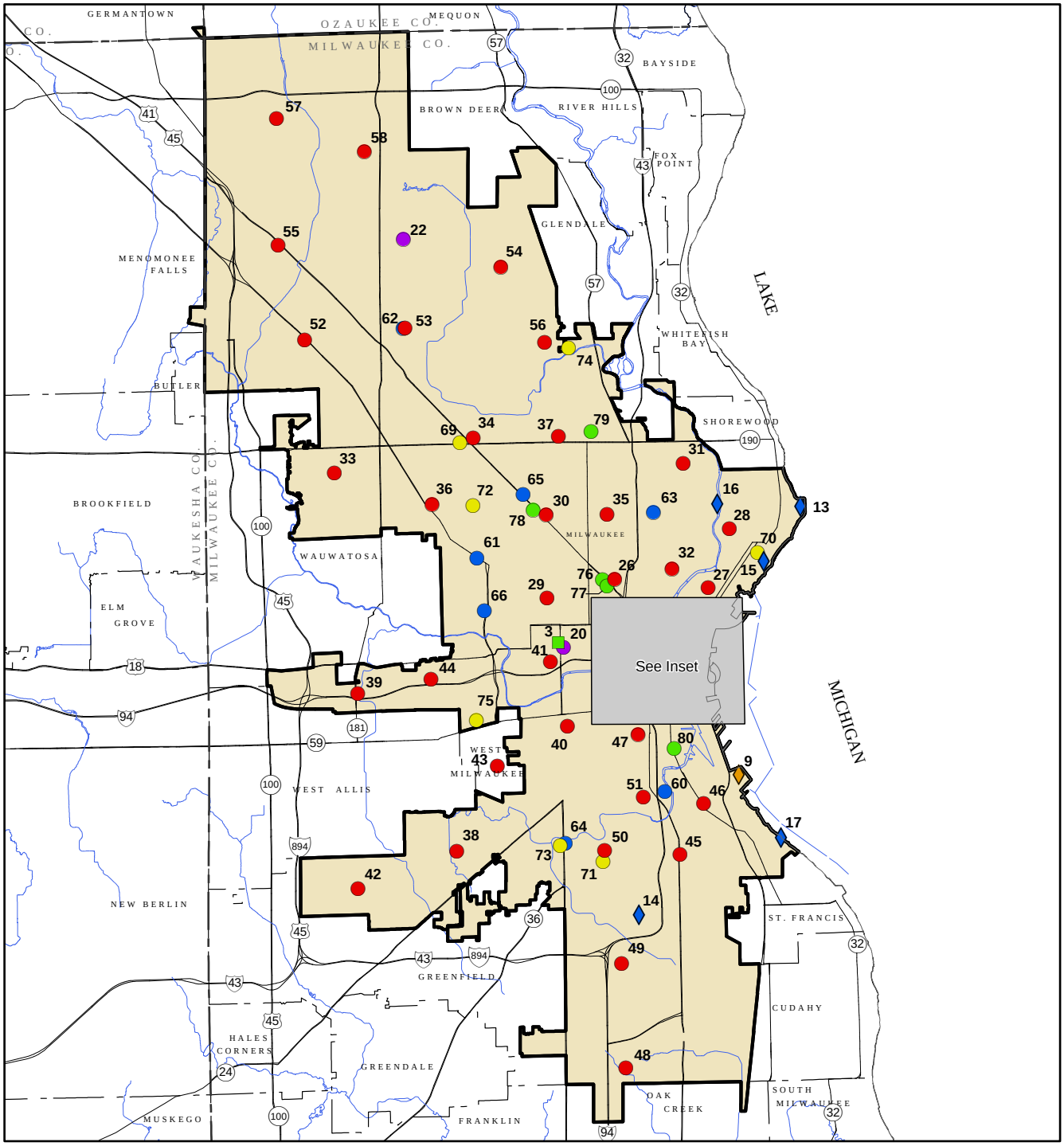
The City of Milwaukee is provided with electric power service by We Energies. Electric power service is available on demand throughout the City. One electric power generating facility is located within the City, and two additional facilities are located outside of the City, within Milwaukee County. Currently, an independent company, American Transmission Company, owns, maintains, and operates the major transmission facilities located in portions of the State of Wisconsin, including those in the City of Milwaukee.

Natural gas service is provided for the entire City of Milwaukee by We Energies-Gas Operations. We Energies is the distributor of natural gas, and the main gas supply is primarily provided for by ANR Pipeline Company which owns main and branch gas pipelines throughout southeastern Wisconsin. In addition, We Energies natural gas system is connected to other major gas pipelines outside of, but in the vicinity of, the City. Natural gas service is available on demand throughout the City.

[12] *Milwaukee Water Works,* Annual Report of the Milwaukee Water Works to the Public Service Commission of Wisconsin for the Year Ending December 31, 2009.

Map 9

CRITICAL FACILITIES WITHIN THE CITY OF MILWAUKEE: 2010



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WATER PURIFICATION PLANTS AND PUMPING STATIONS
- PORT OF MILWAUKEE
- OTHER CRITICAL FACILITIES
- CITY OF MILWAUKEE
- 75 — CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

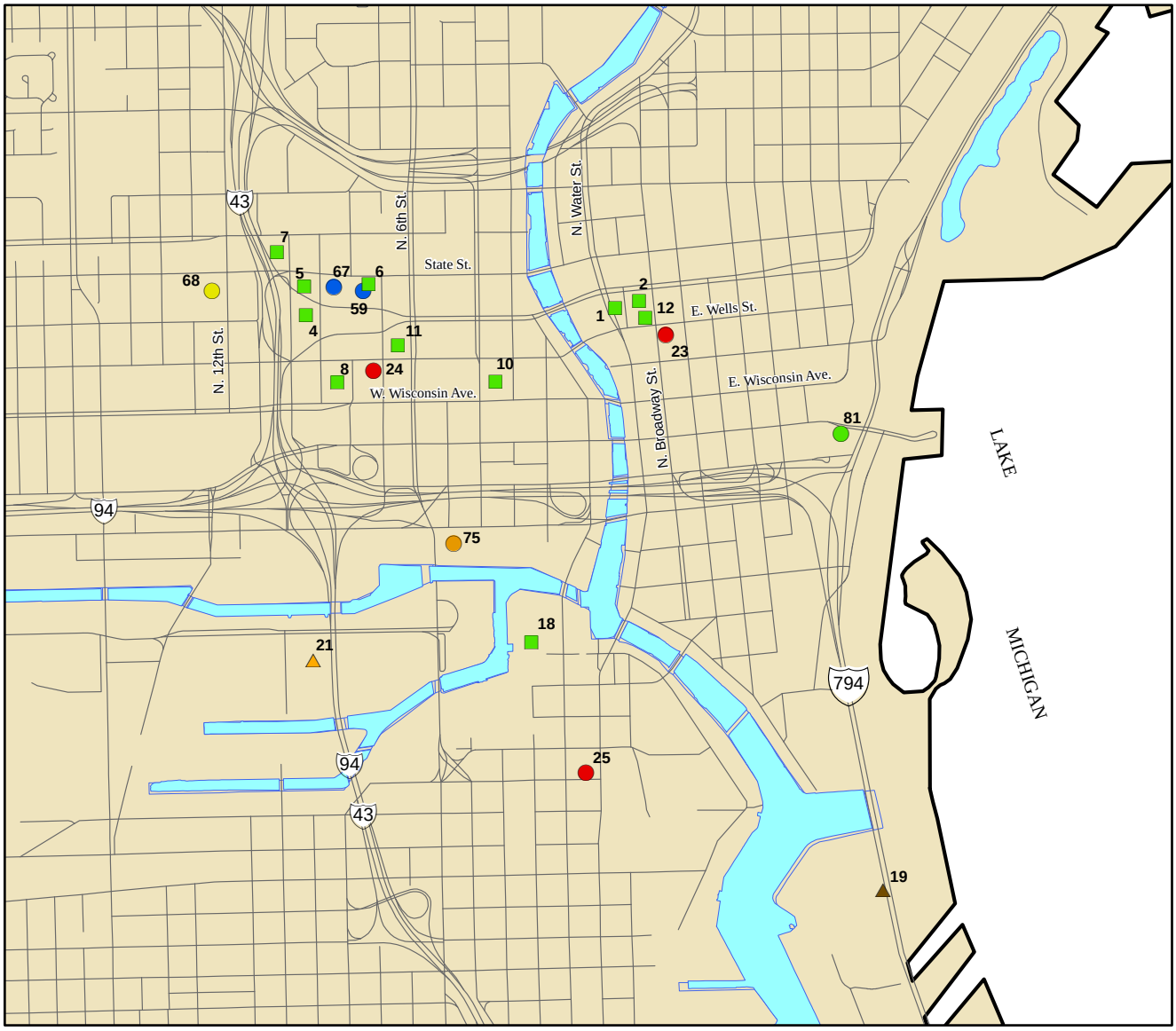
N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

INSET to Map 9



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE INTERMODAL STATION
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WASTEWATER TREATMENT PLANT
- POWER PLANT

24 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

N

GRAPHIC SCALE

0 1,000 2,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

Telephone service within the City of Milwaukee is provided through a number of telephone companies. In general, telephone service is available on demand throughout the City. There is also an extensive system of cellular and broadband PCS telecommunication facilities in the City of Milwaukee.

Several natural gas transmission pipelines run near or along the City's boundaries, in northwestern, southeastern, southwestern, and west-central portions of the City. In addition, natural gas transmission pipelines run through northwestern and southeastern sections of the City. Petroleum pipelines run near or along the City's boundaries in northwestern and southeastern portions of the City.

Solid Waste Disposal

Landfilling and recycling are the primary methods of managing solid wastes generated in the City of Milwaukee. There are currently no active landfills located within the City. However, four licensed, privately owned and operated landfills are located nearby. The Metro Recycling and Disposal Facility is located in the City of Franklin in Milwaukee County, the Falk Landfill is located in the City of South Milwaukee in Milwaukee County, the Orchard Ridge Recycling and Disposal Facility is located in the Village of Menomonee Falls in Waukesha County, and the Emerald Park Landfill is located in the City of Muskego, Waukesha County. In addition, there are 36 inactive solid waste disposal sites located throughout Milwaukee County.[13] Most of these sites have gone through proper closure procedures specified by the Wisconsin Department of Natural Resources (WDNR). Two of these sites, the Moss-American site in the City of Milwaukee, and the Fadrowski Drum Disposal site in the City of Franklin, are classified as Superfund sites. The U.S. Environmental Protection Agency (USEPA) completed remediation activities at the Moss-American site in December 2009. The USEPA removed the Fadrowski Drum site from the National Priorities List in September 2005. Follow-up activities continue to be conducted at both sites. The locations of the landfill and solid waste disposal sites in Milwaukee County are listed in Appendix B Table B-1.

PUBLIC SAFETY FACILITIES AND SERVICES

The type and location of public safety facilities are an important consideration in hazard mitigation planning, because of the potential direct involvement of such facilities in certain hazard situations. The location of the fire stations, police stations, and important governmental and institutional facilities in the City of Milwaukee are shown on Map 9. A listing of these facilities is also included in Appendix B Tables B-1 through B-3. The locations of these facilities in relationship to floodplain areas are indicated as a basis for further analysis described in Chapter IV.

Fire Suppression and Rescue Services

The City of Milwaukee maintains 36 fire houses which are divided geographically into five battalions. Within the fire houses are 36 engine companies, 15 ladder companies, and 12 emergency medical services paramedic units. The Milwaukee Fire Department Special Teams exercise expertise in three major disciplines: Marine Operations (DIVE and Fireboat), Hazardous Materials (HAZMAT), and Heavy Urban Rescue Team (HURT). HURT members are trained in specialized rescue procedures in the disciplines of confined space rescue, collapse rescue, and trench rescue.

The location of each of the fire stations within the City of Milwaukee are shown on Map 9 and listed in Appendix B Table B-2. All fire fighters are full-time employees.

Since 1991, the Milwaukee Fire Department has a service contract with the Village of West Milwaukee to provide full fire and emergency medical service within the Village.

[13] *SEWRPC Technical Report No. 37*, Groundwater Resources of Southeastern Wisconsin, *June 2002.*

Since 2006, the Milwaukee Fire Department has participated in the Mutual Aid Box Alarm System (MABAS). MABAS was originally formed in Illinois in the late 1960s and adopted for use in Wisconsin, MABAS enables each member department to render assistance to, and receive assistance from, other member fire departments without charge when incidents overwhelm local resources. This agreement enables individual departments to significantly supplement their own personnel, apparatus, and equipment when needed. Importantly, the agreement allows individual departments to access equipment, such as water tenders, aerial trucks, and specialized equipment, which they themselves do not possess and which they may only need infrequently.

The Milwaukee Fire Department also participates in Milwaukee County's Emergency Medical System (EMS). Milwaukee County provides training and medical oversight. The system allows paramedics from any participating fire department within the County to respond to medical emergencies in neighboring municipalities when needed. For example, MFD Med No. 15 routinely responds to emergencies in St. Francis as their paramedic unit and Wauwatosa's Med 81 responds to emergencies in the "finger" area on the west side of the City of Milwaukee.

The City of Milwaukee Fire Department does not hold any other official reciprocity agreements, or participate in any other mutual aid agreements with neighboring County, City, and Village municipalities with the exception of emergency medical response services (EMS). The EMS program is a countywide system that enables City of Milwaukee Fire Department EMS paramedics to respond to medical emergencies, to render assistance to, and receive assistance from, other departments in neighboring municipalities as needed. Under the agreement, departments render assistance without charge to the extent of available resources not required for the protection of their own service areas. These agreements enable individual departments to significantly supplement their own personnel, apparatus, and equipment with that from other departments in responding to emergencies. Importantly, the agreement allows individual departments to access equipment, such as tankers, aerial trucks, and extrication equipment, which they themselves do not possess and which they may need infrequently.

In addition to the various mutual aid agreements, each department has reciprocal mutual aid agreements with one or more neighboring departments within the City of Milwaukee. Some of these are formal, written agreements; others are unwritten. Many departments have indicated that they would respond to any request for mutual aid, whether or not there is a mutual aid agreement, provided that they are able to do so without jeopardizing their own services.

Law Enforcement

The City of Milwaukee is divided into seven police districts, and the locations of each district police station are shown on Map 9. The Office of the Milwaukee County Sheriff is also located in the City of Milwaukee, and is shown in the inset to Map 9. These law enforcement facilities are listed in Appendix B Table B-3.

The City of Milwaukee and other local community police departments, as well as the Milwaukee County Sheriff's Department, operate under mutual aid provisions of Section 66.0313(2) of the *Wisconsin Statutes.* As such, the City Police Department and County Office of the Sheriff routinely provide or receive assistance from other community personnel in law enforcement matters. Because of the relatively high level and specialization of law enforcement capabilities that exist at the City and County level, mutual aid is often provided to other communities when specialized capabilities are needed.

CRITICAL COMMUNITY FACILITIES

In addition to fire stations and law enforcement stations, as described above, other community facilities which are of importance in hazard mitigation planning include schools, hospitals and major clinics, and certain government administration buildings. It is important to note that these facilities identified herein are consistent with those

critical community facilities identified in the initial Milwaukee County pre-disaster mitigation plan.[14] Map 9 shows the locations of police and fire stations, hospitals and major clinics within the City of Milwaukee, and locations of select government facilities, including the Milwaukee County Courthouse and the Milwaukee County Secure Correctional Facility, as well as water purification and treatment plants. Because of the need for access to and from these facilities, the hazard mitigation plan includes facility locations and shows the relationship to the flood hazard areas. This relationship is discussed in Chapter IV of this report. A listing of critical community facilities is included in Tables B-1 through B-5 in Appendix B. Although not mapped, there are over 300 public, private, charter, choice, and partnership schools throughout the City of Milwaukee listed in Table B-5 in Appendix B.

Although not specifically identified as critical community facilities, City public works yards, cell towers, telephone land lines, and switching stations in certain emergency situations can also be considered critical. The importance of maintaining access to facilities like the City public works yards that house additional or specialized emergency response equipment and maintaining the ability of the fire and police departments to communicate can be critical in emergency situations, especially during situations involving power outages.

HAZARDOUS MATERIAL STORAGE AND USE

Public Law 99-499, the Superfund Amendment and Reauthorization Act (SARA/Title III) of 1986, and Wisconsin Act 342 set forth requirements for hazardous material reporting and safety planning. The primary reporting and centralized recordkeeping related to hazardous materials is carried out under a partnership program involving the industries and other users of hazardous materials, the Wisconsin Division of Emergency Management, county emergency management departments, local emergency planning committees, and the local fire departments. Reporting facilities are any facility that uses, stores, or produces chemicals at or above 10,000 pounds. Because there is no "hazardous chemical" list, the general assumption is that anything requiring the completion of a material safety data sheet (MSDS) is included as a reporting requirement. Reporting facilities include manufacturers, warehouses, and petroleum storage site operators. Planning facilities include a wide range of users of limited amounts of hazardous materials. In addition to industrial materials, the agricultural industry routinely uses materials considered extremely hazardous. These uses range from individual farm use materials to large chemical storage facilities.

The City of Milwaukee Fire Department is one of eight units in the State of Wisconsin that hosts a Level A Regional Response Hazardous Materials Team. Level A teams are equipped with the highest level of skin and respiratory protective gear and are capable of responding to the most serious of spills and releases, including all biological, chemical, and radiological emergencies.[15] Stationed in Milwaukee, this team also covers all of Ozaukee, Washington, and Waukesha Counties, and portions of Jefferson County.

Between 2007 and 2009, the City of Milwaukee averaged 136 hazardous material spills or releases per year, almost all of which were minor. The majority of these incidents involved gasoline, engine waste oil, diesel fuel, mineral oil, or other petrochemical substances. These spills have typically been properly handled through local emergency response actions.

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[14] *Milwaukee County Emergency Management*, Milwaukee County, Wisconsin, Pre-Disaster Mitigation Plan, *August 2004 (draft).*

[15] *Wisconsin Emergency Management*, 2010 Annual Report, *accessed on February 15, 2011 through the internet at* http://emergencymanagement.wi.gov/resources/docs/2010AnnualReportfinal_1_12_2011.pdf

HISTORIC SITES

Historic sites in the City of Milwaukee often have important recreational, educational, and cultural value. Certain sites of known historic significance are listed on the National Register of Historic Places. Currently, there are approximately 142 individual sites and about 41 historic districts[16] within the City listed on the National Register. The location of sites and districts in the City of Milwaukee listed on the National Register of Historic Places are presented in Table B-6 in Appendix B.[17] Sites of historic local interest can also be found by contacting the Historic Preservation Commission at the City Clerk's office in the City of Milwaukee.[18]

REGULATIONS AND PROGRAMS RELATED TO HAZARD MITIGATION

Regulations and programs perform critical roles in hazard mitigation planning and plan implementation. The current regulations which are most directly related to hazard mitigation include floodplain and stormwater management ordinances and emergency operations programs. The zoning ordinances and operations programs administered by the City of Milwaukee that are most related to hazard mitigation are summarized below.

Floodplain Zoning Ordinance

The City of Milwaukee has enacted a floodplain district zoning ordinance. This ordinance is intended largely to preserve floodwater conveyance and storage capacity of floodplain areas and to prevent the location of new flood-damage-prone development in flood hazard areas. Under the ordinance, designated floodplain areas within the City are divided into three overlay zones: 1) a floodway overlay zone, 2) a flood fringe overlay zone, and 3) a flood storage overlay zone. Under the City's zoning code, a "floodway" is defined as "the channel of a river or stream and those portions of the floodplain adjoining the channel required to carry the regional flood discharge." The City zoning code defines a "regional flood" as "[a] flood determined to be representative of large floods known to have generally occurred in Wisconsin and which may be expected to occur on a particular stream because of like physical characteristics," and which has a flood frequency of once in every 100 years. The code defines a "flood fringe" as "[t]hat portion of the floodplain outside of the floodway which is covered by flood waters during the regional flood" and which is "generally associated with standing water rather than rapidly flowing water." The code defines flood storage as "those floodplain areas where storage of floodwaters has been taken into account during analysis in reducing the regional flood discharge."

The City floodplain overlay zone ordinance states its purpose as follows: Floodplain overlay zones are intended "to identify floodprone areas in the city with respect to establishing corrective and preventive measures to reduce flood-related damage and alerting the public to the flood-related hazards it may face in such areas." Development in the floodplain will vary, depending on the type of overlay zone. The ordinance prohibits floodplain development which result in either the obstruction of flow or an increase of the regional flood height due to floodplain storage lost by an amount equal to or exceeding 0.01 foot.

Under the ordinance, permitted uses in designated floodway overlay zones include several open space uses, functionally water-dependent uses, and uses or structures accessory to open space uses or classified as historic structures. Permitted structures in floodway overlay zones must meet conditions specified in the ordinance. Prohibited uses in designated floodway overlay zones include: dumping and filling not authorized by the WDNR, although incidental grading activities normally associated with the development of open space, outdoor

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[16] *A historic district is a geographically definable area, urban or rural, that contains a concentration of significant historic sites or structures from the same period of time.*

[17] *National Register of Historic Places,* www.historicdistricts.com/wi/milwaukee/state.html

[18] *Historic Preservation Commission,* HistoricPreservation@milwaukee.gov, *phone: (414)286-5722.*

recreation, yards, parking, or loading areas is permitted; storage of material that is buoyant, flammable, explosive, or harmful to human, animal, or plant life; solid waste disposal, soil absorption sanitary sewer systems, or construction of wells providing water for human consumption; and all fill, structures, or other development that would impair floodwater conveyance by adversely increasing flood stages or velocities, or would itself be subject to flood damages.

Under the ordinance, permitted uses in designated flood fringe overlay zones include uses permitted in floodway districts; residential, commercial, institutional, manufacturing, industrial, and accessory structures; public utilities, streets and bridges, parking and loading areas; and storage of materials. All permitted uses are subject to conditions specified in the ordinance.

As noted above, development in the flood storage overlay zone may not result in an increase of the regional flood height due to floodplain storage lost by an amount equal to or exceeding 0.01 foot.

Under the ordinance, development in floodway and flood fringe overlay districts may not adversely affect channels, floodways, or banks of any tributaries of the City's watercourses or land outside the floodplain. The ordinance bans the use of any structure or land or the erection, alteration, relocation, extension, or substantial improvement of any structure in a floodway or flood fringe overlay zone prior to the issuance of a City permit. The ordinance also declares that permit applicants have the responsibility for securing all necessary required local, State, and/or Federal permits. The ordinance also provides that no river or stream in the City may be altered or relocated until the City Common Council grants a floodplain district boundary amendment in accord with the City zoning code.

As previously noted, the mapping of floodplain boundaries associated with Lincoln Creek, the Milwaukee River, and portions of the Menomonee River, have been recently updated under a cooperative program involving the MCAMLIS Steering Committee, the MMSD, and SEWRPC. In October 2008, the City ratified FEMA Digital Flood Insurance Rate Maps (DFIRM) dated September 26, 2008 for various waterways within the City of Milwaukee, and made various revisions to the City floodplain zoning regulations to reflect the most current version of the *Model Floodplain Ordinance* prepared by the WDNR, as well as other changes or requested by the WDNR or suggested by the WDNR and SEWRPC.

Stormwater Management Regulations

The City of Milwaukee's stormwater management regulations are set forth in Chapter 120 of the City code of ordinances. The stated purposes of that chapter include the following: 1) the promotion of the public health, safety, and general welfare; 2) the establishment of procedures to control the adverse impacts associated with stormwater runoff; 3) assistance in the attainment and maintenance of water quality standards; 4) reduction of the effects of development on land and stream channel erosion; 5) the minimization of damage to public and private property; and 6) reduction of nonpoint source water pollution by minimizing impervious cover on development sites. The regulations generally prohibit any person from discharging, spilling, or dumping substances or materials which are not entirely composed of stormwater into receiving bodies of water, storm sewers, or drainage facilities, or onto driveways, sidewalks, parking lots, or other areas that drain into the drainage system. The term "drainage system," as used in the regulations, is defined as "the collection and conveyance of storm water runoff, snow melt runoff, surface water runoff or other drainage from the land" and is declared to include "all drainage facilities, watercourses, waterbodies and wetlands." Certain activities are declared exempt from the general prohibition unless they are found to have an adverse impact upon stormwater. The exempt activities include 1) discharges authorized by a WDNR permit; 2) discharges resulting from fire-fighting activities, excluding training activities; 3) discharges in compliance with the City's construction site erosion control ordinance,[19] and 4) discharges from uncontaminated groundwater, potable water sources, roof drains, foundation drains and sump pumps, air-

[19]*Chapter 290, "Erosion Control,"* City of Milwaukee Code of Ordinances.

conditioning condensation, springs, lawn watering, individual residential car washing, water-main and hydrant flushing, landscape irrigation, diverted streamflows, irrigation water, flows from riparian habitats and wetlands, street wash water, and swimming pools if the water has been dechlorinated. The regulations prohibit connecting any wastewater building sewer or drain to the drainage system.

The regulations also generally prohibit any person from proceeding with any residential, commercial, industrial, or institutional improvement or subdivision of property without having provided for appropriate stormwater measures that control or manage runoff from such development or redevelopment or future development of the subdivided property. Unless exempted or waived as provided in the regulations and as summarized below, any such person must have a stormwater management plan prepared, submit the plan to the City for approval, and obtain such approval 1) before an existing drainage system is altered, rerouted, deepened, widened, enlarged, filled, or obstructed in preparation for improvement, 2) before or concurrent with the submittal and approval of an erosion and sediment control plan as specified in the City's construction site erosion control ordinance,[20] or 3) before the improvement in question is commenced. The person involved is responsible for the implementation of the plan.

Under the regulations, the following development activities are exempt from the stormwater management plan requirements: 1) development occurring within a gross aggregate area of less than one acre which is not part of a larger common plan of development or sale; 2) agricultural activities not associated with development; 3) maintenance of, alteration of, use of, or improvement to an existing structure or construction activity that does not significantly change or affect the water quality and hydrologic conditions of the surface-water discharge; 4) maintenance activities undertaken by any municipal, State, or Federal governmental agency; and 5) stormwater management measures to be undertaken by the City of Milwaukee on an outfall in a specific watershed when the City Engineer has determined that a stormwater management plan need not be prepared. The stormwater management regulations also provide that requests to waive the stormwater management plan requirements shall be submitted to the City Engineer. Under the regulations, the City Engineer is responsible for coordinating a review by City agencies of any such waiver request and may grant a waiver if the development in question is not likely to 1) increase or decrease the rate or volume of stormwater runoff, 2) have an adverse impact on a wetland, watercourse, or receiving body of water; 3) contribute to the degradation of water quality; or 4) otherwise impair attainment of the objectives of the City stormwater management regulations.

The regulations also prescribe what must be contained in any City-required stormwater management plan, including certain general information, as well as detailed descriptions of existing site conditions, proposed site alterations, predicted impacts from the proposed development on water quality and quantity, and best management practices proposed to be used for the protection of water quality. A City-required stormwater management plan, under the regulations, must also be accompanied by an irrevocable letter of credit, a certified check, or a surety bond to guarantee implementation and completion of the plan. The plan must also be accompanied by a second such guarantee to ensure that the facilities involved are maintained. This latter guarantee remains in effect until the facilities are recertified as required under the regulations.

The ordinance requires stormwater management plans for any developments or redevelopments that cause a land disturbing activity of one acre or more, cause the cumulative area of all land disturbing activities at a property to be on acre or more over a three-year period, or cause an increase of 0.5 acres or more of impervious area. For those developments or redevelopments that cause an increase of 0.5 acres or more of impervious area, the ordinance specifies that the runoff release rate and requirements be governed by MMSD Chapter 13 surface water and stormwater rules. For developments or redevelopments that cause a land disturbing activity of one acre or more or cause the cumulative area of all land disturbing activities at a property to be on acre or more over a three-year period, the ordinance requires that the peak runoff release flow rates under post-development conditions shall

[20]Ibid.

be at least 10 percent less than those under predevelopment conditions, except that within the Milwaukee River Greenway Site Plan Review Overlay Zone, the peak runoff release flow rates under post-development conditions shall be at least 50 percent less than those under predevelopment conditions.

The MMSD operates a long-standing industrial waste and pretreatment program designed to substantially reduce the potential for contaminants entering Lake Michigan and local watercourses from industrial sources. The program is intended to minimize the toxic and hazardous substances entering the MMSD sewerage system and, thereby, ensures compliance in this regard with Federal, State, and local rules and regulations. To accomplish that objective, the MMSD has adopted rules which limit potentially harmful industrial wastewater contributions and works with industries connected to the public sewer system to achieve compliance with the rules.

The MMSD has adopted a comprehensive rule designed to minimize the potential to increase flood risk due to development or redevelopment in the Districts service area. The rule applies to the City of Milwaukee and the other communities within the MMSD service area which lie upstream of the City in the tributary watershed areas. The rule was in effect as of January 1, 2002, and provides for community ordinances which require the management of the volume and peak rate of stormwater flows from new development and redevelopment in such a way that peak flows in a watershed do not increase downstream flooding. The rule provides for flexibility in choosing the means to comply with the rule. Options include limiting stormwater runoff from new development or redevelopment to established acceptable release rates or development of regional or multiple site approaches designed to meet the rule objective. This rule should be an important component of a strategy to minimize the creation of new or increased flooding problems.

Other Related Regulations and Programs

The floodplains in the City of Milwaukee are currently delineated and mapped as documented in the FEMA Flood Insurance Study (FIS) dated September 26, 2008. This FIS revised and updated the information on the existence and severity of flood hazards in Milwaukee County as set forth in a previous FIS dated November 1987. Residents of the City are eligible to participate in the National Flood Insurance Program (NFIP). There are a number of completed activities which have modified the floodplain conditions in the City of Milwaukee. These include the removal of the North Avenue Dam, the completion of the MMSD Lincoln Creek flood control project, the MMSD Menomonee River Valley Park flood control project, the Grantosa Creek detention basin, the MMSD Southbranch Creek flood control project, the MMSD Hart Park Menomonee River flood mitigation project, and the Canal Street extension over the Menomonee River. In addition, other flood abatement projects are in the design stages. The City of Milwaukee Departments of Public Works and City Development continue to work cooperatively with the MMSD, the MCAMLIS Steering Committee, and SEWRPC to develop updated hydrologic and hydraulic analyses and floodplain mapping. The City staff will then work to obtain necessary approvals from the WDNR and FEMA, often with assistance from SEWRPC, with the goal of having the resulting floodplains as the basis for the applicable flood insurance maps and floodplain zoning maps. The City of Milwaukee has also enacted a construction site erosion control ordinance based on a State model ordinance.

In addition to the regulations and programs noted above, from 2000 through 2005 the MMSD, as detailed in Chapters V and VII of this report, engaged in comprehensive, detailed Phase 1 and 2 watercourse system planning efforts to update and implement its 1990 stormwater drainage and flood control system plan. These work efforts by the MMSD include significant flood mitigation planning efforts for areas within the corporate limits of the City of Milwaukee. These latter efforts constitute the current citywide flood mitigation planning program within the City. In undertaking the updating and implementation of its watercourse system plan, the MMSD has recognized the importance of achieving consensus from all the major stakeholders involved regarding the goals and objectives of the planning effort, as well as the need to obtain a final set of acceptable and implementable solutions for current flooding problems along each of the streams involved.

Accordingly, for each watershed located partly within the City of Milwaukee where flooding problems exist, the MMSD formed a stakeholder group to facilitate this aspect of plan development. The stakeholder groups include representatives of the City of Milwaukee and other concerned local units of government, as well as the WDNR and SEWRPC, and, as appropriate within particular watersheds, other public and/or private agencies and organizations, including environmental and neighborhood organizations and concerned private businesses. Stakeholder meetings have been held throughout the MMSD's process of developing alternatives for flood management within each area involved in order to obtain feedback regarding proposed solutions to flooding problems. Stakeholder meetings have been held for each area involved since 1998 and continue to be held through the plan development process.

In some municipalities, the MMSD has also held community workshops to obtain community input regarding possible solutions to flooding problems in the context of what kind of community resource area residents—not just flood victims, but all residents involved—desire regarding their watercourse as a community resource. In some cases, the MMSD has held a number of special technical meetings with technical representatives from concerned communities, as well as from the WDNR, SEWRPC, and Milwaukee County.

Throughout this public involvement process, potential solutions have been developed with input from major stakeholders. Various solutions and scenarios have been presented and feedback has been sought regarding their acceptability. The process has also considered and, as appropriate, incorporated the objectives of concerned local agencies and the authority and policy decisions made by the MMSD.

Emergency Operations Planning

Milwaukee County has developed an emergency operations plan[21] that is updated annually, which sets forth an all-hazards action plan. In addition, many of the local units of government, including the City of Milwaukee, have developed emergency operations plans and/or programs which complement the County and which also set forth procedures and actions to deal with a range of situations and events. Milwaukee County's emergency operations plan notes that the County is vulnerable to exposure to many hazards that have the potential for disrupting the community, causing damage, and creating casualties. In addition to flooding, the plan recognizes that the County is vulnerable to other natural hazards, including tornadoes and severe weather; technological hazards; accidents involving hazardous materials; terrorism and civil disorder; and utility hazards, such as power failure and water shortages or contamination.

The MMSD has prepared an emergency action plan for the Milwaukee County Grounds Floodwater Management Facility, which is located near Underwood Creek in the Menomonee River watershed.. This plan describes notifications to be made and actions to be taken in the event an unexpected failure of the facility's embankment during an extreme flooding event when the Facility is full and structures along the Menomonee River are already experiencing flooding.

The County plan includes procedures and protocols to respond to disasters or large-scale emergencies. The purpose and goal of the County emergency operations plan is to assist government in protecting lives, property, and the environment from major emergencies by addressing the areas of mitigation, preparedness, response, and recovery. This plan is considered the core of the Milwaukee County emergency operations program. It provides policy for department and agency managers and emergency management professionals to use in planning and actual operations. In response to a disaster or large-scale emergency, all local government forces, including law enforcement, fire, medical, health, public works, and others, will be considered a part of the County's emergency

[21]*Milwaukee County Sheriff Department,* Milwaukee County Emergency Operations Plan, http://www.mkesheriff.org/rapidcat/catalog/pagetemplate.cfm?template=/rapidcat/common/viewPage.cfm&PageId=2425&CompanyId=1138, *2004.*

management organization, and will be the first line responders to such an emergency. When the emergency or disaster exceeds the local government's and County's capability to respond, assistance will be requested from the State of Wisconsin. The Federal government will provide assistance to the State of Wisconsin when all local and State resources have been exhausted. The County plan includes elements on direction and control, warning and communications, and management of resources during emergency situations.

The City of Milwaukee's emergency operation plan is scheduled to be updated and revised in 2011 as part of activities related to the Urban Area Security Initiative.

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Chapter III

ANALYSIS OF HAZARD CONDITIONS

In order to evaluate various potential hazard mitigation alternatives for the City of Milwaukee and select the most effective and feasible hazard mitigation strategies, the existing potential hazard problems in the City must first be analyzed and the vulnerability to such hazards documented. Accordingly, this chapter provides the following:

- Identification of the hazards likely to affect the City of Milwaukee;
- Profiles of the extent and severity of hazard events which occurred in the City;
- Assessment of the vulnerability and risk associated with each type of hazard; and
- Identification of the potential for changes in hazard severity and risk under future conditions.

The vulnerability assessment focused on the City and community assets described in Chapter II.

In preparing this updated plan, the analysis of the existing potential hazard problems and the documentation of vulnerability to such hazards were reviewed and updated as warranted. This review and updating included:

- Reevaluation of the identification of the hazards likely to affect the City of Milwaukee;
- Updating of the data upon which the profiles of the extent and severity of hazard events that occurred in the City were based;
- Reassessment in light of the updated data of the vulnerability and risk associated with each type of hazard; and
- Reevaluation as warranted by the updated assessments of the potential for changes in hazard severity and risk under future conditions.

HAZARD IDENTIFICATION

The process of identifying those hazards which should be specifically addressed in the City of Milwaukee hazard mitigation plan was based upon consideration of a number of factors. The process included input from the City of Milwaukee Hazard Mitigation Steering Committee, including a priority rank ordering of hazards; review of the hazard identification set forth in the State hazard mitigation plan; review of documentation of past hazard events; and review of related available mapping, plans, and assessments. It is important to note that the Milwaukee

County Pre-Disaster Mitigation Plan was reviewed and utilized as a resource, as part of the hazard identification and assessment in terms of the natural hazards analyses relevant to the City of Milwaukee. As part of the updating process, the identification of hazards likely to affect the City of Milwaukee was reviewed and reevaluated. The reevaluation included additional input from the City of Milwaukee Hazard Mitigation Steering Committee.

Local Input

The City of Milwaukee Hazard Mitigation Plan was developed through a collective effort of a number of agencies, organizations, and community representatives under the guidance of the City of Milwaukee Hazard Mitigation Steering Committee, which was created by the City of Milwaukee Department of Public Works (DPW) specifically for plan development purposes. That committee is comprised of appointed officials and public representatives from throughout the City and County knowledgeable about, and directly involved in, hazard mitigation matters (see Appendix A).

During the drafting of the initial plan, two meetings of the Milwaukee Hazard Mitigation Steering Committee were devoted, in part, to hazard identification. At the first meeting, an initial listing of hazards to be considered was presented. The Steering Committee was asked to expand upon that listing, and each Steering Committee member was asked to select the three hazards which were considered most important. The hazards identified in the Milwaukee County Pre-Disaster Mitigation Plan were also reviewed and incorporated for use in the City plan. The listing of the potential hazards identified at the initial and second meeting, along with the number of committee members who indicated the importance of each hazard, is shown in Table 6.

As part of the updating process, the Steering Committee reevaluated the hazards to be considered using a hazard and vulnerability assessment tool. A copy of this tool is included in Appendix A. Members of the Steering Committee indicated the likelihood of each hazard occurring in the City of Milwaukee and evaluated the severity of each hazard on the basis of possible impacts to people, property, and business. Finally, the Steering Committee evaluated that relative state of preparedness for each hazard. The ratings given by the Steering Committee for each hazard were used to derive a perceived level of risk posed by each hazard. Following this, the hazards were ranked by perceived level of risk.

Summary of Hazard and Vulnerability Assessment Tool Results

Methods

The assessment tools were completed at the March 30, 2011 meeting of the City of Milwaukee Hazard Mitigation Steering Committee, with 11 surveys being returned and analyzed. For each hazard in each survey, a risk was computed using the formula:

Risk(in %) = [(Probability/3) x (Human impact + Property impact + Business impact + Preparedness)/(4*3)]* 100

Where Probability (likelihood that an event would occur), Human impact (possibility of death or injury), Property impact (physical losses and damages), Business impact (interruption of services), and Preparedness (preplanning) were each assigned a number from 0 to 3, with 0 indicating “not applicable”, 1 indicating low, 2 indicating moderate, and 3 indicating high.

The interpretation of the result returned by this formula is that the perceived threat increases with increasing percentage risk.

For each hazard, an average risk was calculated using the results of all the returned surveys. The hazards were then ranked by average risk, with a rank of 1 indicating the highest perceived risk. For each hazard, minimum and maximum risks were calculated. The results from the assessment tool were analyzed for 39 hazards.

Table 6

HAZARD IDENTIFICATION SUMMARY FOR THE 2005 PLAN BASED UPON CITY OF MILWAUKEE HAZARD MITIGATION STEERING COMMITTEE INPUT

Number of Points Assigned to Hazards Identified by the Steering Committee[a]	Hazards Required by FEMA[b]	Hazard Types Considered
		A. Natural Hazards
15	✓	Flooding
7	✓	Thunderstorms, high wind, hail, lightning
7	✓	Winter storms
3	✓	Tornadoes
0	✓	Temperature extremes
0	✓	Coastal erosion
0	✓	Drought
0	✓	Earthquake
		B. Other Hazards Human Induced/Technical Hazards
0	- -	Transportation accidents
0	- -	Arterial street and roadway
0	- -	Railroad
0	- -	Airport
0	- -	Milwaukee harbor boating/shipping
1	- -	Contamination or loss of water supply
- -[c]	- -	Hazardous materials incident
- -[c]	- -	Medical/health risks
0	- -	Fixed facility (like storage/distribution centers)
3	- -	Terrorism incident
- -[c]	- -	Major fire and emergency incidents
0	- -	Power outage incident/energy grid incident
- -[c]	- -	Basement backups (to be considered in conjunction with flooding)

[a]*Points represent the number assigned by the Steering Committee at its August 10th, 2004 meeting during a nominal group hazard ranking process.*

[b]*U.S. Federal Emergency Management Agency Federal Code of Federal Regulations 44 CFR Parts 201 and 206 Hazard Mitigation Planning and Hazard Mitigation Grant Program; Interim Final Rule, February 26, 2002.*

[c]*Hazards identified to be included in the mitigation plan by the City of Milwaukee Hazard Mitigation Steering Committee meetings on August 10, and September 21, 2004).*

Source: City of Milwaukee Hazard Mitigation Steering Committee.

In order to assess the degree of agreement among Steering Committee members in the assessment of average risk, the interquartile range was calculated for each hazard. This quantity indicates the range of the half of the responses that are in middle. A smaller interquartile range indicates greater agreement among Task Force members as to the level of risk, while a larger interquartile range indicates less agreement.

Results

The results from the assessment tool are summarized in Table 7. The average level of risk for hazards ranged from 12.1 percent for the lowest ranked hazard (earthquake) to 67.2 percent for the highest ranked hazard (stormwater flooding). The seven highest average risks belonged to natural hazards related to meteorological causes, mostly causes associated with either winter weather or severe storms. The remaining three of the 10 highest average risks belong to technological or human-induced hazards. The interquartile ranges for the 10 hazards with the highest average risks tended to be relatively large, indicating a diversity of opinion among Steering Committee members as to the level of risk posed by each of these hazards. In some instances, such as the hazards posed by stormwater flooding, riverine flooding, and ice storms there was general agreement among Steering Committee members that the risk was relatively high, but disagreement as to just how high.

The 10 lowest average risks belonged to hazards related to a variety of causes, including technological or human-induced hazards related to land use, natural hazards related to geological events, natural hazards related to meteorological events, and hazards related to human behavior. The interquartile ranges for the 10 hazards with the lowest average risks tended to be low, indicating strong agreement among Steering Committee members as to the level of risk posed by each of these hazards.

Past Hazard Experience

Past experiences with disasters are an indication of the potential for future disasters for which the City of Milwaukee could be vulnerable. Accordingly, a review was made of the hazards that have faced Milwaukee in the past and a ranking by risk was made based upon disaster history and emergency management experience. As part of this plan update, the review of hazards faced by the City was updated to include experiences that have occurred since the original plan was drafted and the ranking by risk was reevaluated in light of this updated disaster history.

If disaster damages exceed the capabilities of local, County, and State agencies, Federal assistance will be requested. Federal disaster assistance may be offered through a variety of programs. Assistance may be directed to individuals and families, businesses, agricultural producers, or local governments. Table 8 provides a summary of estimated damages from flooding-related Presidential declared disasters that affected the City of Milwaukee, from 1973 through 2010. Information on estimated damages and fatalities is included where available.

Between 1973 and 2010, the City of Milwaukee and environs had 11 presidential disaster declarations and three presidential emergency declarations. The total documented estimated damages of these events were five deaths and approximately $278 million as shown in Table 8. Since these estimated property damage totals were inclusive of the entire County, the actual amount of damages specifically within the City of Milwaukee is unknown.

It should be noted that this amount significantly underestimates the sum of all losses in the Greater Milwaukee Area from natural hazards. In some years there are significant weather events causing millions of dollars of damage for which no Federal disaster assistance was requested. Thus, losses from hazards in Milwaukee County are significantly greater than the $278 million estimate shown in Table 8. Major indicators of hazard severity are the deaths, injuries, and economic losses resulting from natural hazards and disasters. The National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center (NCDC) publishes National Weather Service (NWS) data describing recorded weather events and resulting deaths, injuries, and damages.

To illustrate the broader hazard damage potential, since 1950 the City of Milwaukee has experienced 528 weather hazard events resulting in 137 fatalities and 363 injuries reported, as shown in Table 9. These records indicate that just less than $328 million in property damages accumulated over this time period. As summarized in Chapter II of this report, less than 1 percent of the land area in the City of Milwaukee is agricultural land. Historical urbanization has reduced the threat of an agricultural related hazard event. Considering the low risk and lack of historic incidents, agricultural related damages from hazards will not be addressed further in this plan.

Table 7

PERCEIVED RISKS OF HAZARDS AS DETERMINED BY HAZARD AND VULNERABILITY ASSESSMENT TOOL: 2011

Event	Minimum (percent)[a]	Maximum (percent)[a]	Average (percent)[a]	Interquartile Range (percent)[b]	Rank
A1. Riverine flooding	13.9	75.0	42.9	35.4	6.5
A2. Stormwater flooding	33.3	91.7	67.2	14.3	1
A3. Tornado or high straight-line wind event	25.0	91.7	45.5	26.4	4
A4. Earthquake	0.0	33.3	12.1	20.8	39
A5. Lake Michigan coastal erosion	8.3	50.0	21.7	16.7	34.5
A6. Snow storm	33.3	58.3	42.9	16.7	6.5
A7. Blizzard or extreme snowfall	33.3	75.0	47.7	27.8	2
A8. Ice storm	33.3	83.3	46.2	19.5	3
A9. Extreme heat	11.1	50.0	28.0	25.0	23
A10. Extreme cold	13.9	34.6	23.6	21.5	28
A11. Lightning	13.9	83.3	34.9	22.9	14
A12. Thunderstorm	27.8	83.3	43.4	15.6	5
A13. Hail	5.6	44.4	31.6	21.5	19
A14. Fog	0.0	50.0	33.1	28.5	16
A15. Drought	0.0	50.0	21.7	23.6	34.5
A16. Dust storm	0.0	41.7	14.7	18.8	38
B1. Contamination or loss of water supply	13.9	44.4	23.5	4.9	29
B2. Loss of sewerage system	0.0	44.4	20.7	5.6	36
B3. Loss of telecommunication	13.9	44.4	27.8	22.2	24.5
B4. Electrical system outage	13.9	66.7	38.1	40.2	11
B5. Computer system incident/cyber attack	0.0	66.7	30.3	33.3	20
C1. Hazardous materials railroad incident	13.9	61.1	30.1	23.6	21
C2. Hazardous materials roadway incident	13.9	91.7	36.6	25.0	13
C3. Hazardous materials pipeline incident	0.0	61.1	22.2	7.6	32
C4. Hazardous materials fixed facility incident	16.7	55.6	32.1	27.1	18
D1. Aircraft transportation accidents	16.7	50.0	27.8	10.4	24.5
D2. Roadway transportation accidents	13.9	66.7	38.8	12.2	10
D3. Railway transportation accidents	11.1	66.7	28.3	19.4	22
E1. Correctional center incident	0.0	33.3	18.2	10.4	37
E2. Civil unrest	0.0	30.6	23.0	5.6	30
E3. Terrorism incident	19.4	50.0	27.5	4.9	26
E4. Biological contaminants (anthrax, smallpox, etc.)	13.9	25.0	22.0	4.9	33
E5. Workplace violence	13.9	75.0	28.9	37.5	9
E6. School violence	13.9	66.7	36.9	22.2	12
F1. Communicable disease outbreak or epidemic	13.9	75.0	32.3	25.7	17
G1. Major fire	16.7	66.7	41.2	31.9	8
G2. Explosion	11.1	50.0	34.6	26.4	15
G3. Mass casualty incident	13.9	50.0	24.2	7.6	27
G4. Building collapse or cave-in	11.1	44.4	22.5	14.6	31

[a] *Perceived threat increases with percentage.*

[b] *Interquartile range acts as a measure of agreement upon the perceived level of threat with a smaller interquartile range indicating stronger agreement and a larger interquartile range indicating weaker agreement.*

Source: SEWRPC.

Table 8

SUMMARY OF ESTIMATED DISASTER DAMAGES THAT AFFECTED THE CITY OF MILWAUKEE FOR FEDERALLY DECLARED DISASTERS AND EMERGENCIES: 1973-2010

Date	Event	Affected Area	Reported Damages	
			Fatalities	Property Damages (in thousands of dollars)[a]
April 1973	Flooding	Milwaukee County	0	- -
1976	Ice storm	Milwaukee County	- -	- -
January 1979-December 1978	Snow emergency	Milwaukee County	0	- -
August 1986	Flooding	Milwaukee County	2	$ 27,111.5
September 1986	Flooding	Milwaukee County	0	8,085.9
June 1993	Flooding and wind damage	Milwaukee County	0	- -
August 1996	Flooding, severe storms	Milwaukee County	0	- -
July-June 1997	Flooding	Milwaukee County	0	104,046.3
August 12, 1998	Flooding and high winds	Milwaukee County	0	14,507.0
July 2000	Flooding, severe storms	City of Milwaukee and surrounding municipalities	0	8,442.6
January 2001-December 2000	Snow emergency	Milwaukee County	0	- -
May 2004	Flooding, severe storms	Milwaukee County	2	1,158.3[b]
February 2008	Snow emergency	Milwaukee County	0	- -
June-July 2008	Severe storms, tornadoes, and flooding	Milwaukee County	0	79,951.3
July 2010	Severe storms, tornadoes, and flooding	Milwaukee County	1	34,828.9
Total	- -	- -	5	$278,131.8

[a]*Dollar values are adjusted to year 2010 by using the annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

[b]*As of July 30th, 2004, FEMA had received over 2800 applications for assistance and had approved 668 grants related to the May flooding event. As of this date, FEMA had approved over $1.05 million in housing assistance, and over $0.5 million in other needs assistance for Milwaukee County (FEMA Disaster Summary, July 30th, 2004).*

Source: Milwaukee County Pre-Disaster Mitigation Plan, National Climate Data Center, Wisconsin Emergency Management, FEMA, and SEWRPC.

It is also important to note that the amount of estimated losses reported from major events has been increasing. Based upon the date of the occurrence of events summarized in Table 9, over $192 million in hazard-related property damages were reported in association with hazards which took place between 2000 and 2010. This is about 59 percent of all reported damages over the period 1950 to September 2010. The decade of the 1990s was an unusually active one for natural disasters in the State of Wisconsin as a whole. Another possible reason for the increase in reported damage estimates may be improvements in how local community and County officials report damages. Nonetheless, it is apparent that the City of Milwaukee is experiencing significant rates of loss due to natural hazards.

Table 9

WEATHER HAZARD EVENTS RECORDED IN MILWAUKEE COUNTY, WISCONSIN FROM 1950 TO SEPTEMBER 2010 (SORTED BY NUMBER OF EVENTS)

Event	Total	Reported Damages		
		Fatalities[a]	Injuries[a]	Property Damage[b] (in thousands of dollars)
Dust Storms	0	0	0	$ 0.0
Wild Fires/Forest Fires	0	0	0	0.0
Tornadoes and Waterspouts	18	0	176	16,622.2
Lightning	26	0	0	2,499.2
Fog	44	0	0	0.0
Flood	45	1	1	265,733.0
Temperature Extremes	51	118	183	28.3
Snow and Ice	63	14	1	14.2
Hail	103	0	2	8,754.7
Thunderstorms/High Winds	178	4	22	35,177.9
Total	528	137	363	$327,829.5

[a]*Deaths and injuries reported were, in some cases, based upon a geographic area impacted by the hazard event which affected Milwaukee County and had a larger area of impact than the City itself.*

[b]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

Source: Milwaukee County Pre-Disaster Mitigation Plan, the National Climatic Data Center (NCDC) a part of the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), and the National Environmental Satellite, Data and Information Service (NESDIS).

The NWS data summarized in Table 9 shows that thunderstorms and high winds, followed by hail storms, snow and ice, and temperature extremes, are the most frequent weather hazard. Flooding, followed by thunderstorms and high winds, and tornadoes, are the most damaging weather hazards; and extreme temperature, primarily heat, followed by snow and ice and thunderstorms and high winds, are the most deadly weather hazards. In addition, it should be acknowledged that weather events are often complex and damages may occur from multiple hazards, such as when hail, rain, wind, and tornadoes strike during a single storm.

To illustrate the potential frequency of thunderstorms and tornadoes, a review was made of the warnings historically issued by the National Weather Service, as shown on Table 10. Over the period 1982 through 2009, there were 382 thunderstorm-related watches or warnings and 95 tornado-related watches or warnings issued for Milwaukee County. On average, the National Weather Service offices in Wisconsin issue less than one tornado warning, and nine to 10 severe thunderstorm warnings for Milwaukee County per year.

Improved weather forecasting and warning systems, as well as stronger building codes, help explain why tornado-related mortality has not been prevalent in the recent past, although tornadoes remain a very serious threat to human life. The sudden emergence of temperature extremes as a leading cause of hazard-related mortality is most likely due to a combination of improved recordkeeping by health organizations and the longer life expectancy of individuals. Mortality from heat waves disproportionately affects the elderly.

Summary and Ranking of Hazards

There are several ways the list of specifically considered hazards can be ranked and summarized in the City of Milwaukee hazard mitigation plan. Current guidance for all hazard mitigation plans promotes comprehensive consideration of all natural hazards. These hazards have been ranked by consideration of their frequency, amount

Table 10

MILWAUKEE COUNTY SEVERE WEATHER HISTORY: 1982-2009

Year	Severe Thunderstorm		Tornado	
	Watch	Warning	Watch	Warning
1982	1	1	0	0
1983	5	3	1	0
1984	6	6	7	2
1985	5	1	6	1
1986	7	3	6	0
1987	5	8	2	2
1988	0	4	2	0
1989	10	6	2	1
1990	5	5	4	0
1991	10	4	2	0
1992	3	2	3	0
1993	10	5	4	0
1994	9	7	3	2
1995	10	6	1	0
1996	5	7	9	0
1997	9	5	2	0
1998	11	5	2	0
1999	8	7	0	0
2000	7	14	3	2
2001	10	4	1	1
2002	7	5	1	0
2003	7	4	3	0
2004	15	9	5	0
2005	11	9	0	0
2006	17	16	2	0
2007	3	9	3	0
2008	8	14	4	3
2009	6	3	1	2
Total	210	172	79	16

Source: National Weather Service Forecast Office.

of damage, and death and injuries incurred, as well as by concerns and degree of importance assigned by the collective judgment of the City of Milwaukee Hazard Mitigation Steering Committee.

In addition, selected hazards other than natural hazards have been identified for consideration in the City of Milwaukee hazard mitigation plan based upon input from the City Hazard Mitigation Steering Committee. The hazards to be specifically considered in the plan and their ranking are summarized in Table 11, along with qualitative information on the hazard severity. As part of the updating process, the ranking of hazards to be considered in the initial plan was reevaluated giving consideration to data related to the occurrence of hazards since the original plan and to the perceived risk associated with each hazard as summarized in Table 7.[1]

[1]*The rankings in Table 11 were assigned by combining rankings of the natural hazards listed based upon the number of occurrences, amount of damages, numbers of fatalities and injuries reported since 1950, and the perceived risk associated with each hazard as identified by the Steering Committee and summarized in Table 7. It is important to note that some of the natural hazards listed in Table 11 represent combinations of hazards listed in Table 7. For example, while specific risks associated with thunderstorms, such as hail and lightning are listed separately in Table 7, they are combined into one category in Table 11.*

Table 11

SUMMARY OF HAZARDS TO BE CONSIDERED IN THE CITY OF MILWAUKEE HAZARD MITIGATION PLAN

Hazard	Risk of Occurrence (high, medium, or low)	Warning Time (short, medium, or long)	Damage to Property (high, moderate, or low)	Threat to Life Safety (high, medium, or low)	Duration of Impact (long, moderate, or short)	Size of Affected Area (large, medium, or small)
Natural Hazards						
Flooding	High	Medium	High	Low	Moderate	Large
Thunderstorm, High Wind, Hail, Lightning	High	Short	High	High	Long	Large
Winter Storms	Medium	Medium	Low	Medium	Moderate	Large
Tornadoes	Low	Medium	High	Medium	Short	Small
Temperature Extremes	Medium	Long	Low	High	Long	Large
Coastal Erosion	Low	Long	Medium	Low	Long	Small
Earthquake	Low	Short	Low	Low	Short	Large
Other Hazards						
Contamination or Loss of Water Supply	Low	Short	Moderate	Medium	Moderate	Medium
Hazardous Materials Incident	High	Short	Low	Medium	Moderate	Small
Medical/Health Risks	Low	Short	Low	High	Moderate to long	Small to large
Terrorism Incident	Low	Short	Moderate to high	High	Short	Small to medium
Major Fire and Emergency Incident	Low	Short	Low	High	Moderate to long	Small to large

Source: City of Milwaukee Hazard Mitigation Steering Committee and SEWRPC.

Clearly, hazard severity can be assessed and ranked in a variety of ways. The purpose of ranking hazards is to help set priorities and direct more resources to address those hazards of the greatest severity. However, the kinds of mitigation actions that will be needed and warranted depend on the type of vulnerability to be addressed. Some hazards, such as excessive heat and lightning, are unlikely to cause a disaster, but can be fatal and, therefore, are serious hazards. Vulnerability to such hazards can best be addressed by preventative measures, such as public information to encourage hazard awareness and personal protection. Other hazards, such as flooding, are pervasive and devastating, and may require a variety of tools—mapping, building codes, zoning laws, insurance, elevation or acquisition of floodprone structures, and public awareness—to effectively reduce the risk of disaster. However, flooding might not result in more fatalities than a heat wave. In general, ranking hazards by the number of deaths that they cause shifts the focus away from major and largely avoidable disasters, such as floods. Weather hazards that have caused past City of Milwaukee disasters are probably the hazards that will cause future disasters. However, the types of natural hazards that result in fatalities remain a public health and safety concern.

VULNERABILITY ASSESSMENT ANALYSIS METHODS AND PROCEDURES

In the previous section of this report the hazards considered applicable to the City of Milwaukee were identified and ranked. This section of the report develops a vulnerability assessment for the identified hazards, including vulnerable asset description, hazard event profiling, and estimated losses information. This vulnerability assessment provides the basis for developing mitigation strategies which address the identified vulnerabilities.

This section of the report, which includes a description of the methods and procedures utilized in developing the vulnerability assessment, is followed by the assessment for each of the identified hazards. The vulnerability assessment for each hazard includes, where applicable, a profile of hazard events, a description of potentially affected assets, and estimates of potential losses. In addition, the potential for future changes in the vulnerability of the hazard to the City is included for each of the identified hazards. Since the hazard mitigation plan involves one municipality, no specific multi-jurisdictional variance of risk is included. Where there is a specific variance of risk involved within the City of Milwaukee, it is noted.

The procedures utilized in the vulnerability analyses are based upon guidance provided by the Federal Emergency Management Agency (FEMA) and the Wisconsin Department of Military Affairs, Division of Emergency Management.[2] The analysis includes three components: 1) profile of hazard events, 2) inventory of assets, and 3) estimation of losses. In addition, where applicable, potential changes in vulnerability under future conditions and the variance of vulnerability within the City of Milwaukee is analyzed.

In general, the procedures utilized in this analysis focused upon the methodology consistent with the Hazard U.S. (HAZUS) software as maintained by the Federal Emergency Management Agency. In many cases, the mapping of assets and problem areas was done utilizing the detailed mapping and orthophotography available for the City of Milwaukee in both hard copy and digital form, including general base maps, large-scale topographic and cadastral maps, and year 2000 large-scale orthophotographs. All of the mapping was done utilizing geographic information system (GIS) ArcMap software.

With regard to the community assets, the basic City of Milwaukee inventory data set forth in Chapter II include data and mapping on existing and planned land use, demographics, and economic characteristics of the City; property value; flood hazard mapping; Lake Michigan coastal erosion hazard areas; transportation and utility systems; public safety facilities and services; and critical community facilities. These data have been used and supplemented with information obtained from the National Oceanic Atmospheric Administration National Climatic Data Center; the Wisconsin Department of Military Affairs, Division of Emergency Management; and more hazard-specific local data, such as building-specific structure values, as the basis for the community asset data base. The profiling of hazard events was developed by utilizing HAZUS methodology, data available on the Federal Emergency Management Agency and National Oceanic and Atmospheric Administration National Climatic web sites; data provided by the Wisconsin Department of Military Affairs, Division of Emergency Management; and file data available from the City of Milwaukee and the Southeastern Wisconsin Regional Planning Commission (SEWRPC).

Data and estimated losses and vulnerability were developed utilizing standard risk assessment methodology as set forth in FEMA and State Division of Emergency Management guidelines for hazard mitigation planning where hazards can be estimated spatially and by order of magnitude over a range of events. All damage estimates cited have been adjusted to constant 2010 dollars using the Consumer Price Index. For hazards which cannot be quantified, alternative approaches have been used relying on qualitative measures.

A vulnerability description has been included for each of the applicable hazards listed in Table 11.

VULNERABILITY ASSESSMENT FOR FLOODING AND ASSOCIATED STORMWATER DRAINAGE PROBLEMS

Flooding is a significant hazard in the City of Milwaukee. As described in Chapter II, there are approximately 61 miles of major streams in the City of Milwaukee, located within five watersheds: the Milwaukee River, Menomonee River, Kinnickinnic River, Oak Creek, and Root River watersheds. A sixth watershed encompasses those areas adjacent to Lake Michigan which drain directly into the Lake through intermittent streams. Aside from Lake Michigan, no other major lakes (those over 50 acres) exist in the City of Milwaukee.

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[2]*Federal Emergency Management Agency*, State and Local Mitigation Planning How-to Guide, *"Understanding Your Risks, Identifying Hazards and Estimating Losses," Publication No. FEMA 386-2, August 2001; Federal Emergency Management Agency*, Local Multi-Hazard Mitigation Planning Guidance, July 1, 2008. *See also Federal Emergency Management Agency*, State and Local Plan Interim Criteria Under the Disaster Mitigation Act of 2000, *July 11, 2002.*

Floodlands are the wide, gently sloping areas contiguous to, and usually lying on both sides of, a stream channel. For planning and regulatory purposes, floodlands are normally defined as the areas subject to flood inundation by the one-percent-annual-probability (100-year recurrence interval) flood event. The floodlands shown on Map 5 in Chapter II of this report have been identified by the City of Milwaukee, the Southeastern Wisconsin Regional Planning Commission, and the Federal Emergency Management Agency. Approximately three square miles, not including surface water in existing stream channels, or about 3 percent of the total area of the City, is located within the one-percent-annual-probability flood hazard area.

In addition to flooding, stormwater drainage problems exist on a scattered basis throughout the City of Milwaukee. The distinction between stormwater drainage, stormwater management, and flood control is not always clear. For the purpose of this report, flood control is defined as the prevention of damage from the overflow of natural streams and watercourses. Drainage is defined as the control of excess stormwater on the land surface before such water has entered stream channels. The term "stormwater management" encompasses both stormwater drainage and nonpoint source pollution control measures. The focus of this section is on the flooding hazard, with stormwater drainage issues discussed as required for particular storm events.

In order to evaluate various potential flood mitigation alternatives for the City of Milwaukee and select the most effective and feasible flood mitigation strategies, the existing flooding problems in the City must first be analyzed. Accordingly, this section summarizes the extent and severity of the flooding problems within the City and the potential for these problems to increase in the future, and sets forth analyses of such problems as developed under detailed floodland management system planning programs as described in the Flood Mitigation Plan for the City of Milwaukee revised in 2003[3] and various Milwaukee Metropolitan Sewerage District watercourse system plan reports.

Historical Flooding Problems

As noted earlier in this chapter, a number of major flooding events, including several that caused significant damage, have been recorded in the area now encompassed by the City of Milwaukee, as well as in the watershed areas partly encompassed within the City, since the areas involved were settled by Europeans in the 19th Century. Below is a list and brief description of the historical major flood events between 1897 and 1986 that have affected the City of Milwaukee as summarized in the Milwaukee County Pre-Disaster Mitigation Plan[4] and the City of Milwaukee Flood Hazard Mitigation Plan.[5] The descriptions of the floods during that time period are presented chronologically by event, followed by watershed-specific descriptions. Those descriptions are followed by a review of more-recent floods that have occurred from 1993 to the present.

- March 1897—This flood event inundated approximately a 1.7-mile-long reach of the Menomonee River beginning just north of present-day W. Wisconsin Avenue in Milwaukee County and extending downstream into the Menomonee River industrial valley. Considerable economic loss was incurred.

- March 1912—This snowmelt flood event occurred in the Kinnickinnic River watershed and is the earliest major flood of record within the watershed for which any significant amount of information is available. Damage caused by this flood was concentrated in the 0.77-mile-long reach of the Kinnickinnic River between present-day S. 6th Street and present-day S. 16th Street. Damage to homes along that reach totaled thousands of dollars, with floodwaters reported above the windowsills of some of the structures.

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[3]*SEWRPC Community Assistance Planning Report No. 261*, Flood Mitigation Plan for the City of Milwaukee, Milwaukee County, Wisconsin, *October 2000, revised April 2003.*

[4]*Milwaukee County Emergency Management,* Milwaukee County Pre-Disaster Mitigation Plan, *August 2004.*

[5]*SEWRPC Community Assistance Planning Report No. 261,* op. cit.

- June 1917—This flood event caused extensive damage in the lower Menomonee River watershed, particularly in the Menomonee River industrial valley. The Menomonee River floodplain below what is now the Wisconsin Avenue viaduct was subjected to very serious flooding that drove almost every resident there from the area. Several businesses with major facilities in the Menomonee River industrial valley, including the Chicago, Milwaukee, St. Paul & Pacific Railroad and the Falk Corporation, incurred significant flood damage.

- January 1938—This flood event, while significant, is known to have affected only scattered areas along the lower Kinnickinnic River and along Wilson Park Creek. The Kinnickinnic River overflowed its banks near a railway bridge crossing at S. 18th Street extended, depositing large blocks of ice on the tracks, and flooded a railroad bridge located directly west of S. 20th Street. Although this flood occurred in January, it was attributed to the occurrence of heavy rainfall.

- June 1940—This flood event inundated and caused damage to areas primarily along the Menomonee River with scattered occurrences of flooding also reported along Honey Creek, Underwood Creek, and the Little Menomonee River. The S. 84th Street bridge over Honey Creek in the City of Milwaukee was washed out. Near the confluence of the Menomonee and Little Menomonee Rivers in Milwaukee, rising flood waters forced segments of what is now N. Mayfair Road and W. Hampton Avenue to close.

- March/April 1960—This flood event primarily occurred in the Kinnickinnic River and Menomonee River watersheds as the result of a snowmelt-rainfall event. The event caused widespread damage in the City of Milwaukee along the Kinnickinnic River and scattered problems in the City along Wilson Park Creek. The flood caused problems along the Kinnickinnic River as far west as S. 43rd Street and along Wilson Park Creek as far south as General Mitchell Field (now General Mitchell International Airport). Basements of residential and commercial buildings were flooded, collapsing walls in some cases.

- August 1960—This flood event caused extensive flooding along the Kinnickinnic River downstream of S. 43rd Street. A portion of the flood flow from the Kinnickinnic River was diverted from the stream at W. Montana Street extended and flowed five blocks in an easterly direction along the Chicago & North Western Railway right-of-way to S. 12th Street, where the flow turned northward, moving about two blocks along S. 12th Street to rejoin the Kinnickinnic River. Considerable flood damage occurred in basements located along this route, including damage to appliances and other contents. Farther upstream, residential structures along W. Manitoba Avenue again experienced flood damage and numerous basements were flooded and at least one incident of basement wall collapse was reported.

- September 1972—This flood event caused by a relatively large quantity of rainfall occurring under wet antecedent moisture conditions resulted in significant flood damage and disruption in the Kinnickinnic River watershed within the City of Milwaukee. Most of the damage and disruption involved was confined to the reach of the Kinnickinnic River between S. 6th Street and S. 16th Street in the City. The flood problems were restricted largely to this reach because of the considerable channel modifications that had been completed by this time within the watershed on the Kinnickinnic River, Wilson Park Creek, Lyons Park Creek, and other tributaries, thereby providing for the control of the relatively high flows that were experienced. Floodwaters overtopped the low point of the roadways of the 10 bridges that then crossed the Kinnickinnic River beginning with and including S. 7th Street and extending through S. 15th Street, extending as much as about one city block away from the River. Floodwaters overtopped the S. 43rd Street bridge over the Kinnickinnic River in the City. Damage occurred to residential and commercial buildings.

- April 1973—This major flood event caused flood problems throughout most of the seven-county Southeastern Wisconsin Region, with certain areas, such as the Kinnickinnic River and Menomonee River watersheds, experiencing severe flood damages. The flooding that occurred was somewhat more serious than what would ordinarily be expected under the relatively moderate levels of rainfall involved because of the existence of very wet antecedent moisture conditions.

- August 1986—This flood event centered in a one to four-mile-wide band extending northwesterly from the City of Oak Creek through General Mitchell International Airport to the northern portion of the City of Wauwatosa. It resulted in a maximum rainfall of 6.84 inches in 24 hours, the single day record at the General Mitchell International Airport recording station. Widespread flooding occurred at the airport, which was shut down. Severe damage occurred especially along the reach of the Kinnickinnic River between S. 6th Street and S. 16th Street in Milwaukee. Flooding impacts occurred in other areas, including along Wilson Park Creek, located in the Kinnickinnic watershed, and the near northwestern portion of Milwaukee along the Menomonee River and Woods Creek, where severe basement flooding occurred due to sewer backup.

Kinnickinnic River Watershed

Measured by the spatial extent of the flood damage and disruption resulting from the event, the April 1973 flood (which within the Kinnickinnic River watershed had a 1.8 percent annual probability of occurrence) was not the most serious flood experienced in the watershed. In addition, by this time, as noted above, considerable channel modifications had been completed within the Kinnickinnic River watershed on the Kinnickinnic River, Wilson Park Creek, Lyons Park Creek, and other tributaries, thereby again providing for the control of the relatively high flood flows that were experienced. Within the watershed, major damage and disruption attributed to the flood were confined to the S. 6th Street to S. 16th Street reach of the Kinnickinnic River in the City of Milwaukee, although damage also occurred at General Mitchell Field. Although major channel modifications had been completed throughout the aforementioned Kinnickinnic River reach in 1961, the modified channel in combination with the 13 stream crossings then in the reach did not have sufficient capacity to convey the 1973 flood flows within the channel banks. As a result, floodwaters overtopped the low point of the roadways of all 11 bridges then crossing the Kinnickinnic River beginning with and including S. 7th Street and extending through S. 15th Place. Accordingly, overland flooding occurred on both sides of the River between S. 6th Street and S. 16th Street, extending as much as 700 feet, or more than one city block, away from the River. The areal extent of the effect of flooding undoubtedly extended outside the area affected by the overland flooding in the form of secondary flooding. Many residential and commercial buildings in the area of overland flooding incurred both structural damage and damage to contents as a result of basement or first-floor flooding. Extensive monetary losses occurred in the case of some individual structures, including a $16,000 loss resulting from damage to the inventory of a pharmacy located less than one-half block from the Kinnickinnic River. In addition, an isolated incident of flood damage occurred at General Mitchell Field, where a concrete box culvert beneath a taxiway in the northwestern corner of the airport suffered serious damage as a result of high stormwater flows.

Except for the serious flood damage and disruption that occurred in the S. 6th Street to S. 16th Street reach of the Kinnickinnic River, no serious flood problems were reported in the Kinnickinnic River watershed as a result of the April 1973 flood event. Significantly, the area along and near the River between S. 16th Street and S. 43rd Street, which had experienced serious flood damage and disruption during the major flood events of 1912, 1917, 1938, and 1960, did not exhibit any flood problems as the result of the April 1973 flood event, even though the flood flows generated by the earlier flood events were probably of the same order of magnitude as that of the April 1973 flood. As in the case of the September 1972 flood event, the absence of flood problems along the S. 16th Street to S. 43rd Street reach of the River in the April 1973 flood event probably reflects the effectiveness of the channel improvements made to the River in that reach between 1960 and 1965.

An August 1986 storm event centered in a one- to four-mile-wide band extending northwesterly from the City of Oak Creek through General Mitchell International Airport to the northern portion of the City of Wauwatosa near Lawrence J. Timmerman Airport resulted in a storm total rainfall of 6.84 inches in 24 hours, the single-day record

at the General Mitchell International Airport recording station. The 24-hour rainfall recorded at the airport had about a 0.5 percent annual probability of occurrence. Widespread flooding occurred in the Mitchell International Airport area and closed the airport. The overall flooding attendant to the storm event caused great damage, including severe damage along the reach of the Kinnickinnic River between S. 6th Street and S. 16th Street in the City of Milwaukee. However, the August 1986 rainfall event caused an area of inundation along this reach of the River that was substantially smaller than the area along the same reach that was inundated in the April 1973 flood event. The substantial differences in the areas of inundation may be attributed to the proper performance of significant channel improvements implemented between 1973 and 1986. A one-percent-annual-probability flood would have been contained within the limits of the improved channel. It is clear that the flood control improvements involved functioned as designed to significantly reduce flood damages in the August 1986 storm.

In the August 1986 flood event, significant flooding impacts also occurred along Wilson Park Creek, located in the Kinnickinnic River watershed. Severe basement flooding due to sewer backup was also experienced in numerous areas in the Kinnickinnic River watershed that are remote from streams.

Menomonee River Watershed

The April 1973 flood event, which illustrates the extreme sensitivity of rainfall-induced floods to antecedent moisture conditions in the Menomonee River watershed, was the most severe flood event recorded in the watershed up to that time in terms of damage and disruption. In that flood event, moderate rainfall volumes occurred over the entire watershed under very wet antecedent moisture conditions. Although the event caused flood problems throughout most of the urban area of the watershed, which at the time encompassed about 54 percent of the total area of the watershed, the damage and disruption arising from the event were most serious along Underwood Creek in the Village of Elm Grove and along the Menomonee River in the City of Wauwatosa. In addition, significant damage and disruption and/or significant overland flooding occurred in the Cities of Mequon and Wauwatosa and the Villages of Germantown and Menomonee Falls. However, the flood had little impact on the other riverine-area communities in the watershed, including the City of Milwaukee. The general absence of significant flood problems in these communities in the April 1973 flood event is primarily attributable to the presence of structural flood control works that protected riverine-area residential, commercial, and industrial development. Thus, largely as a result of channel modifications and sheet steel floodwalls completed by the City of Milwaukee Sewerage Commission and the Metropolitan Sewerage Commission between 1962 and 1968 along the 1.5-mile-reach of the Menomonee River from the Chicago, Milwaukee, St. Paul & Pacific Railroad yard in the Menomonee River industrial valley upstream to about N. 45th Street in the City of Milwaukee, the April 1973 flood there was confined to the channel area. Similarly, a sheet steel floodwall constructed along the Menomonee River by The Falk Corporation in 1962 prevented flooding at the company's location, even though the peak stage of the April 1973 flood was about two feet higher than that of the March-April 1960 flood, which caused the Falk Corporation to suffer extensive losses. It is important, however, to recognize that there were areas in the Menomonee River watershed that continue to experience localized stormwater problems.

In the August 1986 flood event, significant flooding impacts also occurred near northwestern portion of the City of Milwaukee, including the area along the Menomonee River and Woods Creek adjacent to Milwaukee County Stadium. Severe basement flooding due to sewer backup was also experienced in numerous areas in the Menomonee River watershed that are remote from streams.

Milwaukee River Watershed

With regard to the Milwaukee River watershed, the studies performed in the preparation of the initial comprehensive plan for the watershed adopted by SEWRPC in 1972, as well as research performed under subsequent related planning efforts, indicated that up to, and including, 1971, five major flood events occurred within the watershed since its settlement by Europeans: one in March 1918, one in August 1924, one in March 1929, one in March 1959, and one in March-April 1960. Although no significant widespread damage occurred as a result of these flood events in areas then or now located within the City of Milwaukee, the historical experience with flooding in the portion of the Milwaukee River watershed located within the City includes flooding along the 3.1-mile-long reach of the River extending from the site of the North Avenue dam to the mouth of the River. The

damages associated with such flooding have been relatively very minor in the reach involved, being limited to minor damage due to basement seepage in structures along the River and to the backup of sewers within the downtown area of the City. Some shallow inundation of low-lying street intersections located relatively close to the Milwaukee River reach involved has also occurred.

No historical flood damages are known to have occurred along the approximately three-mile-long reach of the Milwaukee River extending from the North Avenue dam to Estabrook Park. The riverbanks along this reach are generally high, and a considerable proportion of the stream bank area is devoted to park or other open space uses.

In the August 1924 flood event, portions of the 2.1-mile-long reach of the Milwaukee River extending from Estabrook Park to W. Silver Spring Drive experienced very high water levels, as evidenced by reported high water marks. The peak flood stage of the River at the W. Silver Spring Drive crossing of the River, located in the present-day City of Glendale, was about 11 feet above normal and only about 2.4 feet below the crown of the road over the bridge. Much of the potential damage in the reach involved was eliminated, however, by the implementation in 1937 of channel improvements between Lincoln Park and N. Port Washington Road. Basement flooding has also been experienced in the past along this reach of the River due to stormwater drainage problems not directly related to the flood stages of the Milwaukee River. Remedial measures were implemented by the City of Milwaukee to alleviate the surface drainage problems that caused this basement flooding.

Floods of moderate severity occurred on the Milwaukee River in 1959 and in 1960, with the 1959 flood having a 10-percent-annual-probability of occurrence and the 1960 flood being slightly larger. The major floods that occurred in 1918 and 1924 in the City of Milwaukee each annual probabilities of occurrence of about 1.3 percent.

Flooding, in various degrees, has long commonly occurred adjacent to Lincoln Creek, which is tributary to the Milwaukee River and whose subwatershed is located largely within the City. Flooding along Lincoln Creek has increased proportionally to the conversion of land within its subwatershed from open, rural use to urban use. Subsequently, channel improvements and bridge replacements were implemented to accommodate the increased flows. During the period from 1960 through 1981, the four largest flood events of record along Lincoln Creek occurred in 1964, 1968, 1972, and 1973. The major consequences of these and other runoff events along Lincoln Creek have been flooding of roadways and underpasses, first-floor flooding of buildings, and basement flooding caused by sewer backup. Over the period from 1960 through 1975, more than 1,300 separate flooding and water-related problems were reported to the City of Milwaukee by property owners in the Lincoln Creek area. The problems thus reported included first-floor inundation, yard flooding, and basement flooding, with the most common complaint being basement flooding. Studies and planning efforts completed subsequent to SEWRPC's preparation and adoption of its initial comprehensive plan for the Milwaukee River watershed, including a SEWRPC study undertaken to develop the detailed flood control plan for Lincoln Creek that was adopted by SEWRPC in 1983 as an amendment to the Milwaukee River watershed study, identified the Lincoln Creek subwatershed area in the City of Milwaukee as a specific problem area, with over 1,600 structures located within the flood hazard area.

In late 2001, MMSD completed a comprehensive flood control and stream rehabilitation project on Lincoln Creek which included bridge removals and conveyance modifications, in-line floodwater storage, floodplain lowering and widening, habitat enhancements, and two floodwater detention facilities. The detention facilities include the 26-acre Green Tree Detention Pond and the 11-acre Havenwoods wetland/detention facility which provide a total of 229 acre-feet of storage. The project spanned more than 9 miles of stream channel and included bio-engineered stream restoration using native prairie and wetland plants. This project removed all 1,600 homes and businesses from the one-percent-annual-probability floodplain, and is reflected in the effective FEMA digital flood insurance rate map for Milwaukee County.

Oak Creek Watershed

Within the portion of the Oak Creek watershed that is located within the City of Milwaukee, historical flood damages have been limited to two areas: 1) one area along the North Branch of Oak Creek located east of S. 13th

Street and north of W. College Avenue where three commercial buildings are currently located within the flood hazard area; and 2) and an area in the southern portion of General Mitchell International Airport where three governmental structures are located in the flood hazard area of the Mitchell Field Drainage Ditch.

Root River Watershed
Neither any historical flood damages nor any current flood problem areas have been identified within the portions of the Root River watershed that are located within the City of Milwaukee.

Lake Michigan Direct Drainage Area
Flooding problems are reported to be relatively minimal in the portion of the Lake Michigan direct drainage area that is located within the City.

Description of Recent Flood Events
Since 1993, there have been 25 flood events reported by the NCDC affecting the City of Milwaukee and some of the watershed areas that lie partly within its boundaries, or an average of 1.5 flood events per year. Those flood events were reported to the NCDC to have caused damages totaling about $37 million in property damage, and none related to crop damages. The most severe recent events occurred in 1997, 1998, 2000, 2004, 2008, 2009, and 2010. These flood events, which are significant with regard to the current flood mitigation planning effort for the City, include the following:

- The event of June 20-21, 1997, when a period of moderate rainfall followed by intense thunderstorms centered in northern Milwaukee County resulted in at least four inches of rain across the County, with much of the County receiving at least six inches of rain. More than nine inches of rain was recorded in the Village of Brown Deer. Severe localized damage occurred in Brown Deer, the City of West Allis, and the Lincoln Creek area of the City of Milwaukee. The reach of Lincoln Creek between N. 37th Street and N. 60th Street in the City experienced significant flooding and stormwater drainage problems during the flood event. Of the total of 1,510 flooding complaints received by the City in the one-week period following the flood event, about 980, or 65 percent, occurred with regard to the Lincoln Creek subwatershed. Severe, direct overland flooding also occurred in several other areas, including areas along the Menomonee River in the Cities of Milwaukee and Wauwatosa. Sewer backup flooding was reported in the Kinnickinnic River watershed, but no damages resulting from overbank flooding along waterways in that watershed were reported. There were, however, numerous occurrences of stormwater drainage and sanitary sewer backup problems in communities located throughout the areas of heavy rainfall.

  Estimated flood damages during the June 1997 event were $92.7 million[6] in Milwaukee County. Assistance received by the City of Milwaukee through the FEMA and State Hazard Mitigation and Public Assistance programs administered by the Wisconsin Department of Military Affairs Division of Emergency Management associated with this event totaled about $1,122,000 under the FEMA Hazard Mitigation program and $1,412,000 under the FEMA Public Assistance program.

- The event of July 2, 1997, a “follow-up” storm to the June 20-21, 1997, storm event, involved as much as four inches of rain, but resulted in little additional property damage.

- The event of August 6, 1998, in which over six inches of rain fell in northwestern Milwaukee County and eastern Waukesha County, resulting in severe direct overland flooding for a second consecutive year along Lincoln Creek in the City of Milwaukee as well as along the Menomonee River in the City of Wauwatosa, Underwood Creek in the City of Brookfield and the Village of Elm Grove, and Southbranch Creek in the Village of Brown Deer. Significant property damage resulted from over-

[6]*Damages adjusted to 2010 dollars using the Consumer Price Index.*

bank flooding along Lincoln Creek and the Menomonee River. As in the 1986 and 1997 major storm events in the area, there were numerous occurrences of stormwater drainage and sanitary sewer backup problems in communities located throughout the areas of heavy rainfall.

Estimated flood damages during the August 1998 event were $13.1 million[7] in Milwaukee County. Assistance received by the City of Milwaukee through the FEMA and State Hazard Mitigation and Public Assistance programs associated with this event totaled about $227,000 under the FEMA Public Assistance program.

- The event of July 2, 2000, in which as much as 6.5 inches of rain fell on portions of eastern Waukesha and southern Milwaukee Counties, including 4.42 inches recorded at General Mitchell International Airport on the far south side of the City of Milwaukee. The storm associated with this event produced one tornado in southern Milwaukee County about three-fourths of a mile northwest of 27th Street and Ryan Road in the City of Franklin. The tornado moved east/northeast through the City of Oak Creek and into neighboring Racine County. In addition to damage from the tornado, significant damages due to flooding also occurred. The most severe flooding occurred in the communities south of Milwaukee, including the Cities of Franklin and Oak Creek and the Villages of Greendale and Hales Corners. In the City of Milwaukee, reported damages occurred mainly in the Kinnickinnic River and Oak Creek watersheds, with damages mostly limited to basement flooding due to either sewer backup or inoperable sump pumps cause by power outages.

  Estimated flood damages during the July 2000 event were $8.1 million[8] in Milwaukee County.

- The storms that occurred in the Region in May of 2004 occurred over relatively long periods of time and the probability of occurrence of the rainfalls at a given location generally decreased as storm duration increased. In the City of Milwaukee, widespread flood damage was not reported. The most severe five- and 10-day rainfalls in the City occurred at the City of Milwaukee gauge in the Menomonee River watershed at 8800 W. Lisbon Avenue where the annual probability of occurrence for both storm durations was estimated at 10 to 20 percent. The annual probabilities of the 15- and 20-day rainfalls at that location were in the range from 4 to 10 percent and the 25-day rainfall probability was about 2 percent. Despite the occurrence of relatively rare long-term rainfalls at the W. Lisbon Avenue gauge, the recorded peak flow on the Menomonee River at N. 70th Street in the City of Wauwatosa had a probability of only 20 to 50 percent. That flood probability is in line with the estimated five-day rainfall probability over the entire Menomonee River watershed where rainfall amounts were generally less at locations other than the W. Lisbon Avenue gauge. Elsewhere, recorded peak flood flows on streams in the City of Milwaukee had annual probabilities of occurrence ranging from greater than 50 percent on the Kinnickinnic River at S. 11th Street to 10 to 20 percent on the Milwaukee River.

- The June 2008 rainfall events broke three records for Milwaukee. The 7.18 inch, 48-hour rainfall occurring on June 7 and 8 was the largest 48-hour total ever recorded and the monthly total rain of 12.27 inches set a new Milwaukee record for both June and for monthly maximum rainfall.

[7]Ibid.

[8]Ibid.

Many areas in the City of Milwaukee experienced stormwater drainage flash flooding as a result of the June 7th rain, including vehicles stalling and floating at intersections and in some parking lots and 28 manhole covers/sewer grates being blown off from the water pressure. Just west of downtown Milwaukee, water up to two feet deep was reported in some intersections (N. 51st Street and W. Good Hope Road, Layton Avenue, S. Howell Avenue near Edgerton Avenue and to the south, W. Fond du Lac Avenue and W. Locust Street, S. 27th Street and W. Morgan Avenue), causing damage to buildings and abandonment of cars. A section of IH-894 had to be closed for a time near S. 27th Street due to the presence of water over the freeway and ramps. General Mitchell International Airport closed at 8 pm on June 7th due to major flooding. Also, a state of emergency was declared in Milwaukee County. On June 8th more rain exacerbated flooding, with the Kilbourn Tunnel being closed due to flash flooding. Approximately 1,000 homes in the City of Milwaukee reported water in their basements and several neighborhoods reported downed trees. Two privately owned buildings on the near south side collapsed due to the weight of rain on their roofs.

MMSD reported a 686 million gallon (MG) separate sewer overflow from June 7-9, 2008. MMSD reported a combined sewer overflow June 7-15, 2008 of 2.9 billion gallons (BG), which was the largest combined sewer overflow since the deep tunnel opened in 1994.

In the first half of June all the rivers in the City of Milwaukee reached flood stage, with the Milwaukee gage at the Milwaukee River cresting at 7.34 feet on June 14, 2008 which is the second highest stage recorded since 1914.

On June 14th, disaster aid from FEMA was authorized under a major disaster declaration issued for the state by President Bush. Federal funding of $6 million was made available to affected individuals in 30 counties in Wisconsin including Milwaukee. Damage totals for Milwaukee County were estimated at $43 million, with $32 million for residences and $6 million to private businesses. It was estimated that 19,000 homes in Milwaukee County were damaged, with approximately 40 percent due to sump pump failures. Governor Doyle announced in September 2009 that the State still needed $1.22 billion to cover flood damage for housing, businesses, and infrastructure to the 30 declared counties. As of June 2009, the State had received about $124 million from the US Department of Housing and Urban Development.

- The June 18-19, 2009 event was a series of thunderstorms that dropped 6.02 inches of rain on the downtown Milwaukee area and 4.15 inches at the General Mitchell International Airport (GMIA). These thunderstorms dropped very heavy rain over a relatively short period of time (as much as two inches per hour), resulting in stormwater drainage flash flooding and basement backups, and even some river flooding in the Milwaukee metropolitan area. Sewage and stormwater seeped into a storage room in the Milwaukee County medical examiner's office at N. 9th Street and W. Highland Avenue, some flash flooding and flood damage occurred at the service level of Miller Park, two feet of standing/flowing water was reported at IH-894 near GMIA, there was an estimated one foot of water over the curb at IH-894 at S. 27th Street, several cars stalled in high water near S. 6th Street and W. Canal Street, and both directions of the 3200 block of W. Capitol Drive were closed due to high water and abandoned cars. The City of Milwaukee Environmental Engineering Section reported 658 calls for basement backups, 172 calls for surface ponding, and seven sanitary sewer overflows for the June 19, 2009 event.

- The 2010 flood event in Milwaukee included two events, one event on July 14 and 15 and a more severe event on July 22. The July 14-15 event dropped more than five inches of rain in parts of the City in less than six hours, causing stormwater street flooding at 157 locations, basement backups, and sewer overflows. The City of Milwaukee received 42 reports of manhole covers being blown off. Standing water was reported at N. 35th Street and W. Capitol Drive, N. 60th Street and W. Mill Road,

and W. Juneau Avenue and N. King Drive. Approximately 1,200 basement backup complaints were called in to the City of Milwaukee Department of Public Works (DPW). MMSD reported a 2.75 MG separate sewer overflow and a 521 MG combined sewer overflow for the July 14-15 event.

General Mitchell International Airport reported a rainfall total of 5.61 inches for July 22nd, which is the second highest one day rain for Milwaukee for the period of record behind only the 1986 rain event of 6.81 inches. Rainfall at the MMSD rain gage at 3600 W. Fond du Lac Avenue totaled 7.52 inches for the day. Rain gages on the City of Milwaukee north side measured rainfall amounts of more than 3.7 inches in one hour, which is less frequent than the one-percent-annual-probability (100-year recurrence interval) event. For the month through July 22nd, Milwaukee received 9.49 inches of rain, nearly three times the normal amount.

The July 22nd event caused stormwater drainage street and freeway ponding, basement backups, and closure of GMIA due to surface ponding. One person was injured when their vehicle was swallowed in a large sinkhole at Oakland and North Avenues, and one death was reported for the driver of a car that went into Lincoln Creek. Over 6,000 homes in the City reported water filled basements. IH-43 was shut down between Atkinson Avenue and Mequon Road in Ozaukee Co and U.S. Highway 45 was shut down at W. Hampton Avenue. Fond du Lac Avenue was flooded from W. North Avenue to N. 107th Street, and the ramps at IH-43 and Capitol Drive were closed. Water pressure blew off manhole covers throughout Milwaukee, with one at N. 68th Street seen blowing five feet out of the manhole. Streets surrounding the Bradley Center and the US Cellular Arena were under nearly a foot of water. Rushing water moved along both sides of Downer Avenue south of E. Edgewood Avenue at the University of Wisconsin-Milwaukee campus. Water rose quickly on Downer Avenue to cover hubcaps, then license plates of parked vehicles. Localized flooding caused at least five basements to collapse in the 5000 block of N 19th Place, adjacent to Lincoln Creek. Two homes in the 1900 block of W Eggert Place, also adjacent to Lincoln Creek, were demolished due to destroyed foundations. MMSD estimated a total sewer overflow of 2.1 billion gallons (1.985 billion gallons combined sewer overflow, 171 million gallons separate sewer overflow).

For the July 2010 events the preliminary private damage estimate for the City of Milwaukee was $6.3 million (5,496 residential and business properties affected, 17 with major damage and three destroyed). This estimate did not include property owned by the City and public costs. Nineteen Milwaukee homes became uninhabitable due to flood damage after inspection. Damage estimates included approximately $27.1 million in the private sector and $10.3 million in the public sector for Milwaukee County. Riverside University High School at 1615 E. Locust Street received nearly six feet of water in its lower level, causing more than $4.6 million in damage. Forty-two Milwaukee Public School properties sustained flood damage totaling $6.5 million. The Milwaukee Department of Public Works crews picked up more than 1,300 tons of flood debris. President Obama declared a Federal disaster for Milwaukee County on August 11, 2010, with $45.8 million approved for Individual Assistance to Milwaukee and Grant Counties on 31,600 total applications.

Vulnerability and Community Impacts Assessment

The floodplain areas, as well as the subwatershed boundaries, within the City of Milwaukee are shown on Map 5 in Chapter II of this report. These areas are generally located along the major stream system throughout the City. The floodplains have been delineated for a total of about 61 miles of stream within the City. Most of the floodplain areas for which detailed studies are available have been mapped on large-scale topographic mapping prepared at a scale of one inch equals 100 feet with a contour interval of two feet. Flood flows and stages are currently readily available for about 58 miles of the total stream reaches involved, while the floodplain for about three miles of stream is delineated by approximate methods under the Federal Flood Insurance Study for the City. Under the Milwaukee County Automated Mapping and Land Information Program, updated digital large-scale topographic maps for the entire City have been prepared, and Light Detection and Ranging (LiDAR) data were collected in 2010, enabling development of one-foot interval elevation contours for the entire County.

As of 2010, a total of 485 structures were identified as being located within the one-percent-annual-probability floodplain in the City of Milwaukee. The flooded structures were identified using floodplain delineations completed as part of a floodplain delineation project undertaken by SEWRPC for the Milwaukee County Automated Mapping and Land Information System (MCAMLIS) Steering Committee and MMSD and the Menomonee River Phase 2 Watercourse Management Plan completed in 2002 (Phase 2). Digital Flood Insurance Rate Mapping incorporated the MCAMLIS/MMSD/SEWRPC mapping for the Milwaukee River, Lincoln Creek, and Southbranch Creek. Phase 2 mapping was used for the Menomonee River, Grantosa Creek, and the Little Menomonee River. For the Kinnickinnic River, Lyons Park Creek, Villa Mann Creek, Wilson Park Creek, and Honey Creek There are 218 structures which are considered to be repetitive- or substantial-loss structures as compiled by Wisconsin Emergency Management as of October 2010. Repetitive-loss properties are those that have two or more flood insurance claims of at least $1,000 each. There are 181 single-family structures, 33 two- and four-family structures, and four other structures so classified in the City of Milwaukee. In addition, FEMA has also identified a subset of properties meeting one of three criteria: 1) four or more losses of $1,000 or more; 2) two or more losses in a 10-year period that, in aggregate, equal or exceed the current value of the insured property; and 3) three or more losses that, in aggregate, equal or exceed the current value of the insured property. In 1999, FEMA issued guidance stating that emphasis should be given to properties in this subset and that they are a high priority for mitigation measures. There are three properties in the City of Milwaukee that fall into this subset. A listing and selected information on each of the repetitive, or substantial, loss structures is compiled by the Federal Emergency Management Agency under the National Flood Insurance Program, and is available from the Wisconsin Division of Emergency Management.

As of 2003, the Milwaukee Metropolitan Sewerage District (MMSD) had completed flood control projects for Lincoln Creek, Southbranch Creek, the Valley Park neighborhood and portions of the Hart Park area of the Menomonee River, and the headwaters of Grantosa Creek. As a result of those projects, a total of 1,785 of the 1,838 structures identified at that time had been protected from flooding during events with probabilities of one percent or greater. In addition, the MMSD has continued with more-detailed planning and preliminary design for the other watercourses under its jurisdiction. This subsequent work has included obtaining field survey elevation data for potentially floodprone structures. As noted above, based upon the most recent analyses as of 2010, 485 structures are located in the flood hazard areas of the City of Milwaukee.[9]

There are 218 repetitive-loss structures, including the three structures that are considered high priority by FEMA. Details of those projects are discussed in Chapter V.

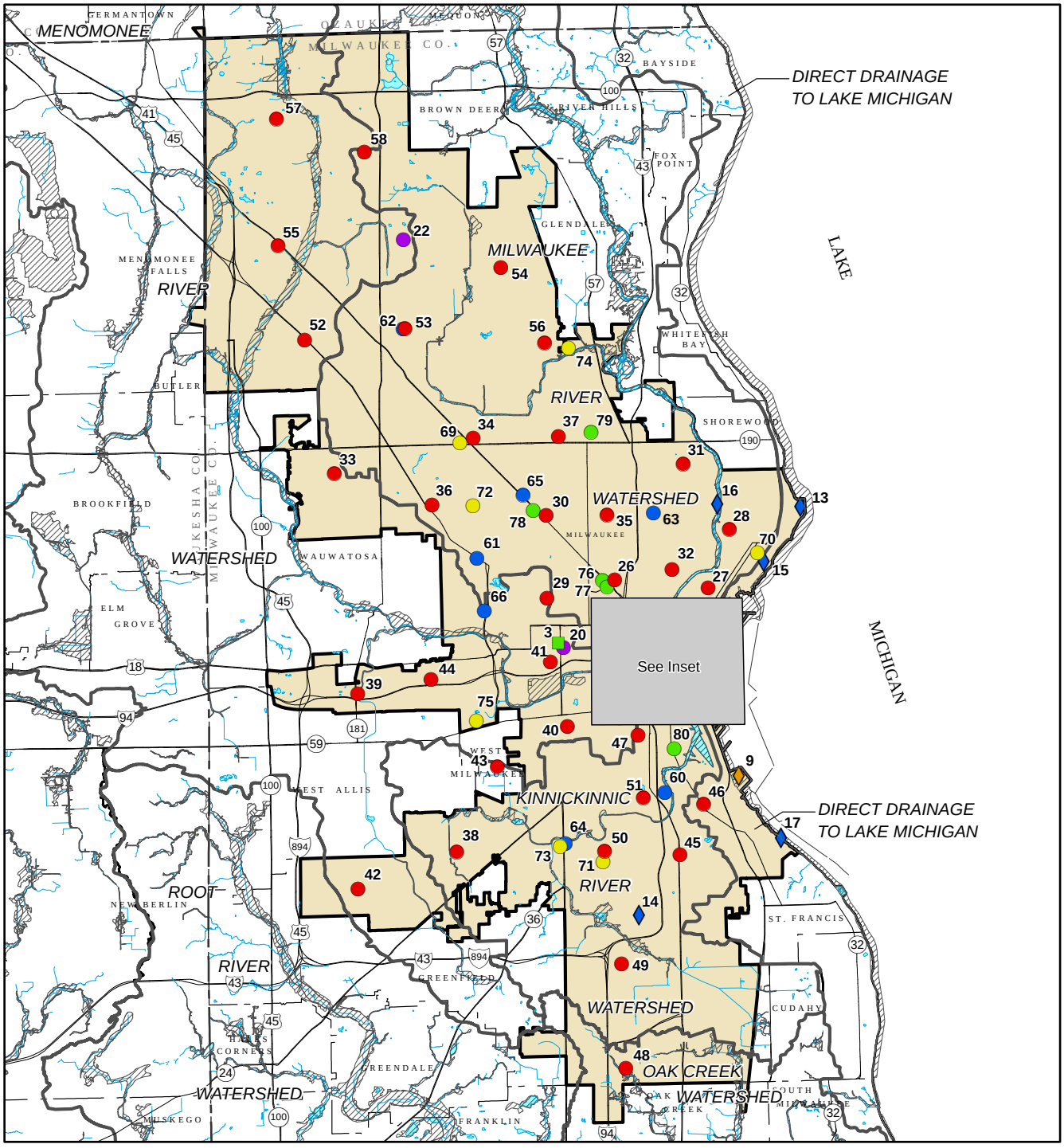
Map 10 shows the location of selected types of critical community facilities, including fire and police stations, hospitals, and community administration facilities within the City. None of these facilities are located within the flood hazard areas. However, because of the need for access to and from these facilities, the flood mitigation plan includes their location and shows the relationship to the flood hazard areas. There are no schools, nursing homes, or other critical facilities located within the flood hazard areas within the City.

A review of the extent and severity of flooding conditions within the City of Milwaukee indicates that there is a significant community impact primarily as a result of the damages caused by flooding of buildings, primarily basements, and disruption of the transportation system during extreme flooding events. In addition, sanitary sewer

[9]*As part of the MCAMLIS/MMSD/SEWRPC floodplain mapping effort, flood flows are also being updated. Increased flood flows and updated topography used for the MCAMLIS effort had the greatest impact on the numbers of flooded structures along the Kinnickinnic River, Wilson Park Creek, and Lyons Park Creek. Approximately 437 of the 485 structures in the one-percent-annual-probability floodplain are located along these streams.*

Map 10

LOCATION OF CRITICAL COMMUNITY FACILITIES IN RELATION TO FLOODPLAINS IN THE CITY OF MILWAUKEE



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WATER PURIFICATION PLANTS AND PUMPING STATIONS
- PORT OF MILWAUKEE
- OTHER CRITICAL FACILITIES
- CITY OF MILWAUKEE
- 75 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
- ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS
- SURFACE WATER
- MAJOR WATERSHED BOUNDARY

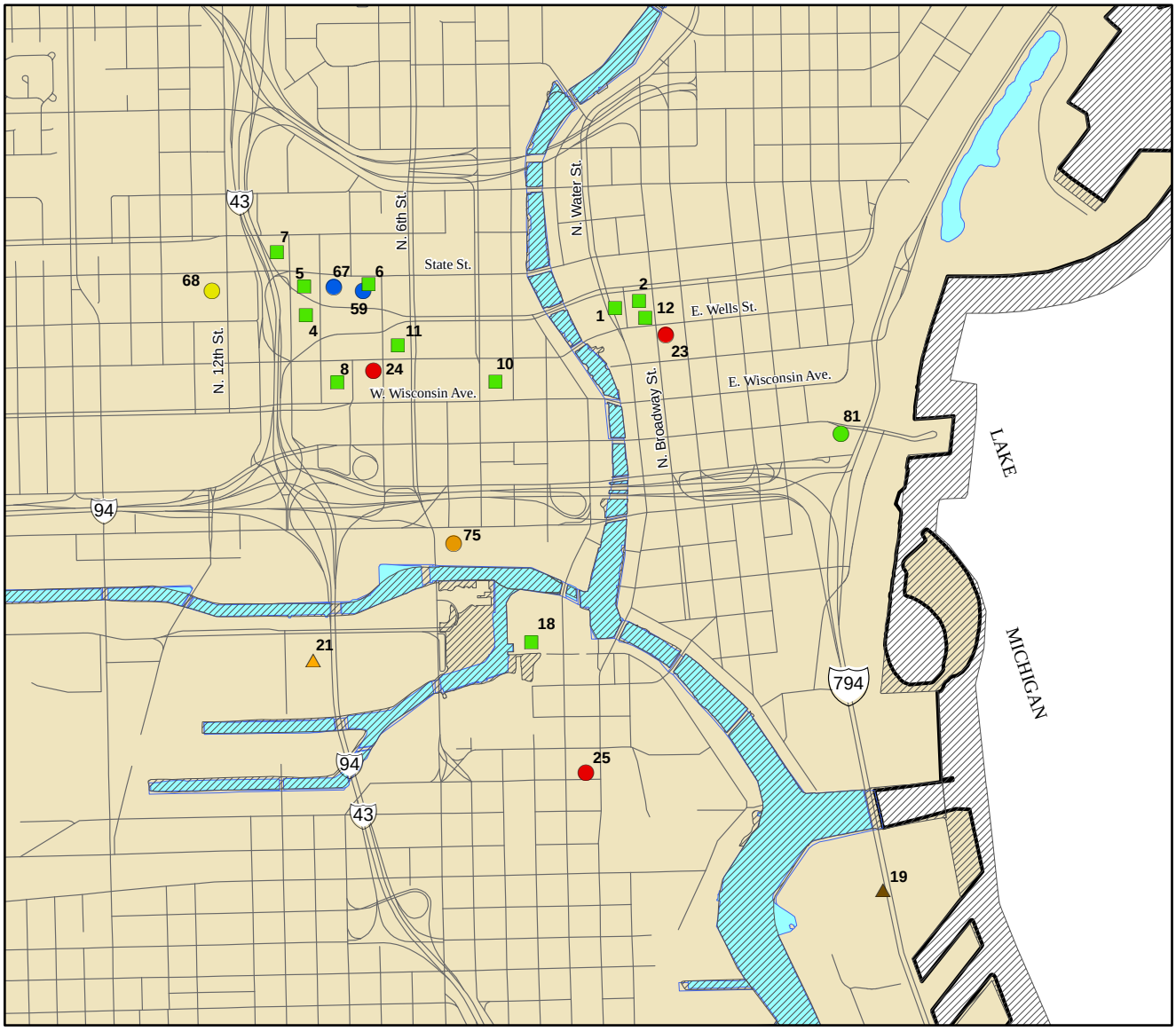
N

GRAPHIC SCALE
0 7,000 14,000
Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.

FINAL DRAFT

INSET to Map 10



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE INTERMODAL STATION
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WASTEWATER TREATMENT PLANT
- POWER PLANT

24 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS

N

GRAPHIC SCALE

0 1,000 2,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.

Table 12

REPORTED BASEMENT SANITARY SEWER BACKWATER PROBLEMS[a] AND ANNUAL PRECIPITATION SUMMARIES WITHIN THE CITY OF MILWAUKEE: 1999-2009

Year	Backwater Complaints (number)	Annual Precipitation Departures from Normal (inches)	Annual Total Precipitation (number of days)			
			Greater than 0.01 to 0.1 Inch	Greater than 0.1 to 0.5 Inch	Greater than 0.5 to 1.0 Inch	Greater than 1.0 Inch
1999	187	+4.95	42	43	16	8
2000	112	+11.44	61	38	16	9
2001	2	+3.80	38	35	22	9
2002	60	-8.12	45	38	11	5
2003	0	-12.51	52	34	11	2
2004	86-400[b]	-1.87	45	48	14	6
2005	0	-8.89	43	50	9	3
2006	0	+3.12	42	46	18	9
2007	0	-1.75	47	46	14	6
2008	1,000	+8.71	44	50	13	11
2009	658	+1.00	36	49	14	7
2010	12,203	+1.17	50	31	17	6

[a]*These are meant to illustrate rain-related basement backwater problems reported and does not include any backups that occurred due to clogged sewers or a problem in the building sewer.*

[b]*86 backwater complaints were reported by property owners during two community meetings held after the May 2004 rainfall period and are considered to be related to specific sanitary sewer problems. Newspaper reports indicate that over 400 basement backup complaints of various types were filed during the May 2004 rainfall events. There also were likely to have been more homes that were affected but not reported.*

Source: City of Milwaukee Department of Public Works, National Weather Service Milwaukee/Sullivan Weather Forecast Office, and SEWRPC.

backup into basements is another important consideration. Flooding of streets and buildings, primarily basements, has been reported in the City as a result of storm events since June 20-21 and July 2, 1997.[10] From 1999 to 2010, there were a total of 14,622 reported basement backwater problems within the City of Milwaukee ranging up to 12,203 in one year as shown in Table 12. The greatest number of reported backwater problems occurred in 2010, with all of the incidents being reported during the month of July. Although total annual precipitation during 2010 was only 1.17 inches above average annual precipitation, precipitation for July 2010 was 7.35 inches greater than average July precipitation. In addition, precipitation for the month of June 2010 was 3.37 inches greater than average June precipitation. The second greatest number of reported backwater problems occurred in 2008, when total annual precipitation was about nine inches above normal and precipitation for the month of June was 8.71 inches greater than average June precipitation. Many of these backups were associated with storms that occurred on June 7 and 8, which deposited about 7.18 inches of rainfall at General Mitchell International Airport.

Several types of structure flooding have been reported from 1997 to present. One major source of basement flooding problems has been surcharging of sanitary sewers and resultant backups into basements. Another source of basement flooding was sump pump failure and clear water overflow due to electrical power outages. Clearwater overflow into the sanitary sewer basement floor drain can quickly exceed the capacity of those

[10]Ibid.

relatively small-diameter sewers, leading to surcharging and backup of a combination of sanitary sewage and clear water into basements. Additional sources of clear water inflow to sanitary sewers were through: 1) flooding of basements due to surface runoff, 2) excessive amounts of water collecting in streets or roadside swales and entering sanitary sewer manholes through unsealed lids and frames, and 3) sanitary sewer manhole lids which were disturbed.

In 2010, the MMSD began development of a Private Property Infiltration and Inflow (I/I) Reduction Program with input from all communities in their service area, including the City of Milwaukee. The purpose of this program was to provide a funding mechanism for local communities to reduce private property I/I to the sanitary sewer system, through investigation, design, and construction of mitigation measures. The communities would prioritize their basement backup areas of concern, and then develop solutions to eliminate infiltration and inflow of clear water to their local sanitary sewer system. As of April 2011, the MMSD had proposed a budget of $151 million for 2011-2021 for the Private Property Infiltration and Inflow Reduction Program for all 28 member communities.

Given the current flood control projects that have been carried out during the past 10 years under the MMSD watercourse management program, the flooding impacts on the City's infrastructure and the need to prepare for major evacuations and other emergency actions are not considered to be a major concern given the nature and the severity of the overland flooding problems. However, the Milwaukee County emergency operations planning program does have provisions for carrying out the latter if it would be needed. Furthermore, significant flood-related impacts on the community economy and businesses are of an infrequent and short-term nature. The major impact on City operations, which are relatively frequent, involve posting and closure of selected roadway locations where floodwaters frequently overtop bridges and culverts and cause short-term roadway flooding.

Stormwater Drainage Problems

Because of the interrelationship between stormwater management and floodland management, stormwater management actions are an important consideration of the flood vulnerability assessment. Stormwater drainage problems are known to exist throughout the urbanized portions of the City. The City has undertaken stormwater management planning programs or initial stormwater management system inventories as the first step in developing comprehensive stormwater management plans. The current status of stormwater management planning in the City of Milwaukee is described further in Chapters II and V. The intense storm events of 2008 through 2010 caused significant surface flooding problems as the local storm drainage facilities were overwhelmed. The City of Milwaukee should identify specific locations where the major stormwater management system is inadequate to handle the runoff from storms with annual probabilities of occurrence of one percent or greater and prepare stormwater management plans to address those deficiencies.

Potential Future Changes in Floodplain Boundaries and Problems

As described in Chapter II of this report, the City of Milwaukee and communities in the tributary areas currently have in place land use controls and planning programs to preserve nearly all of the remaining environmentally sensitive areas, including wetlands and floodplains. Furthermore, development within the City itself is approaching "buildout" conditions with new development expected to be largely limited to infilling and isolated open space parcels outside of the environmentally sensitive areas. The City has an adopted stormwater management ordinance which requires sound stormwater management practices for new development and redevelopment sites which will limit any increases in future stormwater runoff peak rates of flow. Accordingly, there is not expected to be any significant changes in the flood flows and hydrologic characteristics of the stream system resulting from future land use changes in the City. Detailed analyses conducted under the MMSD watercourse system planning program, the Southeastern Wisconsin Regional Planning Commission comprehensive watershed plans for the watersheds tributary to the City of Milwaukee, and an ongoing floodplain mapping program being conducted by SEWRPC for the MCAMLIS Steering Committee and MMSD have documented the potential extent of increases in future flood flows within the City of Milwaukee. As part of the MCAMLIS/MMSD/SEWRPC floodplain mapping effort, flood flows are also being updated to reflect physical changes in the watersheds such as more current land use, more extensive stream gage information, and in some

cases to reflect more recent rainfall events. For some of the City streams the change in flood flows is minimal, while in others it is more significant. The increased flood flows and updated topography used for the MCAMLIS effort had the greatest impact on the numbers of flooded structures for the Kinnickinnic River, Wilson Park Creek, and Lyons Park Creek. Approximately 437 of the 485 structures in the one-percent-annual-probability floodplain are located along these three streams.

The MMSD has also developed the Chapter 13 Rule, which applies to all member and contract municipalities, including the City of Milwaukee. Chapter 13 requires all new development or redevelopment beyond certain imperviousness or land disturbance thresholds to control peak rates of stormwater runoff. The Chapter 13 requirements were developed to maintain the effectiveness of MMSD flood mitigation projects in reducing flooding within the MMSD service area.

With regard to the impact of development beyond the City of Milwaukee limits, however, nearly all of the developing communities lying upstream of the City, have recently prepared, or have under preparation, detailed stormwater management plans and/or stormwater-related ordinances designed to minimize any negative down-stream impacts on flood flows and stages. In addition, most of the developed and developing communities in the tributary subwatersheds are currently involved in the Wisconsin Department of Natural Resources (WDNR) stormwater permitting program as set forth under Chapter NR 216 of the *Wisconsin Administrative Code*. This program will eventually lead to the development of additional stormwater management practices.

In addition to the above and as described in Chapter II of this report, the City of Milwaukee's current floodplain zoning regulations are designed to prevent the development of any new floodprone development, as well as to prevent any floodplain encroachment that would cause changes in the existing flood flows or stages.

If current floodplain and related land use regulations and existing and ongoing stormwater management plans and regulations are carried out and/or implemented in the future the extent and severity of flooding problems within the City resulting from the overflow of streams would not be expected to become significantly more severe in the near term. However, given recent evidence that changes in climate may be increasing the frequency of intense rain storms, it is important that stormwater and floodland management planning begin to consider such impacts. Discharge records at streamflow gauges show evidence that the frequency of large floods is increasing. For example, over the 34-year record for the USGS gauge along the Kinnickinnic River, eight of the 10 largest flows occurred during the 15-year period 1996-2010. Similarly, over the 49-year record for the USGS gauge along the Menomonee River, six of the 10 largest flows occurred during the same 15-year period. Future planning should utilize more reliable estimates of the magnitude of the effects of climate change on precipitation as they become available.

Multi-Jurisdictional Flooding and Stormwater Management Risk Assessment

Flooding and associated stormwater drainage problems have been identified as a significant risk in the City of Milwaukee and adjacent communities. In addition, the Milwaukee County Pre-Disaster Mitigation Plan assesses flooding as posing the greatest risk to both the population and to buildings and structures within Milwaukee County.[11] As noted earlier and summarized in the City of Milwaukee Flood Hazard Mitigation Plan, flood hazard areas have been identified throughout the City and adjacent communities. However, as noted above, nearly all of the developing communities lying upstream of the City, have recently prepared, or have under preparation, detailed stormwater management plans and/or stormwater-related ordinances designed to minimize any negative downstream impacts on flood flows and stages. In addition, most of the developed and developing communities in the tributary subwatersheds are currently involved in the Wisconsin Department of Natural Resources stormwater

[11] *Milwaukee County Emergency Management*, op. cit.

permitting program as set forth under Chapter NR 216 of the *Wisconsin Administrative Code*. In addition, all of the communities served by the MMSD are subject to the MMSD Chapter 13 rule, which requires that communities mitigate potential increases in peak rates of runoff from new development in a manner designated to limit increases in downstream flood flows and stages. These programs will eventually lead to the development of additional stormwater management practices.

As previously mentioned, improvements are being made as part of the MMSD's work and these are reducing the overall flooding problems facing both the City and environs throughout Milwaukee County and beyond. In addition, the MMSD completed its third-generation wastewater facilities planning effort. This effort is responsive to a court-ordered stipulation requiring the facilities plan to be completed by June 30, 2007, and is consistent with Section 201 of the Federal Clean Water Act. As the facilities program was conceptualized, the MMSD proposed to utilize the watershed approach to plan development consistent with the evolving U.S. Environmental Protection Agency policies. That approach was further defined to be conducted cooperatively with a coordinated and integrated comprehensive regional water quality management planning effort involving the Wisconsin Department of Natural Resources, SEWRPC, and local communities, among others. Such an approach is good public planning and administration, as well as being consistent with the requirements of Section 208 of the Federal Clean Water Act, and will lead to a reduction in the overall risk of the City and adjacent communities to flooding and stormwater problems.

VULNERABILITY ASSESSMENT FOR THUNDERSTORMS, HIGH WINDS, HAIL, AND LIGHTNING

Thunderstorms

Compared to other natural hazards within the State of Wisconsin, thunderstorms are the most common type of severe weather event. A thunderstorm is defined as a severe and violent form of convection produced when warm, moist air is overrun by dry, cool air and as the warm air rises, thunderheads (cumulonimbus clouds) form. These thunderheads produce the strong winds, lightning, thunder, hail, and heavy rain that are associated with these storm events. The thunderheads formed may be a towering mass averaging 15 miles in diameter and reach up to 40,000 to 50,000 feet in height. These storm systems may contain as much as 1.5 million tons of water and enormous amounts of energy that often are released in one of several destructive forms, such as high winds, lightning, hail, excessive rains, and tornadoes. Thunderstorms and their related high winds, lightning, and hail hazards are covered within this section. However, excessive rains that cause flash flooding, such as occurred in the summer storm events in 1998 and 2000 when the request for Presidential disaster declaration was approved (see Vulnerability Assessment for Flooding and Associated Stormwater Drainage Problems) and tornadoes are covered separately from this hazard analysis (see Vulnerability Assessment for Tornadoes).

A thunderstorm often lasts approximately 30 minutes in a given location, because an individual thunderstorm cell frequently moves at an average velocity that ranges between 30 to 50 miles per hour (mph). However, strong frontal systems may produce more than one squall line composed of many individual thunderstorm cells. In Wisconsin, these fronts can often be tracked across the entire State from west to east.[12] Thunderstorms may occur individually, form clusters, or occur as a portion of a large line of storms. Therefore, it is possible that several thunderstorms may affect one particular area in the course of a few hours, as well as larger areas of the State or County, within a relatively short period of time.

[12]*National Weather Service Forecast Office.*

All thunderstorms are potentially dangerous. However, only about 10 percent of all thunderstorms that occur each year nationwide are classified as severe.[13] According to the National Weather Service, a thunderstorm is considered severe if it produces hail sizes at least one inch in diameter, generates wind speeds equal to or greater than 58 miles per hour (measured or implied by tree and/or structural damage), or produces a tornado.[14] A thunderstorm with wind speeds equal to or greater than 40 miles per hour or hail at least 0.5 inch in diameter is defined as approaching severe. Severe weather event statistics in the State of Wisconsin for the period 1982-2008 indicate that about 56 percent of these severe storm events are characterized by damaging straight-line winds, 38 percent are hail events, and the remaining 6 percent are made up of tornadoes. Severe thunderstorms can cause injury or death and can also result in substantial property damage. They may cause power outages, disrupt telephone service, and severely affect radio communications, as well as impact surface and air transportation, which may seriously impair the emergency management capabilities of the impacted areas.

The National Weather Service monitors severe weather for 20 southern Wisconsin counties, including the City of Milwaukee, from its Milwaukee/Sullivan office.[15] A severe thunderstorm watch indicates that conditions are favorable for severe weather and that persons within the area for which the watches are issued should remain alert for approaching storms. A severe thunderstorm warning indicates that severe weather has been sighted in an area or indicated by weather radar and persons should seek shelter immediately. These severe thunderstorm watch and warning bulletins and advisories are disseminated over a number of telecommunication channels, including the NOAA Weather Radio, the NOAA Weather Wire and the State Law Enforcement TIME System. NOAA Weather Radio is available to any individual with a weather alert radio. This system and the other sources are routinely monitored by local media which rebroadcast the weather bulletins over public and private television and radio stations. In addition, the National Weather Service operates a 24-hour weather radio transmitter serving Milwaukee and Waukesha Counties, operating at a frequency of 162.400 megahertz (MHz), from a location in the Town of Delafield, Waukesha County. Southern portions of the Milwaukee County area, including portions of the City, are also served by a transmitter operating at a frequency of 162.450 MHz from a location at CTH KR and Wood Road in Racine County.

High Winds

High-velocity, straight-line winds that are produced by thunderstorms and widespread nonthunderstorm high winds are the third most destructive natural hazard in Wisconsin and are responsible for most thunderstorm wind-related damages to property.[16] Thunderstorm winds can also be fatal. During the period from 1982 to 2008 in the State of Wisconsin, 28 fatalities were attributed to wind from severe thunderstorms. Although distinctly different from tornadoes, straight-line winds produced by thunderstorms can be very powerful, are fairly common, and can cause damages similar to that of a tornado event. Depending upon their intensity, high winds can uproot trees, down power lines, and damage or destroy buildings and infrastructure. Flying debris can cause serious injury and death to humans, livestock, and wildlife in their path. Boats and airplanes are also extremely vulnerable to damage from high winds.

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[13] *Milwaukee County Emergency Management*, op. cit.

[14] *Prior to 2010, the National Weather Service criteria for severe thunderstorms were production of hail at least 0.75 inch in diameter, wind speeds equal to or greater than 58 miles per hour, or a tornado.*

[15] *National Weather Service, Milwaukee/Sullivan Weather Forecast Office.*

[16] *Wisconsin Emergency Management Department of Military Affairs,* State of Wisconsin Hazard Mitigation Plan, *July 2001.*

Hail
Hailstorms are also associated with thunderstorms and are the fourth most destructive type of weather hazard in the State of Wisconsin. A hailstorm is a product of strong thunderstorms and unique weather conditions where atmospheric water particles form into rounded or irregular masses of ice that fall to earth. Hail normally falls near the center of the moving storm along with the heaviest rain. However, strong winds at high altitudes can blow the hailstones away from the storm center, causing unexpected hazards at places that otherwise might not appear threatened. Hailstones normally range from the size of a pea to that of a golf ball. Hailstones 1.5 inches or larger in diameter are not common in the State of Wisconsin. Hailstones form when subfreezing temperatures cause water in thunderstorm clouds to accumulate in layers around an icy core. When strong underlying updraft winds no longer can support their weight, the hailstones fall earthward. Hail tends to fall in swaths that may be 20 to 115 miles long and five to 30 miles wide and can fall continuously or sporadically in a series of hail strikes. Hail strikes are typically one-half mile wide and five miles long. They may partially overlap, but often leave completely undamaged gaps between them.

Hailstorms are considered formidable among the weather and climatic hazards to property, because they can dent vehicles and structures, break windows, and damage roofs to the point that significant losses result. Falling hailstones can also cause serious injury and loss of human life. These occurrences, however, are rarely associated with hailstorms. In addition to impact damage, thick hail combined with heavy rain can clog storm sewers and contribute to stormwater flooding. Hail sufficiently thick to cover a road will pose a traffic hazard. The peak season for hailstorms is April through August, although hail has been reported with thunderstorms in every month of the year.

Lightning
Every thunderstorm produces lightning, and lightning has been shown to kill more people within the United States each year than tornadoes.[17] Lightning is defined as a sudden and violent discharge of electricity from within a thunderstorm due to a difference in electrical charges, and represents a flow of electrical current from cloud to cloud or cloud to ground. Water and ice particles also affect the distribution of electrical charge. Lightning bolts can travel 20 miles before striking the ground. The air near a lightning bolt can be heated to 50,000 degrees Fahrenheit (ºF), which is hotter than the surface of the sun. The rapid heating and cooling of the air near the lightning channel causes a shock wave that results in thunder.

Lightning is a significant hazard associated with any thunderstorm and can cause extensive damage to buildings, structures, electrical and electronic equipment, kill or injure people and livestock, and start forest fires and wildfires. Lightning is a major cause of damage to farm buildings and equipment, is responsible for more than 80 percent of all livestock losses, and is the number one cause of farm fires. Counties in southern Wisconsin report a higher number of lightning events compared to other parts of the State due to higher thunderstorm frequency and more thorough documentation by the local media. Statistics have also shown that 92 percent of lightning-related fatalities occur from May to September, and 73 percent of these events occur during the afternoon and early evening. National statistics indicate that approximately 30 percent of persons struck by lightning die and 74 percent of lightning strike survivors have permanent disabilities. In addition, 63 percent of lightning-associated deaths occur within one hour of injury and persons with cranial burns or leg burns from lightning are at higher risk for death than others struck by lightning.

Historical Thunderstorm, High-Wind, Hail, and Lightning Problems
Historically, the State of Wisconsin averages over 30 days each year with thunderstorms across the northern region to about 40 days per year across the southern region. However, the City of Milwaukee averages only about six days per year in which thunderstorms generate winds over 50 knots, and averages only three days per year in

[17] *National Oceanic and Atmospheric Administration.*

which damaging hail (over three-fourths of an inch in diameter) is generated.[18] These thunderstorms and related high winds, hail, and lightning hazards can occur throughout the City during any month of the year, with little or no notice. However, the highest frequency has been shown to occur during the period of May through September, and between the hours of noon and 10:00 p.m. The City of Milwaukee is subject to damage caused by thunderstorms and related hazards, which can be severe and affect large portions of the City, as well as potentially cause substantial loss of life and damage to property.

Description of Recent Thunderstorm, High-Wind, Hail, and Lightning Events

The gravity of any particular thunderstorm and related wind, hail, and lightning hazard events is measured in terms of resulting deaths, injuries, and economic losses. Despite their relatively small size when compared with winter storms, thunderstorms and their related hazard events occur frequently and are dangerous. Thunderstorms and related hazard events are third only to temperature extremes and tornadoes in regards to both total number of deaths and injuries, compared to other natural hazards that impact southeastern Wisconsin, as shown in Table 9. In addition, thunderstorms and related hazard events are second only to damage associated with floods and stormwater as the most costly natural hazards to impact the City of Milwaukee.

A total of 193 thunderstorm and 191 high-wind events, have been recorded in the City of Milwaukee during the 45-year period between July 1956 and September 2010. These events are documented in terms of their magnitude and impact in Table 13 based upon data published by the NCDC. As shown in Table 13, these storms can range from one or two events per year, up to 16 events per year, which demonstrates the high unpredictability of these events. Since 1993, in total, these thunderstorm and high-wind events have resulted in four deaths, 22 injuries, and over $35 million in property damages within Milwaukee County. Most of these damages occurred as a result of two storm events in 1998. The first was a thunderstorm and high-wind event that occurred on May 31, 1998, that resulted in over $25 million in property damage. The second event was a widespread, nonthunderstorm, high-wind event on November 10, 1998, which struck south-central and southeastern Wisconsin and caused four deaths, 14 injuries, and almost $15 million in damages to property. This storm caused nearly $700,000 in damages in the City of Milwaukee. Most recently, a severe thunderstorm impacted the City of Milwaukee on August 21, 2002, resulting in over $6.2 million in property damage.

Severe weather and flooding affected much of south-central and southeast Wisconsin on August 21, 2002, into the pre-dawn hours of the 22nd. This event was probably the most widespread and significant outbreak for the 2002 warm-season. Just about every type of weather phenomena was observed: a tornado; a funnel cloud; powerful, hurricane-force, downburst winds that uprooted trees and damaged buildings; torrential rains reducing visibilities to 100 feet; urban and small stream flooding; numerous lightning strikes—some that resulted in fire damage; and the early stages of a ground-based vortex that never made it to tornado status. Clusters and short lines of thunderstorms ahead of a cold front eventually merged into a single complex that moved west to east across southern Wisconsin. Surface dew points were in the lower 70s and maximum afternoon temperatures were in the mid to upper 80s. At least 56,000 customers in southeast Wisconsin lost electrical power thanks to lightning strikes, and tree damage to power lines. One of the worst lightning strikes was in Fox Point, where a lightning fire burned a home to the ground. Powerful winds associated with this storm affected Milwaukee County. An estimated wind gust of at least 70 knots (80 mph) ripped a 100-foot-long blimp from its mooring at Timmerman Airport, allowing the blimp to fly about six blocks and damage four homes on impact. In Cudahy an eight-car garage's roof was removed by the winds, and three stalls collapsed, based on Amateur Radio reports. A picnic shelter and several other garages and businesses on College Avenue near Lake Michigan also sustained some damage. In the City of South Milwaukee, a business's sign and fence were destroyed by the winds. This storm caused an estimated $6.2 million in property damages in Milwaukee County.

[18] *National Oceanic and Atmospheric Administration,* http://www.nssl.noaa.gov/hazard/totalthreat.html.

Table 13

THUNDERSTORM, HIGH-WIND, HAIL, AND LIGHTNING EVENTS REPORTED IN MILWAUKEE COUNTY FROM 1956 to SEPTEMBER 2010[a]

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
July 11, 1956	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
August 7, 1958	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 28, 1960	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
July 22, 1960	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 22, 1960	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 4, 1961	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 17, 1962	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -
July 22, 1962	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
September 13, 1962	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
March 19, 1963	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
March 19, 1963	City of Milwaukee	- -	- -	X	- -	1.5 inch	- -	- -	- -
June 8, 1963	City of Milwaukee	X	X	X	- -	63 knots/2.0 inch	- -	- -	- -
June 9, 1963	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -
July 31, 1963	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
August 1, 1963	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
April 6, 1964	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 19, 1964	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 19, 1964	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
July 22, 1964	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
July 22, 1964	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
September 3, 1964	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
May 8, 1965	City of Milwaukee	X	X	- -	- -	65 knots	- -	- -	- -
June 27, 1965	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 13, 1965	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 26, 1967	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
June 11, 1968	City of Milwaukee	X	X	- -	- -	63 knots	- -	- -	- -
June 18, 1968	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 29, 1968	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 30, 1968	City of Milwaukee	X	X	- -	- -	53 knots	- -	- -	- -
April 17, 1969	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 29, 1969	City of Milwaukee	X	X	- -	- -	61 knots	- -	- -	- -
August 11, 1969	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
June 19, 1971	City of Milwaukee	X	X	- -	- -	66 knots	- -	- -	- -
September 16, 1972	City of Milwaukee	X	X	- -	- -	51 knots	- -	- -	- -
September 18, 1972	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	- -

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
June 16, 1973	City of Milwaukee	X	X	- -	- -	60 knots	- -	- -	- -
August 9, 1973	City of Milwaukee	X	X	- -	- -	70 knots	- -	- -	- -
May 21, 1974	City of Milwaukee	X	X	- -	- -	65 knots	- -	- -	- -
July 3, 1974	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 11, 1974	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
January 10, 1975	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 13, 1975	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 13, 1975	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
November 9 ,1975	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 13, 1976	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 30, 1976	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -
July 30, 1976	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 24, 1977	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 6, 1977	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 6, 1977	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -
August 4, 1977	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
September 4, 1977	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 7, 1978	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 17, 1978	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
May 18, 1979	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 20, 1979	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 5, 1980	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
June 5, 1980	City of Milwaukee	X	X	X	- -	0 knots/1.0 inch	- -	- -	- -
June 7, 1980	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
July 15, 1980	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 4, 1980	City of Milwaukee	X	X	X	- -	0 knots/1.75 inch	- -	- -	- -
August 4, 1980	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
September 9, 1980	City of Milwaukee	X	X	- -	- -	54 knots	- -	- -	- -
July 12, 1981	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 20, 1981	City of Milwaukee	X	X	- -	- -	51 knots	- -	- -	- -
July 6, 1982	City of Milwaukee	X	X	- -	- -	60 knots	- -	- -	- -
August 3, 1982	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 19, 1983	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
July 19, 1983	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 16, 1983	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
June 17,1984	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 10, 1984	City of Milwaukee	X	X	- -	- -	70 knots	- -	- -	- -
July 10, 1984	City of Milwaukee	X	X	- -	- -	70 knots	- -	- -	- -
July 23, 1984	City of Milwaukee	X	X	- -	- -	53 knots	- -	- -	- -
August 9, 1984	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
August 9, 1984	City of Milwaukee	- -	- -	X	- -	1.25 inch	- -	- -	- -
October 16, 1984	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 12, 1985	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
July 6, 1986	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
July 19, 1986	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 27, 1986	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 27, 1986	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 27, 1986	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
September 28, 1986	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
May 11, 1987	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
May 21, 1987	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
May 21, 1987	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 6, 1987	City of Milwaukee	- -	- -	X	- -	2.0 inch	- -	- -	- -
July 6, 1987	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 12, 1987	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 29 ,1987	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 15, 1987	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 16, 1987	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 16, 1987	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 21, 1987	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
May 8, 1988	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 4, 1988	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 4, 1988	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
August 8 ,1988	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 26, 1989	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 27, 1989	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 27, 1989	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
August 4, 1989	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	- -
March 13, 1990	City of Milwaukee	- -	- -	X	- -	1.75 inch	- -	- -	- -
June 29, 1990	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
September 10, 1990	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
March 27, 1991	City of Milwaukee	X	X	- -	- -	77 knots	- -	- -	- -
March 27, 1991	City of Milwaukee	X	X	- -	- -	67 knots	- -	- -	- -
April 8, 1991	City of Milwaukee	- -	- -	X	- -	0.88 inch	- -	- -	- -
July 7, 1991	City of Milwaukee	X	X	- -	- -	63 knots	- -	- -	- -
July 22, 1991	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
September 9, 1991	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
September 9, 1991	City of Milwaukee	- -	- -	X	- -	2.0 inch	- -	- -	- -
June 17, 1992	City of Milwaukee	X	X	X	- -	59 knots/1.0 inch	- -	- -	- -
June 17, 1992	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
August 30, 1993	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	75.7
July 4, 1994	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	7.4
July 4, 1994	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
July 4, 1994	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	7.4
July 4, 1994	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	7.4
July 4, 1994	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	7.4
July 11, 1994	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
April 18, 1995	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
April 18, 1995	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
May 13, 1995	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
June 6, 1995	Milwaukee County	X	- -	- -	X	N/A	- -	- -	11.5
June 7, 1995	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 15, 1995	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	- -
July 15, 1995	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	- -
July 15, 1995	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 15, 1995	Milwaukee County	X	- -	- -	X	N/A	- -	- -	- -
July 15, 1995	Milwaukee County	X	- -	- -	X	N/A	- -	- -	- -
July 27, 1995	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	- -
August 28, 1995	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	- -
August 28, 1995	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	- -
June 2, 1996	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	4.3
July 18, 1996	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	16.7
August 19, 1996	North Milwaukee County	X	X	- -	- -	0 knots	- -	- -	15.3
October 29, 1996	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
April 6, 1997	Milwaukee County	- -	X	- -	- -	0 knots	- -	- -	409.0
May 5, 1997	Southeastern Wisconsin	- -	X	- -	- -	0 knots	- -	- -	7.9

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
June 24, 1997	Milwaukee County	X	X	- -	- -	52 knots	- -	2	6.8
June 24, 1997	City of Milwaukee	X	X	- -	- -	50 knots	- -	- -	- -
June 30, 1997	Milwaukee County	X	- -	- -	X	N/A	- -	- -	27.3
July 2, 1997	Milwaukee County	X	- -	- -	X	N/A	- -	- -	34.1
July 16, 1997	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	1.4
July 21, 1997	City of Milwaukee	X	- -	- -	X	N/A	- -	- -	1,363.3
July 26, 1997	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	1.4
September 29, 1997	Milwaukee County	- -	X	- -	- -	0 knots	- -	- -	1.4
March 8, 1998	Southeastern Wisconsin	- -	X	- -	- -	0 knots	- -	- -	26.2
May 28, 1998	Milwaukee County	X	X	- -	- -	61 knots	- -	- -	5.4
May 28, 1998	Milwaukee County	X	X	- -	- -	0 knots	- -	- -	1.3
May 31, 1998	Milwaukee County	X	X	- -	- -	87 knots	- -	- -	25,772.2
June 18, 1998	City of Milwaukee	X	X	- -	- -	55 knots	- -	- -	- -
June 18, 1998	Milwaukee County	X	- -	- -	X	N/A	- -	- -	4.0
June 28, 1998	Milwaukee County	X	- -	- -	X	N/A	- -	- -	26.8
July 20, 1998	City of Milwaukee	X	X	- -	- -	0 knots	- -	1	1.3
November 10, 1998	Southeastern Wisconsin	- -	X	- -	- -	0 knots	4	14	698.0
February 11, 1999	City of Milwaukee	X	X	- -	- -	61 knots	- -	3	32.8
May 16, 1999	Milwaukee County	X	X	- -	- -	54 knots	- -	- -	1.3
May 16, 1999	City of Milwaukee	X	- -	- -	X	N/A	- -	- -	5.3
May 16, 1999	City of Milwaukee	X	- -	- -	X	N/A	- -	- -	5.3
May 17, 1999	Milwaukee County	X	- -	- -	X	N/A	- -	- -	66.7
June 6, 1999	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	262.7
July 20, 1999	Milwaukee County	X	- -	- -	X	N/A	- -	- -	98.5
July 23, 1999	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	39.4
August 10, 1999	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
March 8, 2000	Milwaukee County	- -	- -	X	- -	1.25 inch	- -	- -	- -
March 8, 2000	City of Milwaukee	X	X	X	- -	58 knots/1.0 inch	- -	- -	- -
May 8, 2000	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
May 8, 2000	City of Milwaukee	X	- -	- -	X	N/A	- -	- -	6.3
May 11, 2000	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	1.3
May 11, 2000	City of Milwaukee	X	X	- -	- -	65 knots	- -	- -	63.5
May 18, 2000	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
May 18, 2000	Milwaukee County	- -	- -	X	- -	1.75 inch	- -	- -	25.4
May 18, 2000	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
May 24, 2000	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	3.8

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
June 1, 2000	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 2, 2000	Milwaukee County	X	- -	- -	X	N/A	- -	- -	19.1
July 2, 2000	Milwaukee County	X	- -	- -	X	N/A	- -	- -	12.7
August 26, 2000	Milwaukee County	X	- -	- -	X	N/A	- -	- -	63.5
September 11, 2000	City of Milwaukee	X	X	- -	- -	0 knots	- -	- -	2.5
September 11, 2000	City of Milwaukee	X		- -	X	N/A	- -	- -	38.1
February 25, 2001	Milwaukee County	- -	X	- -	- -	0 knots	- -	- -	50.7
April 7, 2001	Southeastern Wisconsin	- -	X	- -	- -	57 knots	- -	- -	- -
May 14, 2001	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 11, 2001	Milwaukee County	X	X	- -	- -	61 knots	- -	- -	61.8
June 11, 2001	Milwaukee County	X	- -	- -	X	N/A	- -	- -	30.9
June 18, 2001	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
August 9, 2001	Milwaukee County	X	X	- -	- -	52 knots	- -	- -	92.7
September 19, 2001	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	- -
October 25, 2001	Southeastern Wisconsin	- -	X	- -	- -	56 knots	- -	- -	- -
December 5, 2001	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	123.6
April 18, 2002	Milwaukee County	X	X	- -	- -	53 knots	- -	- -	- -
June 10, 2002	Milwaukee County	X	X	X	- -	56 knots/0.75 inch	- -	- -	- -
June 15, 2002	City of Milwaukee, Timmerman Airport	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 15, 2002	City of Milwaukee, General Mitchell Airport	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 15, 2002	City of Milwaukee, General Mitchell Airport	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 15, 2002	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 8, 2002	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
August 21, 2002	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	60.8
August 21, 2002	City of Milwaukee, Timmerman Airport	X	X	- -	- -	70 knots	- -	- -	6,202.6
August 21, 2002	Milwaukee County	X	X	- -	- -	65 knots	- -	- -	121.6
August 21, 2002	Milwaukee County	X	- -	- -	X	N/A	- -	- -	608.1
August 21, 2002	Milwaukee County	X	- -	- -	X	N/A	- -	- -	1.2
May 11, 2003	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	35.7
July 4, 2003	City of Milwaukee, Timmerman Airport	X	X	- -	- -	60 knots	- -	- -	- -
July 4, 2003	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	3.6
August 1, 2003	Milwaukee County	X	X	- -	- -	50 knots	- -	- -	- -
August 3, 2003	Milwaukee County	- -	- -	- -	X	N/A	- -	- -	11.9
November 12, 2003	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	51.8
March 7, 2004	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	38.2
March 14, 2004	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	60.2

Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
April 18, 2004	Southeastern Wisconsin	- -	X	- -	- -	N/A	- -	- -	324.3
May 10, 2004	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
May 23, 2004	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
May 23, 2004	Milwaukee County	- -	- -	X	- -	1.5 inch	- -	- -	- -
June 23, 2004	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
June 23, 2004	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 16, 2004	City of Milwaukee, General Mitchell Airport	X	X	- -	- -	50 knots	- -	- -	- -
March 30, 2005	City of Milwaukee, General Mitchell Airport	X	X	- -	- -	50 knots	- -	- -	- -
March 30, 2005	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
March 30, 2005	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
March 30, 2005	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 4, 2005	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
June 7, 2005	City of Milwaukee, General Mitchell Airport	- -	- -	X	- -	1.5 inch	- -	- -	- -
June 7, 2005	City of Milwaukee, General Mitchell Airport	- -	- -	X	- -	0.88 inch	- -	- -	- -
June 7, 2005	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	22.4
June 7, 2005	Milwaukee County	- -	- -	X	- -	2.0 inch	- -	- -	22.4
June 30, 2005	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	- -
June 30, 2005	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
June 30, 2005	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	- -
August 4, 2005	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	22.4
September 13, 2005	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
September 13, 2005	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
November 13, 2005	Southeastern Wisconsin	- -	X	- -	- -	55 knots	- -	- -	23.9
March 13, 2006	Southeastern Wisconsin	- -	X	- -	- -	56 knots	- -	- -	- -
April 13, 2006	Milwaukee County	- -	- -	X	- -	2.0 inch	- -	- -	2,170.6
April 13, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	2,170.6
April 13, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	2,170.6
April 13, 2006	City of Milwaukee	- -	- -	X	- -	0.88 inch	- -	- -	- -
April 13, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	2,170.6
April 13, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
April 13, 2006	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
June 21, 2006	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
June 21, 2006	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	10.9

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Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
June 21, 2006	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	10.9
June 21, 2006	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	City of Milwaukee	X	X	- -	- -	56 knots	- -	- -	21.7
June 21, 2006	City of Milwaukee	X	X	- -	- -	52 knots	- -	- -	- -
July 9, 2006	Milwaukee County	X	X	- -	- -	52 knots	- -	- -	- -
July 9, 2006	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	5.4
July 9, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 9, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	City of Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 9, 2006	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
July 20, 2006	City of Milwaukee	X	- -	- -	X	N/A	- -	- -	16.3
July 22, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 30, 2006	City of Milwaukee	X	X	- -	- -	61 knots	- -	- -	54.3
August 2, 2006	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
August 23, 2006	City of Milwaukee	- -	- -	X	- -	0.75 inch	- -	- -	- -
October 2, 2006	Milwaukee County	X	X	- -	- -	52 knots	- -	- -	- -
October 2, 2006	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
October 2, 2006	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
October 4, 2006	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
October 4, 2006	Downtown Milwaukee	- -	- -	X	- -	0.88 inch	- -	- -	- -
March 21, 2007	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
March 21, 2007	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
March 21, 2007	City of Milwaukee/Timmerman Airport	- -	- -	X	- -	0.75 inch	- -	- -	- -
April 4, 2007	Milwaukee County	X	- -	- -	X	N/A	- -	- -	26.4
June 7, 2007	Downtown Milwaukee	X	X	- -	- -	56 knots	- -	- -	10.6
June 7, 2007	Downtown Milwaukee	X	X	- -	- -	59 knots	- -	- -	10.6
June 7, 2007	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	10.6
June 18, 2007	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	10.6
August 22, 2007	Milwaukee County	X	X	- -	- -	52 knots	- -	- -	26.4
August 22, 2007	Milwaukee County	X	X	- -	- -	52 knots	- -	- -	15.8
August 22, 2007	City of Milwaukee/Timmerman Airport	X	X	- -	- -	68 knots	- -	- -	26.4
August 22, 2007	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	15.8

Table 13 (continued)

Date	Affected Area	Event Type				Magnitude	Reported Damages[a]		
		Thunderstorm	High Winds	Hail	Lightning		Fatalities	Injuries	Property Damage (in thousands of dollars)[b]
September 27, 2007	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
September 27, 2007	Milwaukee County	- -	- -	X	- -	0.88 inch	- -	- -	- -
September 27, 2007	Milwaukee County	- -	- -	X	- -	0.75 inch	- -	- -	- -
September 27, 2007	City of Milwaukee/Timmerman Airport	- -	- -	X	- -	0.75 inch	- -	- -	- -
December 23, 2007	Southeastern Wisconsin	- -	X	- -	- -	50 knots	- -	- -	2.0
June 6, 2008	Milwaukee County	X	X	- -	- -	50 knots	- -	- -	25.4
June 7, 2008	Milwaukee County	X	X	- -	- -	50 knots	- -	- -	- -
June 8, 2008	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
June 14, 2008	Milwaukee County	X	- -	- -	X	N/A	- -	- -	20.3
July 2, 2008	City of Milwaukee/Timmerman Airport	X	X	- -	- -	56 knots	- -	- -	10.2
July 2, 2008	Downtown Milwaukee	X	X	- -	- -	56 knots	- -	- -	10.2
July 16, 2008	Downtown Milwaukee	X	X	- -	- -	56 knots	- -	- -	10.2
August 4, 2008	Milwaukee County	X	- -	- -	X	N/A	- -	- -	10.2
August 8, 2009	Milwaukee County	X	X	- -	- -	39 knots	- -	1	- -
August 9, 2009	Milwaukee County	X	X	- -	- -	60 knots	- -	- -	15.3
August 9, 2009	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
June 18, 2010	City of Milwaukee/General Mitchell Airport	X	X	- -	- -	57 knots	- -	- -	- -
June 21, 2010	Milwaukee County	X	X	- -	- -	56 knots	- -	- -	- -
June 21, 2010	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
July 22, 2010	Milwaukee County	X	X	- -	- -	53 knots	- -	- -	- -
July 22, 2010	Milwaukee County	X	- -	- -	X	N/A	- -	2	- -
August 9, 2010	City of Milwaukee/Timmerman Airport	X	X	- -	- -	54 knots	- -	- -	- -
September 6, 2010	Downtown Milwaukee	- -	- -	X	- -	0.88 inch	- -	- -	- -
September 6, 2010	Downtown Milwaukee	- -	- -	X	- -	1.0 inch	- -	- -	- -
September 6, 2010	Milwaukee County	- -	- -	- -	X	N/A	- -	- -	3.0
September 21, 2010	Milwaukee County	- -	- -	X	- -	1.0 inch	- -	- -	- -
September 24, 2010	Milwaukee County	- -	X	- -	- -	47 knots	- -	- -	2.5
September 25, 2010	Milwaukee County	- -	X	- -	- -	41 knots	- -	- -	0.8
Total	- -	193	191	104	27	- -	4	23	46,322.6

NOTE: N/A indicates data not available.

[a]*Fatalities, injuries, and property damages reported were based upon a geographic area impacted by the hazard event, which affected the City of Milwaukee and, in some cases, a larger area of impact than Milwaukee County itself, generally within the southeast regional area of Wisconsin.*

[b]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

Source: The National Climatic Data Center (NCDC) a part of the Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), and the National Environmental Satellite, Data and Information Service (NESDIS).

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From 1956 to 2010, 104 major hailstorms were reported in the City of Milwaukee. Several of these events coincided with thunderstorm and high wind events. From 1956 to 2010, NCDC reported $8.7 million in reported property damages from hailstorm events that occurred in and around the City of Milwaukee. The costliest hailstorm occurred on April 13, 2005. This event consisted of three hailstorms associated with supercell thunderstorms that pushed east-northeastward through southern Wisconsin This storm produced hailstones up to four inches in diameter. Throughout southern Wisconsin, thousands of motor vehicles, residential homes, businesses, and farms sustained hail damage. There were no reports of injuries or deaths. Vehicle damage consisted of broken windows and dented sheet metal. Roofs, widows, and siding of buildings were damaged. This episode was the most costly recorded hailstorm in the State of Wisconsin. Based on insurance company estimates provided to the National Weather Service, over $8.6 million in damages in Milwaukee County were associated with this event. Because it is covered under most homeowner's policies, hail damage is directly reported to insurance companies and is not usually publicly reported, unless it is extensive.[19]

From 1995 to September 2010, 27 lightning events were reported in Milwaukee County that resulted in significant property damage throughout southeastern Wisconsin. Most of the lightning events occurred during a thunderstorm or high wind event. In all, the NCDC has recorded about $2.5 million dollars in property damage due to lightning events in Milwaukee County, as shown in Table 13. Most of these damages occurred as a result of two lightning events: on July 27, 1997, lightning caused a massive fire at a towing business on the south side of Milwaukee, and on August 21, 2002, a lightning fire in the Village of Fox Point burned a home to the ground. During the 2002 storm event, at least 56,000 customers in southeastern Wisconsin lost electrical power due to lightning strikes and tree damage to power lines.

Vulnerability and Community Impact Assessment

The National Weather Service can forecast and track a line of thunderstorms that may be likely to produce severe high winds, hail, lightning, and tornadoes, but where these related hazards form or touch down, and how powerful they might be, remains unpredictable.

In order to assess the vulnerability of the City of Milwaukee to thunderstorms and related storm hazards, a review of the community assets described in Chapter II indicate the potential for significant thunderstorm and related hazard impacts to: 1) a variety of residential, commercial, and other developed land uses; 2) roadway transportation system; 3) utilities; 4) critical community facilities; and 5) historic sites. In addition, the Milwaukee County Pre-Disaster Mitigation Plan concluded that thunderstorms and related hazards are one of the greatest risks to the population and infrastructure within Milwaukee County.[20] Significant impacts may also be possible to other infrastructure or utility systems, or hazardous material storage sites. On average, between 1993 and 2010 reported damages have resulted in about $233,000 in damages per event, or about $2.6 million per year. However, very few events have been responsible for a large percentage of the total damages. Thus, this average damage cost is considered to be a very approximate measure of potential damages.

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion. About $24.5 billion of this total assessment is comprised of buildings and other improvements. Based on the current average estimate of $2.6 million in reported damages per year, it can be expected that approximately 0.01 percent of the value of all property, including buildings and infrastructure in the City of Milwaukee, will be damaged from these events each year. Due to the unpredictability of thunderstorm, high-wind, hail and lightning events, all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

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[19]*Rusty Kapela, Warning Coordination Meteorologist at Milwaukee/Sullivan NWS, personal communication.*

[20]*Milwaukee County Emergency Management*, op. cit.

Potential Future Changes in Thunderstorm, High-Wind, Hail, and Lightning Conditions

Based upon historical data, the City of Milwaukee can expect to experience an average of 5.8 thunderstorm, high-wind, hail, and/or lightning events per year. It should be noted that the historical record shows considerable variation among years in the number of events that occurred. While it would be expected that in some years the City will experience either fewer events or more events than the average number, the average annual number of events is not expected to change.

Changes in land use can have an impact on the potential for thunderstorm and related hazards to occur. However, development within the City itself is approaching "buildout" conditions with new development expected to be limited, as documented in the adopted regional land use plan and summarized in Chapter II, and indicate a limited potential increase in risk of weather related damage and related losses in the already developed urbanized areas within the City. Because of actions taken by the City, the County, local units of government and individuals, the current vulnerability to thunderstorms and related hazards have decreased in recent years. These ongoing mitigation measures are described further in Chapter V.

VULNERABILITY ASSESSMENT FOR TORNADOES

Wisconsin lies along the northern edge of an area of the United States commonly known as "tornado alley." This area extends northeasterly along an axis extending from Oklahoma and Iowa in the west, to Michigan and Ohio in the east. This corridor is one of the most tornadoprone areas of the United States, reporting 29 violent tornadoes during the year 2001. A tornado is defined as a violently rotating column of air extending from the ground up to the thunderstorm base. It generally lasts for only a short period of time. The tornado appears as a funnel-shaped column with its lower, narrower end touching the ground and upper, broader end extending into the thunderstorm cloud system. In some cases, the visible condensation cloud may not appear to reach the ground, but meanwhile tornado-force winds may be causing severe destruction (rotating winds can be nearly invisible, except for dust and debris). Similar events not reaching the ground surface, are known as funnel clouds. Funnel clouds may be a precursor to a tornado event. In Wisconsin, tornadoes usually occur in company with thunderstorms formed by eastward-moving cold fronts striking warm moist air streaming up from the south. However, it is not possible to predict tornado activity based upon the occurrence of thunderstorms, and, occasionally, multiple outbreaks of tornadoes occur along the frontal boundaries, affecting large areas of the State at one time. Tornadoes generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

Historically, tornadoes have been categorized based upon the most intense damage along their paths using the Fujita Scale. This scale is shown in Table 14. Under this scale tornado intensities range from F0 events, representing the tornados doing the smallest amount of damage, to F5 events, representing the tornados doing the greatest amount of damage. Wind velocities necessary to produce the particular damage are often associated with ratings along the Fujita Scale, but that practice can be misleading. The wind estimates associated with the Fujita Scale are intended to be based upon the expected damage to a well-built residential structure. Poorly built structures can suffer significant structural damage under lesser winds than the Fujita Scale might suggest. Other sorts of structures may or may not experience the same failures under high wind speeds that a house might. Thus the Fujita Scale is largely a residential scale, with much more care required in assessment after wind damage to other sorts of structures. Since February 2007, the Fujita Scale has been replaced by the Enhanced Fujita Scale which retains the same basic design of its predecessor with six strength categories. This scale is shown in Table 15. The newer scale reflects more refined assessments of tornado damage surveys, more standardization, and consideration of damage over a wider range of structures. Because the National Weather Service has decided not to reclassify tornadoes that occurred prior to the implementation of the Enhanced Fujita Scale, the Fujita Scale classifications have been retained for those storms which occurred prior to February 2007.

The destructive power of the tornado results primarily from its high-wind velocities, wind-driven debris, and uplifting force. These tornado characteristics probably account for 90 percent of tornado-caused damage. Since tornadoes are generally associated with severe storm systems, hail, torrential rain, and intense lightning usually

Table 14

FUJITA SCALE CHARACTERISTICS

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

Source: National Oceanic Atmospheric Administration.

Table 15

ENHANCED FUJITA SCALE CHARACTERISTICS

EF-Scale	Wind Speed (miles per hour)[a]	Character of Damage	Relative Frequency (percent)
EF0 (weak)	65-85	Light damage	53
EF1 (weak)	86-110	Moderate damage	32
EF2 (strong)	111-135	Considerable damage	11
EF3 (strong)	136-165	Severe damage	3
EF4 (violent)	166-200	Devastating damage	1
EF5 (violent)	> 200	Incredible damage (rare)	<1

[a]*Equivalent wind speeds associated with the Enhanced Fujita Scale represent a three-second gust of wind.*

Source: National Oceanic Atmospheric Administration.

accompany tornado events. In addition, tornadoes may be accompanied by downbursts; these events are characterized by strong downdrafts initiated by a thunderstorm that manifests as straight-line winds on or near the ground. These winds can be powerful, with speeds up to 70 to 100 mph. These winds interact with tornadoes, and can affect the path of the tornado event in such a manner as to make tornadoes somewhat unpredictable. Depending on their intensity, tornadoes can uproot trees, down power lines, and damage or destroy buildings and infrastructure. Flying debris can cause serious injury and death to humans, livestock, and wildlife in their path. An approaching cloud of debris can mark the location of a tornado, even if the classic funnel cloud is not visible. Before a tornado hits, the wind may die down and the air may become very still.

The National Weather Service monitors severe weather nationwide from its Norman, Oklahoma, office. This office is the only entity that can issue a tornado watch. The National Weather Service office in Milwaukee/ Sullivan, and Milwaukee County Emergency Management, may issue tornado warnings. A tornado watch means that tornadoes are possible, and that persons within the area for which the watches are issued should remain alert for approaching storms. A tornado warning means that a tornado has been sighted in an area or it is indicated as likely to have occurred by weather radar. When tornado warnings are issued for an area, persons near and within that designated area are advised to move to a pre-designated place of safety. Tornado shelters are identified by appropriate signage in public buildings. The National Weather Service operates a 24-hour weather radio

transmitter serving Milwaukee and Waukesha Counties, operating at a frequency of 162.400 megahertz (MHz), from a location in the Town of Delafield, Waukesha County. Southern portions of the Milwaukee County area, including portions of the City, are also served by a transmitter operating at a frequency of 162.450 MHz from a location at CTH KR and Wood Road in Racine County.

In addition to tornado watches and warnings, severe thunderstorm watches and warnings indicate severe weather conditions that may generate conditions in which tornadoes may occur. Such watches and warnings may be followed by tornado watches and warnings as weather conditions develop.

Historical Tornado Problems

Historically, a tornado with one of the longest tracks recorded in Wisconsin occurred on May 23, 1878.[21] This tornado tracked over 150 miles from Iowa County through Dane, Waukesha, and Milwaukee Counties, killing 19 and injuring 45 people throughout the four counties. Although such tornadoes are relatively rare natural hazards in the City of Milwaukee, they can cause substantial loss of life and damage to property.

Description of Recent Tornado Events

In the State of Wisconsin, tornado paths historically have averaged 3.5 miles in length and 50 yards in width, although tornado paths of a mile or more in width and 300 miles in length have been known to occur elsewhere in the United States. On average, tornadoes in southeastern Wisconsin move across the land surface at speeds between 25 and 45 miles per hour, although overland speeds of up to 70 mph have been reported. Tornadoes rarely last more than a few minutes over a single spot or more than 15 to 20 minutes in a 10-mile area, but, in those few minutes, significant damage may occur.

The gravity of any particular tornado event is measured in terms of resulting deaths, injuries, and economic losses. The magnitudes of the tornadoes recorded in southeastern Wisconsin have been low, primarily F0 or weak F1 events on the Fujita scale, as shown in Table 14. Nevertheless, tornadoes are the third most costly natural hazards to impact southeastern Wisconsin.

Since 1950, a total of 18 tornadoes have been recorded in or near the City of Milwaukee, or about one tornado every 40 months. These are shown on Map 11, and documented in terms of their magnitude and impact in Table 16. In total, these 18 tornadoes have resulted in no deaths, 176 injuries, and over $16 million in property damages, with the average damage estimated at more than $926,000 dollars. On average, there are approximately 21 tornadoes reported each year within the State of Wisconsin.

Of the tornadoes reported in Milwaukee County since 1950, seven were categorized as F2 events on the Fujita scale. These seven tornado events collectively resulted in nearly $5 million in property damage in Milwaukee County. However, two F1 tornados caused the greatest number of injuries and highest damage costs recorded. On August 11, 1969, an F1 tornado caused 153 injuries and nearly $1.5 million in damages, and on March 8, 2000, an F1 tornado caused over $5.8 million in property damage and 16 injuries near General Mitchell International Airport. Of the remaining tornado events, nine were classified as F1 tornadoes and one was classified as an F0 event. No magnitude information was available for one tornado.

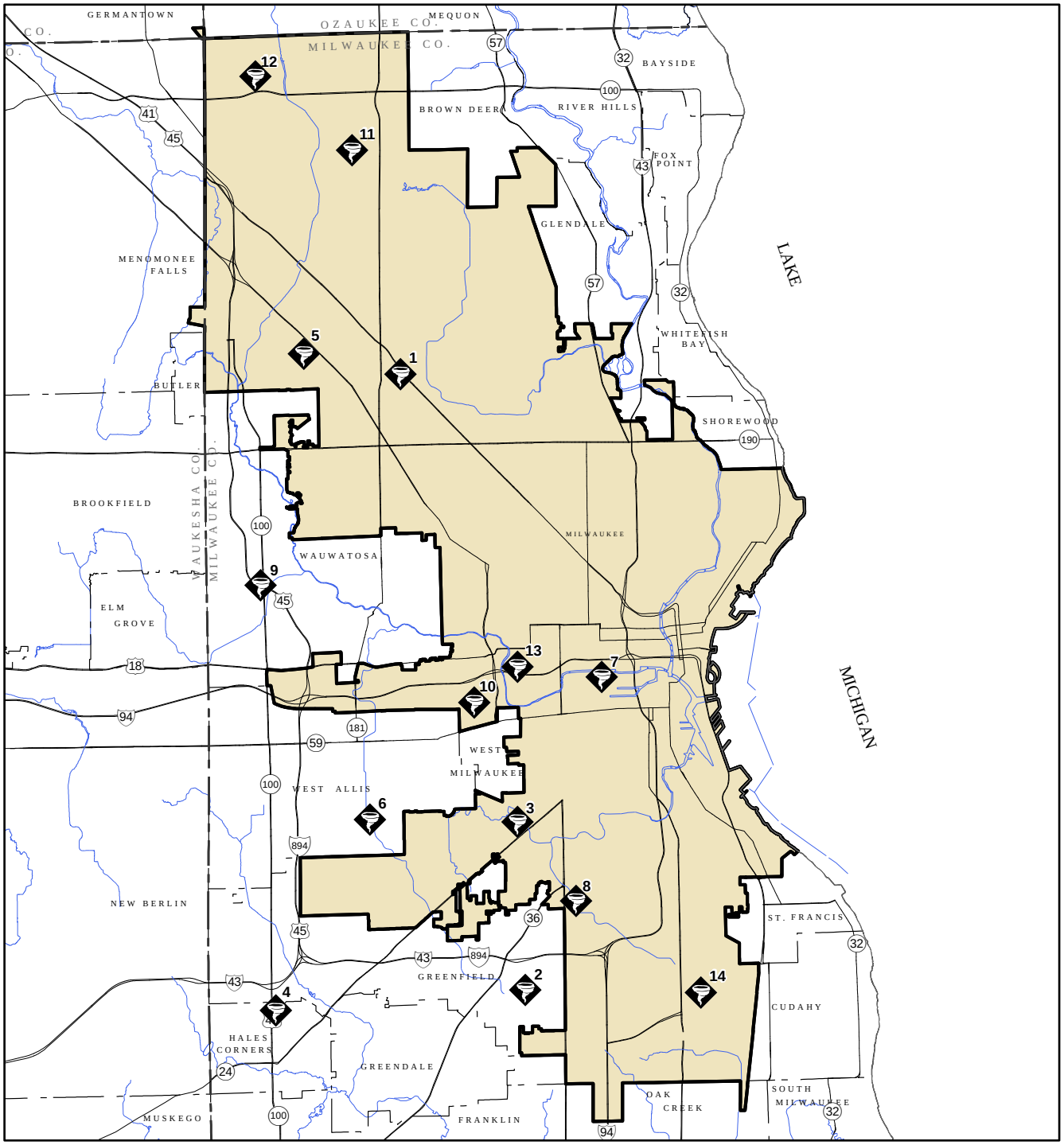
Vulnerability and Community Impact Assessment

In order to assess the vulnerability of the City of Milwaukee to tornado and related storm hazards, a review of the community assets described in Chapter II was made which indicates the potential for significant tornado impacts to: 1) a variety of residential, commercial, and other developed land uses; 2) roadway transportation system; 3) utilities; 4) critical community facilities; and 5) historic sites. In addition, the Milwaukee County Pre-Disaster

[21] *National Oceanic and Atmospheric Administration,* http://www.crh.noaa.gov/mkx/tortrack.htm.

Map 11

TORNADOES IN THE CITY OF MILWAUKEE: 1950-2010



14 REPORTED TORNADO SIGHTING AND REFERENCE NUMBER (SEE TABLE 16)

CITY OF MILWAUKEE

N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: SEWRPC.

Table 16

TORNADO EVENTS REPORTED IN MILWAUKEE COUNTY: 1958-SEPTEMBER 2010

Number on Map 11	Date	Affected Area	Magnitude (Fujita)	Length (miles)	Width (yards)	Fatalities	Injuries	Property Damage (in thousands of dollars)[a]
1	August 7, 1958	City of Milwaukee	F2	1	100	- -	4	$ 189.3
2	September 26, 1959	Milwaukee County	F2	2	33	- -	3	1,879.8
3	July 22, 1962	City of Milwaukee	F2	- -	33	- -	- -	181.1
4	October 4, 1962	Milwaukee County	F1	1	33	- -	- -	181.1
- -	August 22, 1964	Milwaukee County	F1	2	400	- -	- -	1,811.3
5	September 3, 1964	City of Milwaukee	F2	- -	100	- -	- -	1,811.3
6	August 11, 1969	Milwaukee County	F1	- -	100	- -	153	1,490.5
7	August 25, 1975	City of Milwaukee	F1	- -	10	- -	- -	10.2
8	August 25, 1975	City of Milwaukee	F2	- -	20	- -	- -	101.7
9	April 2, 1977	Milwaukee County	F2	1	33	- -	- -	90.3
10	August 4, 1977	City of Milwaukee	F1	- -	- -	- -	- -	- -
11	August 4, 1980	City of Milwaukee	F2		20	- -	- -	663.8
- -	July 20, 1981	City of Milwaukee	F1	1	20	- -	- -	60.2
12	August 17, 1985	City of Milwaukee	F1	2	50	- -	- -	- -
13	May 24, 1989	City of Milwaukee	F0	- -	23	- -	- -	441.1
- -	August 30, 1993	Milwaukee County	N/A	- -	- -	- -	- -	- -
14	March 8, 2000	City of Milwaukee	F1	2	75	- -	16	5,844.8
- -	July 2, 2000	Milwaukee County	F1	7	100	- -	- -	1,905.9
Total	- -	- -	- -	- -	- -	0	176	$16,662.2

NOTE: N/A indicates data not available.

[a]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

Source: National Climatic Data Center and SEWRPC.

Mitigation Plan concluded that tornadoes are one of the greatest risks to the population and infrastructure within Milwaukee County.[22] Significant impacts may also be possible to other infrastructure or utility systems, solid waste disposal sites, or hazardous material storage sites.

Tornado prediction is not an exact science. The National Weather Service can forecast that a line of thunderstorms may be likely to produce tornadoes, but where they form or touch down, and how powerful they might be, remains unpredictable. As can be seen from the distribution of historic F1 and F2 tornado events since 1950 in the City of Milwaukee, shown on Map 11, the locations of tornado impact points are widely scattered throughout the City and County. On average, historic tornado events have resulted in about $926,000 in property damages per event. However, one of the events have been responsible for over one third of the total damages. Thus, the average damages cost is considered to be only an approximate measure of potential damages. Based on a yearly average estimated from reported tornado damage between 1958 and 2010, tornadoes cause approximately $314,381 in damage each year.

During a tornado, homes, businesses, public buildings, and infrastructure may be damaged or destroyed by high winds, rain, and hail. Airborne debris carried by the tornado and associated high winds, can break windows and doors, allowing winds and rain access to interior spaces. Fixed infrastructure, such as roads and bridges, also can

[22]*Milwaukee County Emergency Management*, op. cit.

be damaged by exposure to high winds, although more damage appears to result from washout associated with flash flooding and debris jams as opposed to direct damage due to contact with funnel clouds. Notwithstanding, in an extreme tornado event, such as a F4 event, the force of the wind alone can cause tremendous devastation, uprooting trees, toppling power lines, and inducing the failure of weak structural elements in homes and buildings.

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion.[23] About $24.5 billion of this total is comprised of buildings and other improvements. Based on the current average estimate of $314,381 in reported damages per year, it can be expected that approximately 0.0013 percent of the value of all property, including buildings and infrastructure in the City of Milwaukee, will be damaged from tornadoes each year. Due to the unpredictability of tornado events, all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

Potential Future Changes in Tornado Conditions

Based upon historical data, the City of Milwaukee can expect to experience an average of 0.35 tornado events per year or about one tornado every three years. It should be noted that the historical record shows considerable variation among years in the number of events that occurred. While it would be expected that in some years the City will experience either fewer events or more events than the average number, the average annual number of events is not expected to change.

Changes in land use can have an impact on the potential for tornado and related hazards to occur. However, development within the City itself is approaching "buildout" conditions with new development expected to be limited, as documented in the adopted regional land use plan and summarized in Chapter II, and indicate a continuing level of moderate risk of tornado damage and related losses in the City. Because of actions taken by the City, the County, and individuals, the current vulnerability to tornadoes and related hazards has decreased in recent years. Ongoing mitigation measures are described further in Chapter V.

VULNERABILITY ASSESSMENT FOR EXTREME TEMPERATURES

Extreme heat and cold are two of the most underrated, least understood, and deadly of all the natural hazard events that impact the City of Milwaukee. In contrast to the visible, destructive, and violent characteristics associated with floods and tornadoes, extreme high or low temperatures are "silent killers." Heat deaths occur quietly, without headline-making destruction. The Center for Disease Control and Prevention reports that on average, 688 people die each year nationwide from excessive heat, more than lightning, tornadoes, floods, and hurricanes combined.[24] Excessive heat has become the most deadly hazard in Wisconsin. According to the National Weather Service, between 1982 and 2008, 116 people have died in Wisconsin as a direct result of heat waves. This rate of mortality due to heat events during this period is over four times greater than the next most deadly natural hazards, cold waves (31 deaths). Temperature data for two selected observation stations in the City of Milwaukee have been shown in Table 17 to indicate extreme high and low temperatures and the departure from average temperatures recorded in the period from 1990 through 2009. The average high and low extreme temperatures for these two stations are 95.3ºF and -7.2ºF for General Mitchell International Airport and 98.3ºF and -8.5ºF for Mount Mary College during this period. Prolonged exposure to either of these temperatures could present a significant danger. It is worth noting that Lake Michigan may be exerting some effect on the average and the extreme cold temperature, but is not appreciably reducing the average extreme high temperature.

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[23] *Wisconsin Department of Revenue.*

[24] *U.S. Centers for Disease Control and Prevention, "Heat-Related Deaths—United States, 1999-2003,"* Morbidity and Mortality Weekly Reports, *Volume 55, July 28, 2008.*

Table 17

EXTREME AND DEPARTURE FROM AVERAGE TEMPERATURE CHARACTERISTICS WITHIN THE CITY OF MILWAUKEE: 1990-2009

Year	General Mitchell International Airport				Mount Mary College			
	High Temperature (ºF)	Low Temperature (ºF)	Average Annual Temperature (ºF)	Departure from Average Temperature (ºF)	High Temperature (ºF)	Low Temperature (ºF)	Average Annual Temperature (ºF)	Departure from Average Temperature (ºF)
1990	98	-7	49.9	3.8	98	-8	51.2	3.7
1991	97	-3	50.0	3.9	98	-6	50.6	3.1
1992	90	-5	47.5	1.4	93	-6	48.4	0.9
1993	95	-2	47.8	1.7	95	-5	48.3	0.1
1994	100	-21	49.4	3.3	100	-24	49.3	1.1
1995	103	-5	48.5	2.4	108	-6	49.1	0.8
1996	95	-26	46.0	-0.2	97	-25	46.8	-1.4
1997	92	-8	46.4	0.2	98	-10	48.2	-0.1
1998	95	-4	50.9	4.8	N/A	-5	N/A	N/A
1999	99	-15	48.3	3.1	104	-13	50.5	2.2
2000	89	-8	47.9	1.8	94	-8	48.9	0.7
2001	95	1	48.2	2.9	102	-6	50.5	2.3
2002	98	-6	49.2	1.7	103	-5	49.7	1.5
2003	96	-5	46.2	-0.1	98	-6	48.1	-0.1
2004	91	-10	47.7	0.2	94	-12	48.5	0.3
2005	97	-1	49.2	1.3	99	-3	49.5	1.3
2006	98	12	50.1	2.6	100	14	50.2	2.0
2007	94	-11	48.9	1.4	97	-14	49.3	1.1
2008	89	-6	47.0	-0.5	95	-8	46.8	-1.4
2009	94	-12	47.3	-0.3	95	-14	47.0	-1.2
Average	95.3	-7.2	48.3	1.8	98.3	-8.5	49.0	0.9

NOTE: N/A indicates data not available.

Source: National Oceanic and Atmospheric Administration and SEWRPC.

Heat and humidity together can inflict the most harm to human health. High humidity makes heat more dangerous because it slows the evaporation of perspiration, which is the body's natural cooling process. A measure of discomfort and the level of risk posed to people in high-risk groups is the Heat Index (HI) which is expressed in degrees Fahrenheit (ºF) and equals a relative humidity (RH) adjustment added to the actual air temperature. For example, if the air temperature is 94ºF and the RH is 55 percent, the HI would equal 106ºF (see Table 18). Since HI values were devised for shady, light wind conditions, exposure to full sunshine can increase HI values by up to 15ºF. The level of risk to people in high-risk groups associated with different levels of the HI is shown in Table 19.[25] The NWS initiates alert procedures (advisories or warnings) when the Heat Index is expected to have a significant impact on public safety. The expected severity of a heat wave determines whether advisories or warnings are issued. High temperature periods are often also accompanied by the related air quality problems related to ground-level ozone which can be harmful, especially to sensitive groups, such as active children and adults with respiratory problems. During 2001 and 2002, there were 10 and 11 days, respectively, when weather conditions were forecast in southeastern Wisconsin which could have resulted in unhealthy levels of ozone (the main component of smog).

The following definitions/criteria are for the 20 counties in south-central and southeastern Wisconsin served by the Milwaukee/Sullivan Weather Forecast Office:

[25]*High-risk groups include the very young, the old, and people with chronic health conditions.*

Table 18

HEAT INDEX CHART

Temperature (°F)	Relative Humidity (percent)												
	100	95	90	85	80	75	70	65	60	55	50	45	40
	Heat Index (°F)												
80	87.2	86.4	85.6	84.9	84.2	83.6	83.0	82.4	81.8	81.3	80.8	80.3	79.9
82	94.5	93.0	91.5	90.1	88.8	87.6	86.4	85.4	84.4	83.6	82.8	82.5	81.5
84	102.7	100.3	98.0	95.9	94.0	92.2	90.5	88.9	87.5	86.3	85.1	84.1	83.3
86	111.5	108.3	105.3	102.5	99.8	97.3	95.1	93.0	91.1	89.4	87.9	86.6	85.4
88	121.2	117.1	113.2	109.6	106.3	103.1	100.2	97.6	95.1	93.0	91.0	89.4	87.4
90	131.6	126.6	121.9	117.5	113.3	109.5	105.9	102.7	99.7	97.0	94.6	92.5	90.7
92	142.8	136.9	131.3	126.0	121.0	116.4	112.2	108.3	104.7	101.4	98.5	96.0	93.8
94	154.8	147.9	141.3	135.2	129.4	124.0	119.0	114.4	110.2	106.3	102.9	99.8	97.2
96	167.5	159.6	152.1	145.0	138.3	132.1	126.4	121.0	116.1	111.7	107.6	104.0	100.9
98	181.0	172.0	163.5	155.5	147.9	140.9	134.3	128.2	122.6	117.4	112.8	108.6	104.9
100	195.3	185.2	175.7	166.7	158.2	150.2	142.8	135.9	129.5	123.6	118.3	113.5	109.3
102	210.4	199.2	188.5	178.5	169.0	160.1	151.8	144.1	136.9	130.3	124.3	118.8	113.9
104	226.2	213.8	202.1	191.0	180.5	170.7	161.4	152.8	144.8	137.4	130.6	124.4	118.9
106	242.7	229.2	216.4	204.2	192.6	181.8	171.6	162.0	153.1	144.9	137.3	130.4	124.2
108	260.1	245.4	231.3	218.0	205.4	193.5	182.3	171.1	161.9	152.8	144.4	136.7	129.8
110	278.2	262.2	247.0	232.5	218.8	205.8	193.5	182.0	171.2	161.2	152.0	143.4	135.7

Source: National Weather Service.

Table 19

LEVEL OF RISK FOR PERSONS IN HIGH RISK GROUPS ASSOCIATED WITH THE HEAT INDEX

Heat Index (degrees Fahrenheit)	Category	Possible Heat Disorders for Persons in High Risk Groups
80-90	Caution	Fatigue possible with prolonged exposure and/or physical activity
90-105	Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity
105-129	Danger	Sunstroke, muscle cramps and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity
130 or Above	Extreme Danger	Heat stroke or sunstroke likely

Source: National Weather Service.

- **Outlook Statement**—Issued two to seven days prior to time that minimal Heat Advisory or Excessive Heat Warning conditions are expected. Serves as a long-term "heads-up" message.

- **Excessive Heat Watch**—Issued 24 to 48 hours in advance when Excessive Heat Warning conditions are expected.

- **Heat Advisory**—Issued six to 24 hours in advance of any 24-hour period in which daytime heat indices are expected to be 100° to 104°, or 95° to 99° for four or more consecutive days, and nighttime heat indices are greater than or equal to 75. Advisories are issued for less serious conditions that cause significant inconvenience and, if caution is not exercised, could lead to situations that may threaten life.

- **Excessive Heat Warning**—Issued six to 24 hours in advance of any 24-hour period in which daytime heat indices are expected to exceed 105° for three or more hours, and nighttime heat indices are greater than or equal to 75°. In addition if Heat Advisory conditions are expected to persist for four or more days, an Excessive Heat Warning will be issued. Warnings are issued for weather conditions posing a threat to life.

During extended periods of very high temperatures, coupled with high humidity levels, individuals can suffer a variety of ailments, including heat cramps (muscular pains and spasms due to heavy exertion). Although heat cramps are the least severe symptom, they are an early signal that the body is having trouble with the heat. Heat exhaustion typically occurs when people exercise heavily or work in a hot, humid place where body fluids are lost through heavy sweating. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a form of mild shock. If not treated, the victim may suffer heat stroke. Heat stroke is life threatening and requires immediate medical attention. The victim's temperature control system, which produces sweat to cool the body, stops working. The body temperature can rise so high that brain damage and death may result if the body is not cooled quickly. Sunstroke is another term for heat stroke. In addition to posing a public health hazard, periods of excessive heat usually result in high electrical consumption for air conditioning, which can cause power outages and brown outs.

During the period from 1982 through 2008, 31 people died in Wisconsin due to exposure to cold. When vehicle accidents and fatalities, fires due to dangerous use of heaters, and other winter weather fatalities are also considered, it increases the severity of severe cold periods. Exposure to extreme cold temperatures can cause hypothermia and frostbite; can lead to loss of fingers and toes; or cause permanent kidney, pancreas, and liver injury, and even death. A major winter storm can last for several days and be accompanied by high winds, freezing rain or sleet, heavy snowfall, and cold temperatures. Wind chill is not the actual temperature, but rather how wind and cold feel on exposed skin. As the wind increases, heat is carried away from the body at an accelerated rate, driving down the body temperature. A wind chill of -20°F will cause frostbite in just 30 minutes. Frostbite is damage to body tissue caused by extreme cold. Frostbite causes a loss of feeling and a white or pale appearance in extremities, such as fingers, toes, ear lobes, or the tip of the nose. If symptoms are detected seek immediate medical help. Hypothermia is a condition brought on when the body temperature drops to less than 95°F. Hypothermia may cause lasting kidney, liver, and pancreas problems or death. Warning signs include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. Take the person's temperature. If below 95°F, get medical care immediately. Infants and elderly people are most susceptible. Fifty percent of all cold-related injuries are expected to occur in people over 60 years old, more than 75 percent will happen to men, and about 20 percent will occur in the home.

What constitutes extreme cold varies in different parts of the country. In the south, near freezing temperatures are considered extreme cold. Pipes may freeze and burst in homes that are poorly insulated or without heat. In the north, extreme cold means temperatures well below zero. Winter residents in the City of Milwaukee may see heavy snow, strong winds/blizzards, extreme wind chill, lake-effect snow, and ice storms. The public can stay informed by listening to NOAA Weather Radio, commercial radio or television for the latest winter storm warnings, watches.

Historical Extreme Temperature Problems

Historically, most of the all-time maximum daily temperatures in Wisconsin were recorded during the Dust Bowl years between 1934 and 1936. The City of Milwaukee reached a record high temperature of 105ºF on July 24, 1934. The highest temperature ever recorded in Wisconsin was 114ºF, which occurred on July 13, 1936, at the

Wisconsin Dells. In the City of Milwaukee, beginning on July 12, 1995, the National Weather Service issued a heat advisory, the next day that advisory was upgraded to an excessive heat warning. Temperatures reached 104ºF and the heat index peaked at 125ºF. This was the very first time that the National Weather Service in Sullivan, Wisconsin, had issued a heat advisory and an excessive heat warning. There was a period of high temperatures in 1988, but that was a dry heat and the outcome was much different. This heat wave was unusual because high temperatures were combined with high humidity, resulting in a heat index, which peaked at 125ºF. The "summer of 1995" severe heat wave affected most of Wisconsin and resulted in 154 fatalities, 82 direct and 72 indirect. In addition, approximately 400 people received medical treatment due to heat-related causes. Many of these deaths occurred in urbanized areas in southeastern Wisconsin, particularly in the City of Milwaukee. The 1995 summer heat wave holds the record as the number one weather-related killer in Wisconsin since it became a state in 1848. The July 1995 heat wave was a highly rare and, in some respects, unprecedented event in terms of both unusually high maximum and minimum temperatures and the accompanying high relative humidity.

On December 9, 1995, bitter-cold arctic air swept into Wisconsin on northwest winds of 20 to 40 mph. Temperatures dropped as much as 15ºF in 15 minutes as the strong front moved through. Wind chill values ranged from -25ºF to -50ºF. In the City of Milwaukee, two people died directly from hypothermia, while hypothermia was a secondary cause indirectly related for one death in Dane County and one death in Kenosha County. Twelve cases of frostbite were also reported in the City of Milwaukee. An episode of extreme cold, which started in late January 1996, continued through the first four days of February across south-central and southeastern Wisconsin. Wind chills were in the -35ºF to -60ºF range many times during this event that resulted in four cold-weather hypothermia deaths. In addition, there were 15 reported cases of sustained frostbite in the City of Milwaukee and a low temperature of -23ºF was recorded on February 3, 1996, in the City of Milwaukee.

Description of Recent Extreme Temperature Events

Extreme temperatures that affect the City of Milwaukee are not localized events, as they usually encompass the entire south-central and southeastern portions of the State and may continue for several days or weeks. Table 20 lists the extreme and record high and low temperature events in southeastern Wisconsin from January 1, 1994, through September 30, 2010, which have directly resulted in 121 fatalities and 162 injuries.

In the spring and summer of 2002, several brief one day heat waves were recorded with heat indices over 100ºF and as high as 110ºF. Two deaths were directly related to these events. In the summer of 2001, three rounds of excessive heat in July and August affected most of southeastern Wisconsin. Heat index temperatures reached 110ºF, six people died, and numerous people suffered from heat-related sicknesses in the City of Milwaukee.

During the last two weeks of July 1999, an oppressive heat wave enveloped the City of Milwaukee, peaking during the four days of July 28 through 31, 1999. Throughout these four days, high humidity and temperatures in the 90s and 100s produced heat index values from 110ºF to as high as 125ºF. The heat wave was directly and indirectly responsible for 20 deaths in Wisconsin, 8 in the City of Milwaukee. During this time, there was record peak daily electric power demand in the Milwaukee area, and during that summer, there was a record set for the Midwest region for electrical demand.

A period of very hot and humid weather began on the evening of July 30, 2006 and continued into August 2, 2006. Overnight temperatures fell to only 70 to 75ºF on July 30 and soared into the 95 to 100 degree range during the afternoon of July 31. With dew points in the low to mid 70s, heat index valued dropped to about 75 degrees overnight on July 30 and peaked in the 105 to 110 degree range across south-central and southeastern Wisconsin during the afternoon of July 31. Temperatures and heat index values remained high until the passage of a cold front on the afternoon of August 2 ended the heat wave. This heat wave resulted in two heat-related deaths in Milwaukee County. In addition, an estimated 40 people in Milwaukee County were hospitalized due to heat-related symptoms.

Table 20

EXTREME TEMPERATURE EVENTS IN SOUTHEASTERN WISCONSIN: 1994 TO SEPTEMBER 30, 2010

Date	Time	Type	Fatalities	Injuries
January 13, 1994	6:00 a.m.	Extreme cold	0	0
June 14, 1994	12:00 p.m.	Heat Wave	0	0
July 13, 1995	8:00 a.m.	Excessive heat	85	0
October 12, 1995	2:00 p.m.	Record warmth	0	0
November 1995	- -	Extreme cold	1	0
December 9, 1995	3:00 a.m.	Extreme cold	2	0
January 30, 1996	2:00 a.m.	Extreme wind chill	2	0
January 31, 1996	12:00 a.m.	Extreme cold	0	10
February 1996	- -	Extreme cold	4	0
February 1, 1996	12:00 a.m.	Extreme cold	4	18
June 29, 1996	- -	Heat Wave	0	70
January 17, 1997	12:00 a.m.	Extreme cold	0	3
November 30, 1997	- -	Extreme cold	2	0
July 16, 1997	5:00 p.m.	Excessive heat	1	0
March 26, 1998	6:00 a.m.	Record warmth	0	0
June 25, 1998	6:00 a.m.	Excessive heat	0	21
September 27, 1998	3:00 p.m.	Excessive heat	0	0
November 23, 1998	12:00 p.m.	Excessive heat	0	0
December 1, 1998	12:00 a.m.	Excessive heat	0	0
January 5, 1999	12:00 a.m.	Extreme cold	0	0
February 11, 1999	12:00 a.m.	Extreme cold	0	0
July 4, 1999	3:00 a.m.	Excessive heat	0	0
July 23, 1999	2:00 a.m.	Excessive heat	0	0
July 29, 1999	8:00 a.m.	Excessive heat	8	0
November 8, 1999	12:00 p.m.	Record warmth	0	0
November 13, 1999	1:00 p.m.	Record warmth	0	0
July 21,2001	12:00 a.m.	Excessive heat	2	0
August 6, 2001	11:00 a.m.	Excessive heat	4	0
April 15, 2002	1:00 p.m.	Excessive heat	1	0
June 20, 2002	12:00 a.m.	Excessive heat	1	0
June 22, 2002	12:00 p.m.	Excessive heat	1	0
June 30, 2002	12:00 a.m.	Excessive heat	0	0
July 1, 2002	6:00 a.m.	Excessive heat	0	0
July 8, 2002	11:00 a.m.	Excessive heat	0	0
July 21, 2002	12:00 a.m.	Excessive heat	0	0
July 26, 2002	10:00 a.m.	Excessive heat	0	0
July 24, 2005	2:00 p.m.	Excessive heat	0	0
December 18, 2005	12:00 a.m.	Cold and wind chill	0	0
February 17, 2006	6:00 p.m.	Cold and wind chill	0	0
February 18, 2006	6:00 p.m.	Cold and wind chill	0	0
July 16, 2006	5:00 p.m.	Heat	0	0
July 30, 2006	6:00 p.m.	Heat	0	40
August 1, 2006	12:00 a.m.	Heat	2	0
December 7, 2006	12:00 a.m.	Cold and wind chill	1	0
February 3, 2007	9:00 a.m.	Cold and wind chill	0	0
January 30, 2008	2:00 a.m.	Cold and wind chill	0	0
December 15, 2008	3:00 a.m.	Cold and wind chill	0	0
Total	- -	- -	121	162

Source: Milwaukee County Pre-Disaster Mitigation Plan, National Weather Service, and the National Climatic Data Center.

Table 21

1995 NATIONWIDE HEAT-RELATED FATALITIES BY AGE AND GENDER

Age Group	Female	Male	Total	Percent of Total
0 to 9 Years Old	6	6	12	1
10 to 19 Years Old	0	2	2	<1
20 to 29 Years Old	2	3	5	<1
30 to 39 Years Old	7	27	34	3
40 to 49 Years Old	15	64	79	8
50 to 59 Years Old	22	73	95	9
60 to 69 Years Old	50	129	179	18
70 to 79 Years Old	131	122	253	25
80 to 89 Years Old	145	96	241	24
90 Years Old and Older	51	10	61	6
Unknown	6	54	60	6
Total	425	586	1,021	100
Percent	43	57	100	- -

Source: National Weather Service.

Most heat-related deaths occur in cities. Large urban areas become “heat islands.” Brick buildings, asphalt streets, and tar roofs store heat and radiate it like a slow burning furnace. Heat builds up in a city during the day and cities are slower than rural areas to cool down at night. The amount of sunshine is an important contributing factor in urban heat waves. In addition, the stagnant atmospheric conditions associated with a heat wave trap ozone and other pollutants in urban areas. The worst heat disasters, in terms of loss of life, happen in large cities when a combination of high daytime temperatures, high humidity, warm nighttime temperatures, and an abundance of sunshine occurs for a period of several days. There are also socioeconomic problems that make some urban populations at greater risk. The elderly, disabled, and debilitated are especially susceptible to heat-related illness and death. During the 1995 nationwide heat wave, 67 percent of the fatalities occurred in the 60-year-old to 89-year-old age group (see Table 21).

An arctic high-pressure ridge, fresh, deep snow cover, clear skies, and light winds allowed temperatures to plunge on January 5, 1999, to well below zero across south-central and southeastern Wisconsin. Several new low temperature records were set, -23ºF at Janesville (Rock County) and -20ºF in the City of Kenosha.

In the wake of a major winter storm on December 1, 2006, cold weather settled over southern Wisconsin, with daily temperature averages well below normal. December 7 was an unseasonably cold day in Milwaukee, with a high temperature of 17ºF and a low temperature of 8ºF. One death was attributed to this cold snap.

Vulnerability and Community Impact Assessment

Temperature extremes are primarily a public health concern. The poor and elderly are much more susceptible to temperature-related deaths and injury. Education, improved social awareness, and community outreach programs have likely helped to reduce number of individuals killed or injured by extreme temperature events. Those at greatest risk are the very young, the very old, and the sick. Most deaths during a heat wave are the result of heat stroke. Large and highly urbanized cities can create an island of heat that can raise the area temperature 3ºF to 5ºF. Urban communities with substantial populations of elderly, disabled, and debilitated people could face a significant medical emergency during an extended period of excessive heat. Some residents in high crime areas, especially the elderly, may be afraid to open windows or travel to cooling shelters. As neighborhoods change, some older residents become isolated because of cultural, ethnic, and language differences.

High demands for electricity can result in blackouts and brownouts. Loss of water pressure can result from the opening of fire hydrants in urban areas. Stagnant atmospheric conditions that occur with heat waves are also favorable for trapping ozone and other pollutants in urban areas. Pets can suffer from prolonged exposure to excessive heat.

A review of the community assets described in Chapter II indicates the potential for extreme temperature hazard events to impact: 1) residents, especially the poor, elderly, and sick; 2) pets; 3) municipal water and electric utilities; and 4) natural surface and groundwater reserves. In addition, the Milwaukee County Pre-Disaster Mitigation Plan also found that extreme temperature hazards pose a risk to the population within Milwaukee County.[26] No specific cost data are estimated for temperature extreme events, because the nature of such events does not readily permit direct cost analysis.

Potential Future Changes in Extreme Temperature Conditions

Based upon historical data, the City of Milwaukee can expect to experience an average of 2.8 extreme temperature events per year. It should be noted that the historical record shows considerable variation among years in the number of events that occurred. While it would be expected that in some years the City will experience fewer events or more events than the average number, the average annual number of events is not expected to change.

VULNERABILITY ASSESSMENT FOR LAKE MICHIGAN COASTAL HAZARDS

The Lake Michigan coast lying within the jurisdiction of the City of Milwaukee consists of about eight miles of shoreline. The land uses along the shoreline are documented in Chapter II.

There are three types of Lake Michigan coastal hazards which potentially affect the City of Milwaukee, including:

- Erosion of coastal bluffs, beaches, and nearshore lakebeds;
- Flooding from high lake levels and storm-induced surge (temporary water level changes); and
- Damage to shoreline structures, such as residences, businesses, and public facilities, from storm waves, including wave runup.

The focus of the vulnerability assessment is on the first type of hazard noted above, erosion of bluffs, beaches, and nearshore areas as that phenomenon is a documented hazard in Milwaukee County where bluff recession rates exceeding 12 feet per year have been reported.[27] However, there is only a short length of shoreline between Edgewood Avenue and the north end of the Linnwood Avenue water treatment plant where potential shoreline erosion is an issue. In this reach, the bluffs are considered moderately stable and the rate of erosion is less than one foot per year. The second hazard, flooding from high lake levels, is being considered, along with flooding in other areas of the City. With regard to the third hazard, storm wave damage, there are hazards in the County primarily in the City of Milwaukee in areas protected by sheet piling, breakwaters, and revetments. However, the design of these shore protection structures, most notably those protecting the City sewage treatment and water plants, and the marina facilities, have been designed using standards suitable for major public and private

[26]*Milwaukee County Emergency Management,* op. cit.

[27]*SEWRPC Community Assistance Planning Report No. 163,* A Lake Michigan Coastal Erosion Management Study for Milwaukee County, Wisconsin, *October 1989; and SEWRPC Technical Report No. 36,* Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin: 1995, *December 1997.*

facilities. In addition, the structures are maintained as needed. Given these conditions, Lake Michigan coastal erosion is considered to be a relatively minor hazard in the City of Milwaukee even though there are areas within Milwaukee County where this hazard is more severe.

Historical Coastal Hazard Conditions

Coastal hazard problems have been most evident in the City of Milwaukee during high water periods. These have occurred in recent history on Lake Michigan in the early 1950s, the early 1970s, and the mid-1980s, with record high levels occurring in 1986, surpassing the previous record high level set in 1886.

Low water levels can also cause problems with shore protection structures, such as rotting of timber pilings, which are normally under water, being exposed to air, as well as significantly affecting shipping and boating and marina activity. Lake Michigan levels, as of February 2011, were approximately 1.7 feet below the historical mean for the period 1918-2011, but approximately two-thirds of a foot above the historic record low levels set in 1964 and 1965. During a March 2002, workshop,[28] Lake Michigan low-water-level problems were discussed as an important topic.

A 1989 Lake Michigan coastal erosion management study, prepared for Milwaukee County with assistance from the Wisconsin Coastal Management Program, identified the extent of that erosion at 638 locations along the shoreline. The study identified erosion rates of less than one foot per year over the period 1963 to 1985.[29]

Description of Recent Coastal Hazard Conditions

As described in Chapter II, a 1997 study was prepared by SEWRPC and others in cooperation with the Wisconsin Coastal Management Program to evaluate shoreline erosion and bluff stability conditions along the Lake Michigan shoreline in southeastern Wisconsin, including the City of Milwaukee.[30] That study found relatively stable bluff erosion rates of less than one foot per year over the period 1975 to 1995 in the area of concern in the City of Milwaukee. No building or infrastructure damage has been reported in association with bluff erosion.

In March 1987, 55 to 60 mile per hour northeast winds created 10-foot high waves that pounded the Lake Michigan shoreline. Significant shoreline and bluff erosion was reported all along the shore. Waves crashed over Lincoln Memorial Drive, leaving up to one foot of water standing in the road in some places. The MMSD Jones Island sewage treatment plant was closed due to flooding in tunnels below the plant.[31]

During a large rainfall event, a portion of a bluff along the Lake Michigan shoreline collapsed after soils became saturated with water.

Numerous improvements were made to the City of Milwaukee's lakefront as part of the creation of Lakeshore State Park and integration with Pier Wisconsin, Discovery World, and the Quadracci Pavilion addition to the Milwaukee Art Museum. The first phase of planned improvements was completed in 2007 for the 17-acre park at a cost of $17 million. Detailed coastal analyses were completed with physical models to assess water levels, wave conditions, design storm events, and water circulation. Improvements to the lakefront included reconstruction of

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[28]*University of Wisconsin-Sea Grant Institute and Bay Lake Regional Planning Commission,* Living with the Lakes Workshop*, at University of Wisconsin-Green Bay, March 22, 2002.*

[29]*SEWRPC Community Assistance Planning Report No. 163,* op. cit.

[30]*SEWRPC Technical Report No. 36,* op. cit.

[31]*Milwaukee Journal, "Storm Pounds Lakeshore," March 9, 1987.*

the eastern shore of the island park and two new breakwalls. One 180 linear foot breakwater protects the Quadracci Pavilion addition from wave runup, and a 1,200 linear foot breakwater minimizes wave heights in a maritime basin just north of the state park.[32]

Vulnerability and Community Impacts Assessment
A review of the Lake Michigan lakeshore erosion conditions within the City of Milwaukee indicates that there is a very limited potential community impact as a result of the potential loss of land improvements and infrastructure in selected areas due to lakeshore erosion. With proper surveillance, the need to prepare for major evacuations and other emergency actions are not a significant concern given the isolated nature and the limited severity of the problems. Similarly, the Milwaukee County Pre-Disaster Mitigation Plan identified that several coastal communities are at risk from coastal erosion, but coastal erosion was not considered a primary concern relative to the potential damages to population and infrastructure within Milwaukee County.[33]

Potential Future Changes in Coastal Hazard Conditions
Changes in land use can have an impact on the potential for coastal erosion hazards to occur. Such changes relate to the potential future increase in development within the erosion hazard areas, particularly when not accompanied by proper shore protection measures. Because of the current zoning procedures which are in place, this situation has not occurred.

VULNERABILITY ASSESSMENT FOR WINTER STORMS

Winter storms can vary in size and strength and include heavy snow storms, blizzards, freezing rain, sleet, ice storms, and blowing and drifting snow conditions. Extremely cold temperatures accompanied by strong winds can result in wind chills that cause bodily injury, such as frostbite and death. A variety of weather phenomena and conditions can occur during winter storms. For clarification, the following are National Weather Service approved descriptions of winter storm elements:

- **Heavy Snowfall**—The accumulation of six or more inches of snow in a 12-hour period or eight or more inches in a 24-hour period.

- **Blizzard**—An occurrence of sustained wind or frequent gusts 35 mph or higher accompanied by falling or blowing snow, and visibilities of one-quarter mile or less, for three or more hours.

- **Ice Storm**—An occurrence of rain falling from warmer upper layers of the atmosphere to the colder ground, freezing upon contact with the ground and exposed surfaces, resulting in ice accumulations of one-quarter inch or more within 12 hours or less.

- **Freezing Drizzle/Freezing Rain**—The effect of drizzle or rain freezing upon impact on objects that have a temperature of 32ºF or below.

- **Sleet**—Solid grains or pellets of ice formed by the freezing of raindrops or the refreezing of largely melted snowflakes. This ice does not cling to surfaces.

- **Wind Chill**—An apparent temperature that describes the combined effect of wind and low air temperatures on exposed skin.

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[32]*Fred Klancnik and William Brose, "Lakefront Renaissance,"* Civil Engineering—ASCE, *Volume 80, July 2010.*

[33]*Milwaukee County Emergency Management*, op. cit.

Much of the snowfall in Wisconsin occurs in small amounts, between one and three inches per occurrence. Heavy snowfalls that produce at least eight to 10 inches of widespread accumulation occur, on average, only once per winter season across southern Wisconsin. In addition, a snowfall event of six to eight inches usually occurs once per winter. The northwestern portion of Wisconsin receives most of its snow during early and late season storms, while southwestern and southeastern counties receive heavy snows more often in mid-winter. Snowfall amounts in the City of Milwaukee average 47.5 inches per season.

Historic Winter Storm Problems

True blizzards are not common in Wisconsin. However, when they do occur, they tend to affect the eastern counties near Lake Michigan. Due to less frictional drag over Lake Michigan, northwest wind storms can reach higher speeds. Blizzards are more likely to occur in northwestern Wisconsin than in southern portions of the State, even though heavy snowfalls are more frequent in the southeast. Blizzard-like conditions often exist during heavy snowstorms when gusty winds cause severe blowing and drifting of snow. Heavy snow and ice storms have been a part of nearly every winter in the City of Milwaukee history (see Milwaukee County Pre-Disaster Mitigation Plan).[34] As listed in Table 22, there have been 55 major winter storm events reported since January 1993. All of these storms contained some form of snow, sleet, freezing rain, or slippery road conditions. A heavy snowstorm may cause schools and businesses to close, delay or cancel airline flights, and create treacherous roadway travel conditions.

In March 1976 a disastrous ice storm occurred in the southern portion of the State. This storm was of such magnitude and caused such a significant amount of damage that a Presidential Disaster Declaration was obtained. This storm affected 22 counties, resulted in extensive power outages and caused over $50 million in damage. Near-blizzard conditions occurred in January 1979 when record snowfalls were recorded in many areas of the State and winds gusted to over 30 mph. Many persons were isolated from assistance and services as roads drifted shut and highway crews were unable to keep them open. Conditions were extremely hazardous in the City of Milwaukee where a Presidential Emergency Declaration was obtained to assist in snow removal operations. The winter of 1981-1982 recorded a storm event, with extremely cold temperatures, accompanied by high winds gusting to 50 mph. Wind chill factors reached 100 degrees below zero and severely affected the health and safety of those who ventured outdoors.

Description of Recent Winter Storm Events

Generally, the winter storm season in Wisconsin occurs between October and March. Severe winter weather has occurred, however, as early as September and as late as the latter half of April and into May in some locations in the State. The average annual duration of snow cover in the City of Milwaukee is approximately 85 days. As previously noted, since 1993, there have been 55 winter storms recorded in the City of Milwaukee, or about 3.1 per year.

Ice and sleet storms can occur at any time throughout the winter season from October to April. The majority of these storms occur in west-central to east-central Wisconsin, based on data from 1982-2008. In a typical winter season there are three to five light freezing rain events. A major ice storm occurs about once every other year somewhere in the State. If one-half inch of rain freezes on trees and utility wires, extensive damage can occur, especially if accompanied by high winds that compound the effects of the added weight of the ice. There are also between three and five instances of glazing (less than one-quarter of an inch of ice) throughout the State during a normal winter.

[34]Ibid.

Table 22

WINTER STORM AND ICE STORM EVENTS IN THE CITY OF MILWAUKEE: 1924-2010

Date	Affected Area	Event	Reported Damages		
			Fatalities	Injuries	Property Damages (in dollars)[a]
February 1924	Milwaukee County	Blizzard	3	- -	- -
January 1947	Milwaukee County	Blizzard	0	- -	- -
April 1973	Milwaukee County	Blizzard	0	- -	- -
March 1976	Milwaukee County	Ice storm[b]	0	- -	- -
December 1978 to January 1979	Milwaukee County	Snow emergency[b]	0	- -	- -
December 1987	City of Milwaukee	Blizzard	10	0	- -
January 1, 1993	Statewide	Heavy sow	0	0	- -
November 8, 1993	Milwaukee County	Heavy snow	0	0	- -
January 5, 1994	Central and southern Wisconsin	Heavy snow	0	0	- -
January 26, 1994	All but far northwest Wisconsin	Heavy snow/ice storm	0	0	- -
February 7, 1994	Southern and eastern Wisconsin	Heavy snow	0	0	- -
February 12, 1994	Southeast Wisconsin	Heavy snow	0	0	- -
February 22, 1994	Southern half of Wisconsin	Heavy snow	0	0	- -
February 25, 1994	Southern Wisconsin	Heavy snow	0	0	- -
December 5, 1994	Southern Wisconsin	Heavy snow	0	0	- -
January 19, 1995	Northeast, central and southeast Wisconsin	Heavy snow	0	0	- -
November 26, 1995	Central and southern Wisconsin	Heavy snow	1	0	- -
December 13, 1995	Southern Wisconsin	Glaze	0	0	- -
January 5, 1996	Southeast Wisconsin	Heavy snow	0	0	- -
January 8, 1998	Eastern Wisconsin	Winter storm	0	0	- -
January 2, 1999	Southeastern Wisconsin	Blizzard	0	0	$14,159
March 9, 1999	Southeast Wisconsin	Winter storm	0	0	- -
April 7, 2000	Southeast Wisconsin	Winter storm	0	0	- -
December 11, 2000	Southeast Wisconsin	Heavy snow	0	0	- -
December 2000 to January 2001	Milwaukee County	Snow emergency[b]	0	0	- -
March 2, 2002	South-central and southeast Wisconsin	Heavy snow	0	0	- -
February 3, 2003	Southern Wisconsin	Winter weather mix	0	0	- -
February 11, 2003	South-central and southeast Wisconsin	Winter storm	0	0	- -

Table 22 (continued)

Date	Affected Area	Event	Reported Damages		
			Fatalities	Injuries	Property Damages (in dollars)[a]
March 4, 2003	Milwaukee County	Heavy storm	0	0	- -
April 4, 2003	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
April 7, 2003	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
January 4, 2004	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
January 16, 2004	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
January 26, 2004	Milwaukee County	Heavy snow	0	0	- -
February 8, 2004	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
December 18, 2004	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
January 1, 2005	South-central and southeast Wisconsin	Winter weather mix	0	0	- -
January 6, 2005	South-central and southeast Wisconsin	Winter storm	0	0	- -
January 22, 2005	South-central and southeast Wisconsin	Winter storm	0	0	- -
January 27, 2005	Milwaukee County	Heavy snow	0	0	- -
February 16, 2006	South-central and southeast Wisconsin	Winter storm	0	0	- -
February 13, 2007	Southeast Wisconsin	Winter weather	0	0	- -
February 25, 2007	Southeast Wisconsin	Winter storm	0	0	- -
December 1, 2007	Southeast Wisconsin	Winter storm	0	0	- -
December 15, 2007	Southeast Wisconsin	Winter weather	0	0	- -
January 29, 2008	Southeast Wisconsin	Winter storm	0	0	- -
January 31, 2008	Milwaukee County	Winter storm	0	0	- -
February 5, 2008	Southern Wisconsin	Winter storm[b]	0	0	- -
February 17, 2008	Milwaukee County	Winter weather	0	0	- -
November 30, 2008	South-central and southeast Wisconsin	Winter storm	0	0	- -
December 18, 2008	South-central and southeast Wisconsin	Winter storm	0	0	- -
December 21, 2008	South-central and southeast Wisconsin	Winter storm	0	0	- -

Table 22 (continued)

Date	Affected Area	Event	Reported Damages		
			Fatalities	Injuries	Property Damages (in dollars)[a]
January, 3 2009	South-central and southeast Wisconsin	Winter weather	0	0	- -
January, 9 2009	South-central and southeast Wisconsin	Winter weather	0	0	- -
January, 13 2009	South-central and southeast Wisconsin	Winter weather	0	0	- -
March 29, 2009	Southeast Wisconsin	Winter storm	0	0	- -
December 23, 2009	South-central and southeast Wisconsin	Winter storm	0	0	- -
January, 7 2010	Southeast Wisconsin	Winter storm	0	0	- -
February 9, 2010	Southern Wisconsin	Winter storm	0	0	- -
March 19, 2010	Southern Wisconsin	Winter weather	0	0	- -
Total	- -	- -	14	- -	$14,159

[a]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

[b]*Federally Declared Presidential Emergency.*

Source: Milwaukee County Pre-Disaster Mitigation Plan and the National Climatic Data Center.

The winter of 1998-1999 was considered mild. However, a heavy snowfall occurred January 1-3, 1999, and more than 10 inches fell in most southern counties with parts of Milwaukee, Racine, Kenosha, Ozaukee, Walworth, Washington, and Waukesha Counties receiving more than 18 inches of snow. A recent blizzard occurred December 2-4, 1990, depositing 10 or more inches of snow across the central and southern portions of the State. This excessive snowfall throughout such a large area of the State severely taxed capabilities to clear and remove snow.

December 2000 was one of the 10 coldest Decembers on record for most of the State. In addition, record or near record snow depths of 15 to 34 inches occurred in much of southern Wisconsin during December. The City of Milwaukee registered 49.5 inches in snowfall for the month of December alone and was included in a Presidential Emergency Declaration area.

Two heavy snowfalls occurred in the City of Milwaukee during January 2005. Over the period from January 4 through 6, 2005, low pressure in the southwestern United States pulled large amounts of moisture from the Gulf of Mexico and eastern Pacific Ocean over a stationary front located over Illinois, Iowa, and Missouri. Widespread heavy snow developed in northern Illinois and moved into southern Wisconsin, resulting in heavy snowfall in Milwaukee. Accumulations of snow were between 8 and 10 inches in most of Milwaukee County, with a total of 12 inches reported at the University of Wisconsin-Milwaukee campus. Heavy snow also developed in southeastern Wisconsin on the evening of January 21, 2005, and persisted into January 22. Snowfall rates overnight were in the two to three inch per hour range at times. Total snow accumulations in Milwaukee County generally ranged from 12 to 16 inches. After the storm was over, lake effect snow produced an additional three to four inches of snow across the Region for a two-day total accumulation of 10 to 16 inches. In addition to heavy snow, winds began to strengthen to 20 to 30 miles per hour, with gusts up to 45 miles per hour, by the morning of

January 22. This produced considerable blowing and drifting snow and blizzard conditions at times. Although hundreds of traffic accidents were reported, the storm swept through on a Friday night and road crews had an easier time clearing roadways on Saturday without the presence of rush hour traffic.

The 2007-2008 winter season in Wisconsin was "one-for-the-ages." Numerous winter storms, including a couple blizzards and four ice storms, pounded the southern half of the State. Winter snowfall totals of 70 to 122 inches across the southern counties established new all-time winter snowfall records at many locations. Most of Milwaukee County received in excess of 90 inches of snow during this winter, and much of the City of Milwaukee received over 110 inches. These totals were roughly 200 to 240 percent of normal. The worst storm of the winter occurred on February 5 and 6, 2008, southeast of a line from Dubuque, Iowa to Madison to Sheboygan where 12 to 21 inches of snow were deposited. Two-day snowfall totals in and near the City of Milwaukee ranged from about 13 inches at General Mitchell International Airport (GMIA) to over 17 inches at the City of West Allis. On February 6, snowfall at GMIA totaled 11.6 inches, breaking the old daily record of 8.3 inches set in 1974. Several roads in southeast Wisconsin were closed by the intense snowfalls and blowing snow. Milwaukee County was included in a Presidential Emergency Declaration. The City of Milwaukee received a about $939,710 in Federal funds and about $156,618 in State funds for extraordinary expenses associated with clearing roads and emergency response efforts.

A clipper-type low pressure system passing to the southwest and south of Wisconsin resulted in widespread snow across southern Wisconsin on February 9 and 10, 2010. A second low that had moved northeastward from Texas merged with the clipper system over western Ohio and deepened. This resulted in increasing northeast winds, and with a favorable fetch down Lake Michigan, produced lake enhanced snow that boosted snow totals over eastern Wisconsin. Southeastern Wisconsin received widespread 8 to 14 inches. The heaviest snow of 10 to 14 inches fell along and east of a line from northwest Sheboygan County near Elkhart Lake, through Hartford in Washington County, the City of Waukesha in Waukesha County, and Union Grove in western Racine County to Silver Lake in western Kenosha County. While the highest snow total from the storm was 15.0 inches near of Belgium in Ozaukee County, 13.4 inches in West Allis in Milwaukee County. Over 250 traffic crashes, spin-outs and collisions were reported. One fatality related to the storm occurred in Milwaukee County, where a 73-year old man with a history of heart problems died shortly after shoveling snow.

During the overnight hours of February 1 and 2, 2011, a powerful low-pressure center produced blizzard conditions across much of southern Wisconsin. Snow associated with the system began in the mid-afternoon hours in far southern Wisconsin and pushed northward into the State through the evening. Very strong winds were associated with the storm for an extended period of time. Two-day snowfall totals in the City of Milwaukee ranged between 12 and 20 inches. Peak wind gusts of 60 miles per hour were reported at GMIA.

Vulnerability and Community Impact Assessment

Based on events reported from 1993 to September 2010, it is estimated that the City of Milwaukee experiences on average approximately 3.1 winter storm events each year. Winter storms present a serious threat to the health and safety of affected citizens and can result in significant damage to property. Snow and ice are the major hazards associated with winter storms and are the eighth most destructive natural hazard in Wisconsin. Snow and ice can cause traffic accidents, bring down telephone and power lines, damage trees, impede transportation, burst water pipes, and can tax the public's capabilities for snow removal during heavy storms. A major winter storm can have a serious impact on a community. Loss of heat and mobility are key complications that contribute to winter storm fatalities.

Ice storms and freezing rain are less common than snow, but produce road conditions that can make travel hazardous as shown in Table 23. Even fog or mist on cold roads can produce a glaze of ice that makes travel slippery and dangerous. Accumulated ice can cause the structural collapse of buildings, bring down trees and power lines, causing property damage, loss of power, and isolate people from assistance or services.

Table 23

TOTAL NUMBER OF ACCIDENTS AMONG WEATHER AND ROAD CONDITIONS REPORTED WITHIN THE STATE OF WISCONSIN: 2009

Weather Conditions	Road Conditions							Total
	Dry	Wet	Snow/ Slush	Ice	Sand/Mud/ Dirt/Oil	Other	Unknown	
Clear	39,646	1,408	2,675	2,313	121	92	482	46,637
Cloudy	18,769	4,077	2,978	1,648	77	34	277	27,860
Snow	46	475	7,041	1,184	0	0	70	8,816
Rain	67	7,545	125	260	15	5	66	8,083
Sleet/Hail	2	125	256	718	0	2	14	1,117
Fog/Smog/Smoke	300	177	32	23	2	4	5	543
Blowing Sand/Dirt/Snow	3	4	200	131	1	1	2	342
Severe Crosswinds	27	10	9	12	0	0	2	60
Other	6	6	3	9	0	0	3	27
Unknown	325	36	104	38	5	2	15,996	16,506
Total	59,191	13,863	13,423	6,236	221	140	16,916	109,991

Source: Wisconsin Department of Transportation Bureau of Transportation Safety and SEWRPC.

A review of the community assets described in Chapter II indicates there is a potential for winter storm hazard events to impact: 1) residents at a citywide level, 2) roadway transportation system, 3) utilities, and 4) the operation of critical community facilities. In addition, the Milwaukee County Pre-Disaster Mitigation Plan concluded that winter storm hazards are one of the greatest risks to the population and infrastructure within Milwaukee County.[35]

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion.[36] Slightly over $24.5 billion of this total is comprised of buildings and other improvements. Due to the unpredictability of winter storm events, all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

Potential Future Changes in Extreme Temperature Conditions

Based upon historical data, the City of Milwaukee can expect to experience an average of 3.1 winter storm events per year as documented by the National Climatic Data Center. It should be noted that the historical record shows considerable variation among years in the number of events that occurred. While it would be expected that in some years the City will experience fewer events or more events than the average number, the average annual number of events is not expected to change.

VULNERABILITY ASSESSMENT FOR EARTHQUAKES

An earthquake is a shaking or sometimes violent trembling of the earth that results from the sudden shifting of rock beneath the earth's surface. This sudden shifting releases energy in the form of seismic waves or wave-like

[35]Ibid.

[36]*Wisconsin Department of Revenue.*

movement of the earth's crust. Earthquakes can strike without warning and may range in intensity from slight tremors to great shocks. They can last from a few seconds to over five minutes and may also occur as a series of tremors over a period of several days. The actual movement of the ground during an earthquake is seldom the direct cause of injury or death. Casualties may result from falling objects and debris, because the shocks shake, damage, or demolish buildings and other structures. Disruption of communications or electrical power supplies; and damage to gas, sewer, and water lines can occur. Earthquakes may trigger fires, dam failures, landslides, or releases of hazardous material, compounding their disastrous effects.

Earthquakes are measured by two principal methods: seismographs and human judgment. The seismograph measures the magnitude of an earthquake and interprets the amount of energy released on the Richter Scale, a logarithmic scale with no upper limit. An earthquake measuring 6.0 on the Richter scale is 10 times more powerful than a 5.0 and one hundred times more powerful than an earthquake measuring 4.0. This is a measure of the absolute size or strength of an earthquake and does not consider the effect at any specific location. Most of Wisconsin's occurrences have not been severe, with one registering 5.1 on the Richter Scale.

The severity of an earthquake can also be measured by comparing the peak acceleration associated with the horizontal shaking it produces to the normal acceleration a falling object experiences due to the force of gravity. This is usually expressed as a percentage of *g*, the acceleration due to gravity. The level of risk due to earthquake can be expressed as the percentage of *g* for which there is a 2 percent probability of being exceeded in a 50-year period. Depending on location, sites in the City of Milwaukee have a 2 percent probability of experiencing earthquakes in a 50-year period in which the peak accelerations associated with horizontal shaking exceeds between about 3 percent and 4 percent of *g*.[37] These are low values. While these levels of shaking can be noticeable, they are rarely associated with damage to structures.

Historic Earthquake Problems

Earthquakes that have affected Wisconsin from 1899 to 2010 are listed in Table 24. The most severe earthquake that affected Wisconsin was the record earthquake of 1811, which was centered along the New Madrid Fault. Most earthquakes that do occur in Wisconsin are very low in intensity and can hardly be felt. These very minor earthquakes are fairly common, occurring every few years. Moderate shaking was reported at many places in Wisconsin from the strong earthquake centered near Charleston, South Carolina, on August 31, 1886. Shaking was felt in Beloit, Janesville, and Milwaukee. A May 26, 1909, earthquake damaged a number of chimneys at Aurora, Illinois, and caused considerable damage to poorly constructed homes over a broad area from Bloomington, Illinois, to Platteville, Wisconsin. Two more moderate shocks affected the same area on January 2, 1912. The first tremor was at Aurora, Freeport, Morris, and Yorkville, Illinois, and was followed by a lighter shock. Felt reports were received from Madison and Milwaukee.

An earthquake centered in eastern Missouri on April 9, 1919, affected a broad area from Wisconsin to Mississippi and from Kansas to Ohio, approximately 320,000 square kilometers. In the epicentral region between St. Louis and New Madrid, windows were broken and plaster cracked. Two shocks of short duration were reported felt at Madison.

Scattered felt reports in Wisconsin were noted from a major earthquake in the St. Lawrence River region near La Malbaie, Quebec, Canada, on February 28, 1925. The magnitude 7.0 (Richter Scale) shock was felt over an area of approximately 5,000,000 square kilometers, including the City of Milwaukee. Another strong Canadian earthquake (magnitude 6.25, Richter Scale) affected a large area of the northeastern and north-central United States on November 1, 1935. The area impacted was over 2,500,000 square kilometers and included most of eastern Wisconsin and scattered points elsewhere in the State.

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[37]*U.S. Geological Survey, "2008 United States National Seismic Hazard Maps," USGS Fact Sheet 2008-3018, April 2008.*

Table 24

EARTHQUAKES IN WISCONSIN

Reporting Location	Date	Time (central standard time)	Location (latitude/longitude)	Magnitude
Kenosha	October 12, 1899	- -	42° 34'/87° 50'	3.0
Marinette	March 13, 1905	22:30	45° 08'/87° 40'	3.8
Shorewood	April 22, 1906	- -	43° 03'/87° 55'	3.0
Milwaukee	April 24, 1906	- -	43° 03'/87° 55'	- -
Marinette	January 10, 1907	- -	45° 08'/87° 40'	- -
Beloit	May 26, 1909	8:42	42° 30'/89° 00'	5.1
Madison	October 7, 1914	15:0	43° 05'/89° 23'	3.8
Madison	May 31, 1916	16:45	43° 05'/89° 21'	3.0
Fond du Lac	July 7, 1922	- -	43° 47'/88° 29'	3.6
Madison	October 18, 1931	15:12	43° 05'/89° 23'	3.4
Stoughton	December 6, 1933	23:55	42° 54'/89° 15'	3.5
Dubuque	November 7, 1938	23:30	42° 30'/90° 43'	3.0
Dubuque	November 7, 1938	1:15	42° 30'/90° 43'	3.0
Dubuque	November 7, 1938	3:30	42° 30'/90° 43'	3.0
Thunder Mountain	February 9, 1934	17:21	45° 11'/88° 10'	3.2
Milwaukee	May 6, 1947	15:27	43° 00'/87° 55'	4.0
Lake Mendota	January 15, 1948	11:40	43° 09'/89° 41'	3.8
Oostburg	July 18, 1956	15:30	43° 37'/87° 45'	3.8
Oostburg	July 18, 1956	17:0	43° 37'/87° 45'	3.8
South Milwaukee	October 13, 1956	- -	42° 55'/87° 52'	3.8
Beaver Dam	January 8, 1957	10:0	42° 32'/98° 48'	3.6
Bill Cross Rapids	February 28, 1979	12:4:55	45° 13'/89° 46'	<1.0
Madison	January 9, 1981	9:15	43° 05'/87° 55'	- -
Madison	March 13, 1981	A.M.	43° 05'/87° 55'	- -
Oxford	June 12, 1981	10:30	43° 52'/89° 39'	- -
Milwaukee	February 12, 1987	13:12	42° 57'/87° 50'	- -
Milwaukee	February 12, 1987	13:16	43° 19'/87° 28'	- -
West Kenosha County	June 18, 1990	22:37	43° 60'/88° 20'	- -
Evansville, Indiana	June 18, 2002	22:37	38° 04'/87° 41'	5.0
Ottawa, Illinois	June 28, 2004	1:10	41° 23'/89° 03'	4.2
West Salem, Illinois	April 18, 2008	3:37	38° 27'/87° 53'	5.2
Virgil, Illinois	February 10, 2010	3:57	41° 57'/88° 31'	3.8
Central Indiana	December 30, 2010	6:55	40° 26'/85° 53'	3.8

Source: U.S. Geological Survey, Wisconsin Geological and Natural History Survey, List of Earthquakes in Wisconsin*, and SEWRPC.*

Two strong earthquakes near Anna, Ohio, on March 2, and 8, 1937, caused damage to buildings in the epicentral area and were reported felt over a six-state region. The second shock was perhaps slightly stronger and more widespread than that of March 2nd, but the difference was not great. Both earthquakes were felt in Milwaukee; the latter tremor was also reported felt in Madison.

On November 23, 1939, a shock in southern Illinois having maximum intensity just short of damage caused slight disturbances over an unusually large area (390,000 square kilometers). Milwaukee felt minor vibrations from a moderate earthquake in south-central Michigan on August 9, 1947. Broken windows and considerable plaster and

chimney damage were observed over a 30-kilometer radius from the epicenter, located near Coldwater, Michigan. The total felt area covered approximately 130,000 square kilometers and included portions of Illinois, Indiana, and Ohio.

An earthquake on May 6, 1947, apparently centered just south of Milwaukee near the shore of Lake Michigan, caused only minor damage. There were no reports of injuries. The 4:25 a.m. CDT tremor shook buildings and rattled windows in many communities in a 7,770 square kilometer area of southeastern Wisconsin. There were a few reports of broken windows at Kenosha and residents of other communities reported that dishes and glasses had fallen from shelves. The shock was felt in a 160-kilometer-wide strip from Sheboygan to the Wisconsin-Illinois border and extended from the lakeshore to Waukesha, 40 kilometers inland.

Description of Recent Earthquake Events

On June 28th, 2004, an earthquake with a magnitude of 4.2 occurred approximately 70 miles west of Chicago. This relatively mild earthquake was felt in Milwaukee as well as throughout the Midwest. No damages were reported in the City of Milwaukee, and only very light damages were reported near the epicenter.

The strongest earthquake in the central United States in 74 years occurred on November 9, 1968, in south-central Illinois. The shock was felt over an area of approximately 1,500,000 square kilometers, including all, or portions, of 23 states and southern Ontario, Canada, and measured at magnitude 5.3. Another earthquake in Illinois, about 500 kilometers north of the 1968 epicenter, caused slight damage at several places in Illinois, Indiana, Iowa, and Wisconsin. The September 14, 1972, tremor was felt over 650,000 square kilometers, including Michigan, Minnesota, Missouri, Ohio, and Wisconsin. Cracked plaster was noted at Kewaskum, Milton, Nashotah, and Zenda, Wisconsin. A report from Browntown, Green County, noted that water pipes leaked after the shock.

Reports were received from the City of Milwaukee and in Mt. Hope and Trevor, Wisconsin, following a magnitude 4.0 earthquake on April 3, 1974, centered near the 1968 epicenter in southern Illinois. Within one hour or so, a number of tornadoes passed through the area affected by the earthquake. It is possible some of the reports confused the effects caused by the earthquake and those caused by the tornadoes.

Four recent earthquakes—one centered near Troy Grove, Illinois, on June 28, 2004, one centered near West Salem, Illinois, on April 18, 2008, and one centered near Virgil, Illinois, on February 10, 2010, and one centered near Kokomo, Indiana, on December 30, 2010—were felt by residents in Southeastern Wisconsin (see Table 24). All occurred early in the morning and woke sleeping residents and shook furniture.

Vulnerability and Community Impact Assessment

The earthquake threat to the City of Milwaukee is considered low. Minor damages, such as plaster cracking, have occurred, but most often the results have been only windows rattling and ground shaking. There is little risk, except to structures that are poorly constructed. Most of the felt earthquakes reported have been centered in adjacent and other states. The causes of these local quakes are poorly understood and they are thought to have resulted from the still-occurring rebound of the earth's crust after the retreat of the last glacial ice.

The nearest major active fault is the New Madrid Fault, which stretches along the central Mississippi River Valley in Missouri. Considerable attention has focused in recent years on seismic activity in the New Madrid seismic zone, which lies within the central Mississippi Valley, extending from northeast Arkansas, through southeast Missouri, western Tennessee, and western Kentucky to southern Illinois. Scientists at the Center for Earthquake Information have computed a set of probabilities that estimates the potential for different magnitude earthquakes to occur at the New Madrid Fault. However, even an 8.3 magnitude earthquake at the New Madrid Fault would cause only minor damage in the southeastern corner of Wisconsin. At this time it is not possible to predict the exact date, duration, or magnitude of an earthquake. Based on reports dating back to 1906, earthquakes are officially reported only once every 20 to 25 years. The extent of reported damages based on these events is considered insignificant.

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion.[38] Slightly over $24.5 billion of this total is comprised of buildings and other improvements. Due to the unpredictability of earthquake events, all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

The City of Milwaukee is not likely to suffer directly from a severe earthquake. Thus, the community impacts are considered not to be significant. Similarly, the Milwaukee County Pre-Disaster Mitigation Plan identified that communities are at risk from severe earthquakes, but earthquakes were not considered a primary concern relative to the potential damages to population and infrastructure within Milwaukee County.[39]

VULNERABILITY ASSESSMENT FOR CONTAMINATION OR LOSS OF WATER SUPPLY

Water supply systems are among the most important infrastructure facilities affecting the economic development and environmental quality of the City of Milwaukee. Such systems directly affect the health and welfare of the resident and transient populations of an area, and the viability of commercial and industrial activities in an area. Accordingly, the availability of an ample supply of high-quality water for domestic, commercial, and industrial use and the protection and wise use of the available sources of supply were ranked high in priority votes by the City of Milwaukee Hazard Mitigation Steering Committee.

As noted in Chapter II, Approximately 106 million gallons per day (mgd) of Lake Michigan surface water are utilized as the source of supply by all water users in the City of Milwaukee. An ample supply of clean, wholesome water is essential to urban development. Indeed, without a reliable water supply, urban areas become unhealthy places in which to live and work, subject to epidemics of such waterborne diseases as cholera, dysentery, typhoid fever, and parasitic infections, such as *Cryptosporidium*. In addition to providing safe drinking water, a reliable water supply system is also essential in other ways to good sanitation in urban areas. An adequate and reliable water supply system is essential for bathing, laundering, and other forms of cleaning and washing, and provides the basis for the water carriage system of sanitary sewage conveyance essential to a high level of quality in urban life. An adequate and reliable water supply system is essential to good fire protection, and is also essential to all types of commercial and industrial development.

As noted above, the City of Milwaukee relies almost exclusively on surface water from Lake Michigan as its main water source. As a division of the Department of Public Works, Milwaukee Water Works operates two water treatment plants with the capability of processing 275 million gallons per day. The City's water treatment plants have been upgraded over the past 15 years, including the installation of a state-of-the-art disinfection system. The plants are considered to be well maintained and have recently installed substantial plant security facilities and programs.

Vulnerability and Community Impact Assessment
The potential for water supplies to be interrupted could be due to the following factors:

- Contamination of the Lake Michigan surface water source in the vicinity of the water supply intakes used; and
- Major facility malfunction or shutdown.

[38] *Wisconsin Department of Revenue.*

[39] *Milwaukee County Emergency Management*, op .cit.

Lake Michigan has historically been a source of safe drinking water. However, no one can guarantee that an accident will not happen, and a mishap can have serious consequences. In 1993, the City of Milwaukee's public water supply became contaminated with *Cryptosporidium*, a parasite found in animal wastes. Nearly half of the 850,000 consumers were infected, 4,400 people were hospitalized, and at least 69 people died, making this the largest documented waterborne outbreak in U.S. history (Wisconsin Division of Health, 1996). Although the exact source of the *Cryptosporidium* that caused this outbreak is still uncertain, the total cost of the outbreak associated illness was estimated at about $37 million in medical costs and $77 million in productivity losses.[40] As previously noted, the City of Milwaukee has, over the past 10 years, upgraded its treatment and monitoring water quality systems that include the installation of a state-of-the-art disinfection equipment. This upgrading and related actions are considered to be a sound basis for mitigating potential water quality problems, and based on current and ongoing safety measures, the probability of future events is negligible.

Typically, water supply facilities have a history of safe operation with minimal malfunctions or shutdowns. The industry has been known for providing continuous service due to the use of high-quality and redundancy in equipment. However, the facilities are always subject to the potential for an unanticipated event which could interrupt services. During the last several years, water utilities, including the City of Milwaukee Water Works and related organizations, such as the American Water Works Association and the Wisconsin Department of Natural Resources, have increased efforts to evaluate vulnerability of water supply facilities to a wide range of hazards, including acts of terrorism. The focus of these efforts has been directed toward preparation of vulnerability assessments and emergency response and mitigation plans for each facility.

VULNERABILITY ASSESSMENT FOR HAZARDOUS MATERIALS INCIDENTS

This type of hazard occurs with the uncontrolled release or threatened release of hazardous materials or substances from a fixed site or during transport that may adversely impact public health and safety and/or the environment.

Understanding the potential health effects associated with exposure to a hazardous material contaminant can be complicated and involves determining who may be exposed, how they may be exposed, and how long the exposures may last. Individuals are also known to react differently to chemical exposures depending upon their age and health. In addition, different effects may occur depending on whether a chemical is ingested versus being inhaled and the duration of exposure. There are several ways in which chemicals may enter the human body and cause detrimental health effects as summarized below:

- Inhalation-breathing the chemical into the lungs;
- Ingestion-swallowing contaminated food, water, or medication, or other chemicals;
- Absorption-assimilation through direct contact with the skin, lungs, and eyes, or indirect contact with clothing or other contaminated items; and
- Injections-penetration through the skin, much less common than other modes of exposure, but can possibly occur due to an explosion or some other type of accident.

[40] *Phaedra S. Corso, Michael H. Kramer, Kathleen A. Blair, David G. Addiss, Jeffrey P. Davis, and Anne C. Haddix,* Cost of Illness in the 1992 Waterborne Cryptosporidium Outbreak, Milwaukee, Wisconsin, *Emerging Infectious Diseases, Volume 9, No. 4, April 2003. Costs and losses adjusted to 2010 dollars.*

In dealing with chemical contaminants, there are two types of exposure, namely, acute and chronic exposure. Acute exposure is defined as short-term, high-level exposure and the effects are usually immediate, whereas chronic exposure is defined as long-term, level exposure and the effects may take years to appear. Both are dangerous and have immediate and long-term health implications. General symptoms of toxic exposure can include, but are not limited to, dry and red skin upon contact, irritation of the eyes or lungs, headache, nausea, drowsiness, dizziness, insomnia, confusion, and tremors. Nonetheless, this report is only dealing with acute exposure.

Fixed Facilities

Over the past several decades, the use of chemicals has increased in nearly every sector of the economy. As a result, hazardous materials are present in quantities of concern in business and industry, agriculture, universities, hospitals, utilities, and other facilities in the State. There are no areas of the State that are exempt from a possible hazardous material incident. Despite extensive precautions taken to ensure careful handling during manufacture, transport, storage, use, and disposal, accidents and inadvertent releases are bound to occur. The potential impacts of such releases include short and/or long-term health hazards to those exposed, explosions, fires, and environmental contamination. An incident may also necessitate short- or long-term evacuation, which disrupts the social and economic aspects of the affected area.

The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 also known as SARA Title III, brings industry, government, and the general public together to address emergency preparedness for accidental chemical releases. The EPCRA program requires communities to prepare for hazardous chemical releases through emergency planning. This plan provides essential information for emergency responders and creates a database of hazardous chemical storage information for the community. The community right-to-know aspect increases public awareness of chemical hazards in their community and allows the public and local governments to obtain information about these chemical hazards.

In Wisconsin, facilities that use, store, or produce chemicals at or above the threshold quantities are required to submit a Tier II Reporting Form to the State Emergency Response Board (SERB), Local Emergency Planning Committee (LEPC), and the local fire department.[41] This form is usually a one or two page document, depending on the number of chemicals being reported. Basic information asked for includes the facility name and address, emergency contact person and phone number, chemical names and quantities. The SERB sends the forms out by mid-January each year and they are due back by March 1st. Failure to receive a form does not absolve a facility from their reporting obligations. A facility can be a factory, school, gas station, community center, or hospital. Farm co-ops are exempt from reporting fertilizers and retailers are exempt from reporting goods packaged for resale. Although there are some exemptions, mainly for retailers, a facility that uses, stores, or produces hazardous chemicals may have to report the chemicals stored. However, it should also be noted that the Federal government no longer requires retail gas stations to report. As of May 2011, there are 369 facilities in the City of Milwaukee that report their inventories of hazardous materials and 100 facilities that provide notification that they have an extremely hazardous substance under the requirements of EPCRA.[42]

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[41]*Wisconsin Emergency Management, Emergency Planning and Community Right-to-Know Act Section, Planning Threshold: Facility has an extremely hazardous substance present at any one time in an amount equal or exceeding the chemical-specific threshold planning quantity (TPQ). Reporting Threshold: Facility has 10,000 pounds of a hazardous substance or either 500 pounds or the threshold planning quantity of an extremely hazardous substance present at any one time and is not exempt from reporting requirements.*

[42]*The hazardous material planning and reporting facilities information can be obtained through Milwaukee County Emergency Management.*

Under EPCRA, a hazardous material is defined as any chemical that is a physical hazard or health hazard for which the Occupational Safety and Health Administration (OSHA) requires a facility to maintain a Material Safety Data Sheet (MSDS). Under EPCRA there is no specific list of hazardous materials, but some of the most common hazardous chemicals include propane, kerosene, fuel oil, motor oil, and gasoline. If a facility stores 10,000 pounds or more of these products the owners are required to file a report. Under the law, there are two categories of regulated chemicals: hazardous substances and extremely hazardous substances (EHS). EHS chemicals are found on an Environmental Protection Agency list of approximately 366 substances. Common EHS chemicals include chlorine, sulfuric acid, anhydrous ammonia, and nitric acid. Unlike the more common hazardous substances, the minimum reporting quantities will vary depending on the chemical.

Transportation

The list of hazardous materials is extensive. However, the bulk of products being transported are petroleum products (gasoline, diesel fuel, jet fuel, fuel oil, asphalt, creosote, and propane), chemicals used for industrial or manufacturing processes (anhydrous ammonia, sulfuric acid, and chlorine) and waste products (industrial waste, food waste, medical waste, and animal waste). There are numerous other hazardous materials routinely transported in smaller quantities, such as pesticides, herbicides, and specialized industrial chemicals. The majority of releases are the result of transportation accidents. However, many minor releases are the result of illegal dumping of waste materials.

Demand for established and new chemical substances in all walks of life has resulted in extensive hazardous materials shipments within and through Wisconsin communities daily. The major overland modes of transportation are highways, railroads, and pipelines.

Highways

Trucks are the most common way of transporting hazardous materials, accounting for more than 90 percent of all hazardous materials shipments nationwide according to the U.S. Department of Transportation. Various fuels are the most common cargo that are classified as hazardous. Every roadway in Wisconsin is a potential route for hazardous material transport. IH 94 spans the eastern portion of the City of Milwaukee between the densely populated Milwaukee-Chicago corridor. Large tankers conducting inter- and intra-state transportation of hazardous materials and substances use this highway extensively.

Rail

There are four railroad companies that operate in the City of Milwaukee, as shown on Map 7 in Chapter II. Rail is used for the transport of hazardous materials because of large-load capabilities. Rail transport routes pass through the areas east of IH 94, the Menomonee River Valley, and other portions of the City.

Pipeline

Natural gas service is provided for the entire the City of Milwaukee by the We Energies-Gas Operations. We Energies is the primary distributor of natural gas. In the City of Milwaukee the main gas supply is primarily provided for by ANR Pipeline Company which owns main and branch gas pipelines in the City of Milwaukee and the surrounding area. In addition, the We Energies natural gas system is connected to other major gas pipelines outside of, but in the vicinity of, the City of Milwaukee.

It should be noted that natural gas service and selected other hazards could be vulnerable to events, such as earthquake or an act of terrorism. Such possibilities should be considered as facility and system redundancy is carried out.

An incident involving any one of the above modes of hazardous material transport could result in a local emergency, with the potential to affect large numbers of people. The potential effects include health hazards to those exposed to the hazardous materials, explosions, major fires, and environmental contamination. An incident may necessitate short- or long-term evacuation that would disrupt the affected area. Accidents on major transport

arteries can disrupt or stop traffic for extended periods of time. In the State of Wisconsin there were 2,473 transportation-related hazardous material incidents reported over the period 2000 through 2008.[43] These incidents resulted in four deaths and 47 injuries. In slightly less than half of these incidents, there was no damage to property. Property damages in those incidents that had damages ranged up to about $250,000. The total damages reported as resulting from these incidents were about $2.9 million.

Port of Milwaukee

As described in Chapter II, the Port of Milwaukee is a regional transportation and distribution center which handles a diverse mix of general cargos. Because of its cargo mix and current safety precautions and measures, it is generally considered to be at low risk in regard to potential hazardous materials or terrorism incidents. Nevertheless, the Port is an important facility which requires substantial consideration with regard to law enforcement, fire suppression, and rescue and emergency operations. The City of Milwaukee Police and Fire Departments and the U.S. Coast Guard are involved directly in providing protection services to the Port of Milwaukee. In addition, the Port of Milwaukee is subject to certain Federal regulations, including the Maritime Transportation Security Act, Public Law 107-295. In accordance with these regulations, and related guidelines, all major ports have developed an Area Maritime Security Plan and established an Area Maritime Security Committee. This plan and committee are intended to address security issues at the Port facilities. In addition, in 2010 the U.S. Coast Guard in cooperation with the U.S. Environmental Protection Agency updated their Area Contingency Plan for the Lake Michigan Shoreline. This plan is a tool used to assist and coordinate a response to an oil or hazardous material spill or release into or near the Lake. Thus, the ongoing actions at the Port of Milwaukee related to security are considered to be a component of this hazard mitigation plan

Description of Recent Hazardous Materials Incident Events

Between 2007 and 2009, there were 408 hazardous material spills or releases in the City of Milwaukee, or an average of about 136 per year. Almost all of these spills and releases were minor incidents. The majority of these incidents involved gasoline, diesel fuel, engine waste oil, mineral oil, or other petrochemical substances. These spills and releases resulted in 15 injuries, most of which were minor. Nine of these incidents resulted in the evacuation of sites, vehicles, buildings, or portions of buildings.

Over the period 2000 through 2008, 220 transportation-related hazardous materials incidents were reported in the City of Milwaukee.[44] Most were relatively minor. These incidents resulted in no deaths. Five of these incidents resulted in injuries, with a total of 19 injuries. Property damage was reported in 69 incidents, with the total damages reported being $259,395 in 2010 dollars. While most of these incidents occurred on roadways, five occurred on railways and two were air travel-related.

A total of 32 pipeline incidents have been recorded in the City of Milwaukee during a 29-year period between 1971 through 2009. These events and the resulting fatalities, injuries, and damages are listed in Table 25, based upon data published by the Federal Department of Transportation, Office of Pipeline Safety. As shown in Table 25, the long gap in events between 1992 and 2005 demonstrates that there is a very low probability of occurrence for these events within the City of Milwaukee. In total, these pipeline incidences have resulted in no deaths, 30 injuries, and more than $4.1 million in property damages within the City of Milwaukee. These data indicate that hazardous material incidents are relatively rare, but can cause considerable property damage and have a relatively low risk in terms of loss of human life or injury.

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[43]*U.S. Department of Transportation Pipeline and Hazardous Material Safety Administration Incident Report Database, accessed on August 19, 2009.*

[44]Ibid.

Table 25

NATURAL GAS AND HAZARDOUS LIQUID PIPELINE INCIDENTS IN THE CITY OF MILWAUKEE: 1970-2009

Date	Pipeline Incident	Fatalities	Injuries	Property Damage (in dollars)[a]
1971	Fuel oil	0	0	0
February 3, 1971	Natural gas	0	0	0
March 11, 1971	Natural gas	0	0	4,821
May 25, 1971	Natural gas	0	0	2,099
February 17, 1972	Natural gas	0	1	3,029
January 14, 1975	Natural gas	0	5	21,681
February 13, 1975	Natural gas	0	4	10,840
1977	Gasoline	0	0	307
March 23, 1977	Natural gas	0	0	1,339
September 30, 1977	Natural gas	0	0	7,654
December 18, 1977	Natural gas	0	0	1,913
January 19, 1978	Natural gas	0	1	1,062
November 21, 1978	Natural gas	0	0	3,539
November 25, 1980	Natural gas	0	0	2,125
1981	Gasoline	0	0	132
August 26, 1982	Natural gas	0	3	568
September 7, 1982	Natural gas	0	0	454
July 9, 1983	Natural gas	0	0	2,130
November 22, 1983	Natural gas	0	0	0
1984	Gasoline	0	0	0
March 19, 1984	Natural gas	0	0	0
May 21, 1984	Natural gas	0	0	7,023
May 21, 1984	Natural gas	0	0	11,030
August 9, 1984	Natural gas	0	2	200,651
April 24, 1988	Natural gas	0	12	2,695,026
October 15, 1990	Natural gas	0	0	165,312
February 15, 1991	Fuel oil	0	0	53,908
July 9, 1992	Natural gas	0	0	77,735
December 30, 2005	Natural gas	0	0	364,574
October 3, 2006	Gasoline	0	0	11,016
September 17, 2007	Natural gas	0	0	56,184
February 1, 2009	Natural gas	0	2	437,965
Total	- -	0	30	4,144,117

[a]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

Source: Federal Department of Transportation, Office of Pipeline Safety; and SEWRPC.

Vulnerability, Community Impact, and Multi-Jurisdictional Assessment

There are several factors that should be considered when attempting to identify the scope, magnitude and vulnerability in terms of transportation-related hazardous materials incidents within specific areas of the City of Milwaukee. One factor is the density of traffic and development. Certain pipeline sections, major highway segments, rail lines, or pipelines may handle more hazardous material traffic than others. Therefore, the northern and central portions of the City of Milwaukee are more vulnerable than the other areas, due to the presence of major highways, rail lines, and pipelines. The condition of the transport routes and seasonal weather effects should also be considered, as well as predominant wind patterns within the County. Developing communication between planning agencies and storage site and transportation system owner/operators can be beneficial in

determining the possible risks associated with transporting hazardous materials into or through a particular community. Based on past events, it is likely that there would be averages of about 136 hazardous material releases or spills per year, about 24.4 transportation-related hazardous material incidents per year, and about 1.1 pipeline incidents per year. It should be noted that the historical record shows considerable variation among years in the number of events that occurred. While it would be expected that in some years the City will experience fewer events or more events than the average number, the average annual number of events is not expected to change. On average, these incidents have resulted in reported damages of about $171,700 per year. However, very few events have been responsible for a large percentage of the total damages. Thus, this average damage cost is considered to be a very approximate measure of potential damages. In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion. About $24.5 billion of this total assessment is comprised of buildings and other improvements. Based on the current average estimate of $171,700 in reported damages per year, it can be expected that less than 0.01 percent of the value of all property, including buildings and infrastructure in the City of Milwaukee, will be damaged from these events each year. Due to the unpredictability of hazardous material incidents all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

Milwaukee County Emergency Management maintains records on all planning and reporting facilities within the City of Milwaukee and all reported incidents that have occurred at storage and transportation sites, and during acts of transport.

Potential Future Changes Hazardous Materials Incident Conditions

Although significant hazardous materials incidents are not expected to change in the future, changes in land use can have an influence on the potential magnitude of any particular hazardous materials incidents that occurs. However, development within the City itself is approaching "buildout" conditions with new development expected to be limited, as documented in the adopted regional land use plan and summarized in Chapter II, and indicate a small potential increased risk of potential exposure to hazardous materials incidents, damage, and related losses in the expanding urbanized areas within the County.

VULNERABILITY ASSESSMENT FOR MEDICAL/HEALTH RISKS

This type of hazard is a composite of both potential epidemics and the spread of disease from natural disasters or human-induced hazard-related events. The Center for Disease Control and Prevention (CDC) developed a list of emerging infections priority issues in 1999-2000 which include; antimicrobial resistance, food and water safety, vectors and animal health, blood safety, infections that cause chronic diseases, opportunistic infections, maternal and child health, health of travelers and refugees, and vaccines. The potential for natural and human-induced hazardous incidents exists almost everywhere. While these incidents can be relatively infrequent, they are capable of endangering the health of the individuals involved and the emergency personnel directed to assist them.

Historical Public Health Emergencies

The most serious and deadly disease epidemic of the 20th century came to Wisconsin in September of 1918. An influenza epidemic known as "the Spanish flu," or "la gripe," claimed the lives of more than 8,400 Wisconsin residents between the outbreak of the pandemic and May 1919. This epidemic resulted in 1,292 deaths from influenza in Milwaukee County in 1918, with an additional 261 deaths reported in the County in 1919.[45] Declared by the State Board of Health as the most "disastrous calamity that has ever been visited upon the people of Wisconsin," the Spanish flu had swept across America in under seven days, infecting more than 103,000 people

[45]*State Board of Health of Wisconsin,* Twenty-eighth Report of the State Board of Health of Wisconsin, *1920.*

in Wisconsin alone.[46] The epidemic resulted in major disruptions to activities throughout the State. In early October 1918, the State Health Officer ordered the closing of all public institutions in Wisconsin, including schools, churches, theaters, and saloons, with the only exceptions to the order being factories, offices, and places of regular employment. Within a day, virtually every local government in the State put the order into effect.[47] The devastation wrought by influenza in just a few short months claimed an estimated 50 million lives worldwide and remains to this day the most destructive disease pandemic in world history.

A major epidemic of influenza struck the City of Milwaukee during the winter of 1968-1969. During the eight-week period between November 10, 1968 and January 11, 1969, an estimated 333,680 residents of the City, representing about 43 percent of the City's population, were clinically ill with epidemic influenza, type Hong Kong 1968. Newspaper reports indicated that employers reported that high levels of absenteeism were associated with this epidemic. During December 1968, many schools were closed. Supplies of antibiotics and other drugs ran low, and the resources of the health, police, and fire departments were greatly strained. Hospital services were seriously reduced, and in some hospitals emergency care facilities were temporarily closed. The highest rates of infection were seen among working-age adults and older children. By contrast, preschool age children and adults over the age of 60 were less affected by this epidemic.[48]

In 1993, there was an outbreak of cryptosporidiosis in Milwaukee related to contamination of the City's water supply that affected approximately 400,000 people. This incident was previously described in the section on contamination or loss of water supply.

Description of Recent Public Health Emergencies

In the year 2008 there were more than 15,700 reported incidents of infectious diseases within Milwaukee County as outlined in Table 26, based upon data published by the State Bureau of Health Information and Policy in Wisconsin. The majority of these diseases were sexually transmitted diseases which comprised more than 13,800 of the reported cases (see Table 26). These vital statistics also demonstrate that slightly more than 88 percent of children in grades kindergarten through 12 have received all of the appropriate immunizations. Nonetheless, nearly 18,000 children are noncompliant in terms of obtaining immunizations and pose a potential significant health risk within the City of Milwaukee. In addition, seasonal shortages of influenza vaccinations can also pose significant risk to both the elderly and young children within the City of Milwaukee.

During the spring and summer of 2009, there was an outbreak of a novel type-A influenza virus (H1N1) in Wisconsin. Between April 15 and August 12, about 6,350 confirmed and probable cases were reported in the State. The majority of these cases occurred in the Southeastern Wisconsin Region, mostly in Milwaukee County. The number of reported cases peaked in mid-June and decreased to low levels by mid-July, although this may partially reflect changes in reporting by the Centers for Disease Control. As of August 12, 2009, 4,056 confirmed and probable cases had been reported in Milwaukee County, representing an infection rate of about 427 cases per 100,000 individuals. A second wave of H1N1 infection occurred during the fall 2009-winter 2010 influenza season. In early September, the Wisconsin State Division of Public Health reported that there were high levels of

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[46]*Steven Berg, "Wisconsin and the Great Spanish Flu Epidemic of 1918,"* Wisconsin Magazine of History, *Autumn 2000.*

[47]Ibid.

[48]*Frank F. Piraino, Edwin M. Brown, and Edward R. Krumbiegel, "Outbreak of Hong Kong Influenza in Milwaukee, Winter of 1968-1969,"* Public Health Reports, *Volume 85, 1970.*

Table 26

CASES OF SELECTED INFECTIOUS DISEASES REPORTED IN MILWAUKEE COUNTY: 2008

Disease	Number of Reported Cases
Campylobacter Enteritis	90
Giardiasis	105
Hepatitis Type A	0
Hepatitis Type B	154
Hepatitis Type NANB/C	768
Legionnaire's	11
Lyme	13
Measles	<5
Meningitis, Aseptic	<5
Meningitis, Bacterial	8
Mumps	5
Pertussis	25
Salmonellosis	145
Shigellosis	228
Tuberculosis	31
E. coli O157	16
E. coli, Non-O157	9
Cryptosporidiosis	30
Streptococcus Pneumonia Invasive	129
All Streptococcal Diseases	100
Blastomycosis	14
Haemophilus Flu, Invasive	16
Ehrlichiosis/Anaplasmosis	0
Malaria	<5
Listeriosis	<5
Sexually Transmitted Diseases	
Chlamydia Trachomatis	9,702
Gonorrhea	4,032
Syphilis	137
Immunizations (children in grades K-12) by Compliance	
Compliant	135,784
Noncompliant	17,999
Percent Compliant	88.3

Source: Wisconsin Department of Health Services Bureau of Health Information and Policy, "2008 Profile for Milwaukee County," accessed December 2010.

influenza-like illness in the Southeastern Wisconsin Region and lab reports indicated increased levels of H1N1.[49] This second wave peaked in early December 2009. By early January 2010, low levels of influenza-like illness were being report in southeastern Wisconsin. Between September 1, 2009 and February 22, 2010, 1,077 hospitalizations for H1N1 had been reported in the State of Wisconsin, with 220 of these occurring in Milwaukee County. The combined number of deaths in Wisconsin attributed to H1N1 influenza in both waves was 56, with nine of these occurring in Milwaukee County.[50]

In the year 2008, there were more than 5,800 deaths due to selected diseases within Milwaukee County as shown in Table 27. The majority of these mortalities were due to heart- and cancer-related illnesses. Pneumonia and influenza accounted for 144 deaths and a calculated death rate of 15 persons per 100,000 population. Other infectious diseases and parasitic illnesses accounted for 188 deaths in the year 2008. Table 27 also demonstrates that more than 323 deaths in 2008 were associated with alcohol and drug abuse within Milwaukee County, which is higher than pneumonia and influenza related deaths.

Vulnerability and Community Impact Assessment

A review of the community assets described in Chapter II indicates the limited potential for significant public health emergency-related hazards to the population throughout the City of Milwaukee. However, in general, those at greatest risk are the very young and the very old members of the community.

Potential Future Changes in Public Health Emergency Conditions

Based upon historical national trends of infectious diseases, as well as the continued threat of bio-terrorism, there is a potential for continued, but limited, risk of medical incidents to occur within the City of Milwaukee.

VULNERABILITY ASSESSMENT FOR TERRORISM

Terrorism can be defined as the unlawful use of force, violence, or biological attack against persons or property to intimidate or coerce a government, the civilian population, or any segment of either, in the furthering of political

[49]*City of Milwaukee Health Department, "Novel Influenza A (H1N1) Situation Awareness Report No. 2," September 10, 2009.*

[50]*City of Milwaukee Health Department, "Novel Influenza A (H1N1) Situation Awareness Report No. 20," February 22, 2010.*

Table 27

MORTALITIES DUE TO SELECTED DISEASES REPORTED IN MILWAUKEE COUNTY: 2008

Disease	Number of Mortalities	Death Rates[a]
Heart Disease (total)	2,043	218
Cancer (total)	1,833	194
Cerebrovascular Disease	381	41
Lower Respiratory Disease	369	39
Pneumonia and Influenza	144	15
Accidents:	505	54
Motor Vehicle	52	6
Diabetes	177	19
Infectious Disease and Parasitic	188	20
Suicide	118	13
Alcohol and Drug Abuse as Underlying Cause of Death		
Alcohol	171	18
Other Drugs	152	16
Tobacco Use	1,093	117

[a]*Death rates are per 100,000 people.*

Source: Wisconsin Department of Health Services Bureau of Health Information and Policy, "2008 Profile for Milwaukee County", accessed December 2010.

or social objectives. The Federal Bureau of Investigation categorizes two types of terrorism in the United States: domestic terrorism, which involves groups or individuals whose activities are directed at elements of our government or population without foreign direction, and international terrorism which involves groups or individuals who are foreign based and/or directed by countries or groups outside the United States or whose activities transcend national boundaries. Additionally, some acts conducted by gangs, people involved in civil unrest, radical splinter groups or activists, and people involved in illegal drug trade could also be described as terrorism.

An act of terrorism can take several forms, depending on the technological means available to the terrorist, the nature of the political issue motivating the act, and the points of weakness of the terrorism target. Based on guidelines provided by the U.S. Department of Homeland Security, terrorism refers to the use of Weapons of Mass Destruction (WMD) including biological, chemical, nuclear, and radiological weapons; arson, incendiary, explosive, and armed attacks; industrial sabotage and intentional hazardous materials releases; and 'cyber-terrorism.'[51] Several terrorist action possibilities are listed and briefly described below.

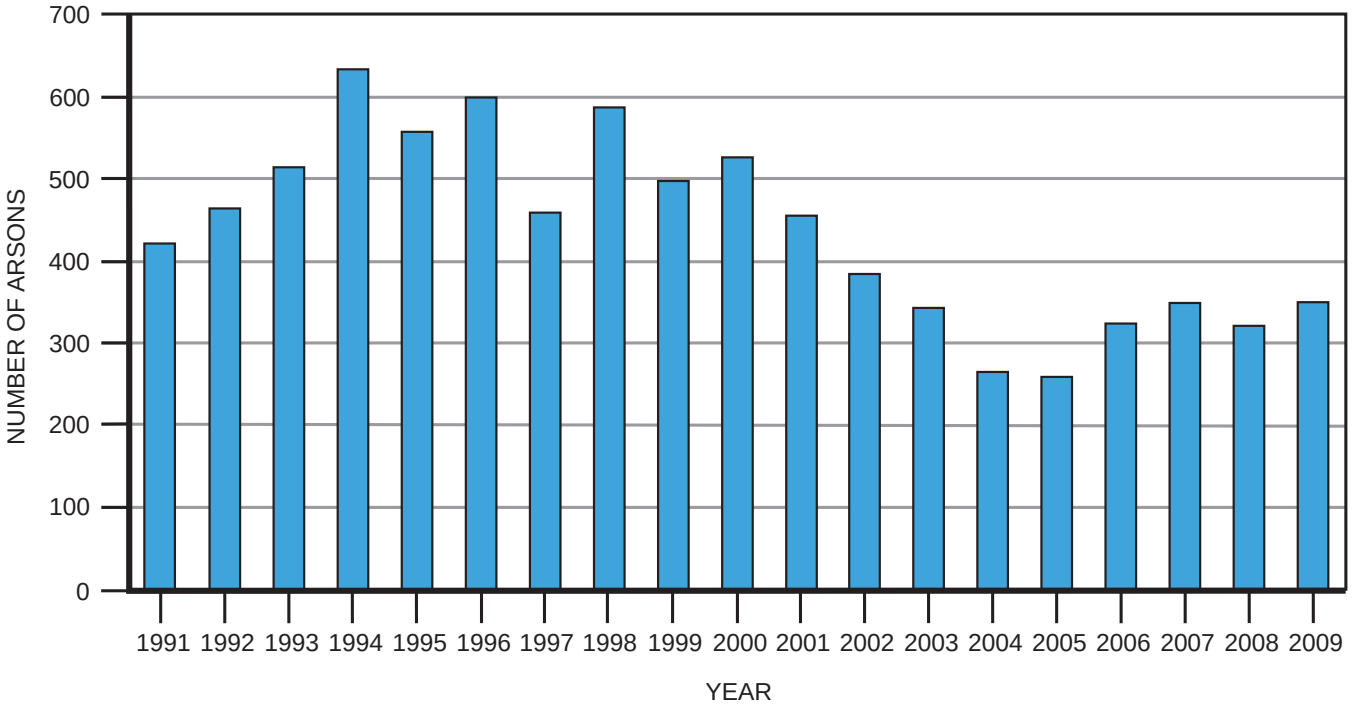
Incendiary Devices and Arson

Most terrorist incidents in the United States have involved bombs or incendiary devices, including arson, detonated and undetonated explosive devices, tear gas, pipe and firebombs, and rocket attacks. Often the capacity existed for large-scale damage and/or mass casualties. An example of this would be the bombing of the Alfred Murrah Federal Building in Oklahoma City in April 1995. The type of materials and method of delivery utilized in the bombing of the Murrah Federal Building are readily accessible to a potential terrorist. Because of the ready

[51]*FEMA, State and Local Mitigation Planning How-to Guide, Integrating Manmade Hazards Into Mitigation Planning, Version 2.0, September 2003.*

Figure 2

NUMBER OF ARSONS REPORTED IN THE CITY OF MILWAUKEE: 1991-2009



Source: City of Milwaukee Public Safety Report, City of Milwaukee Fire Department, and City of Milwaukee Police Department.

availability of such materials, the potential for mass damage and casualties and experiences to date in the nation, it is anticipated that of the various types of Weapons of Mass Destruction (WMD) and explosive weapons have a high potential for use in the United States.

FEMA defines arson and incendiary attack as the initiation of fire or of explosion on or near a target either through direct contact or remotely by other means. Generally, the extent of damage can be determined by type or quantity of accelerant and the materials present at or near the target. Arson can further be defined as any willful or malicious burning or attempt to burn, with or without intent to defraud, a dwelling, public building, motor vehicle, or other property. Fires of suspicious or unknown origins are not classified as arson. Nationally, arson resulted in 170 civilian deaths and was responsible for $684 million in property losses in 2009.[52] The number of reported arsons in the City of Milwaukee rose in the 1990s as shown in Figure 2, as new techniques and equipment increased the identification of arson as the cause of suspicious fires. Over the period 2000 through 2009, the average number of arson fires in the City of Milwaukee was about 346 arson fires per year. These fires resulted in an average of $2.24 million in property damages per year.

[52]*Michael J. Karter, Jr., "Fire Loss in the United States During 2009," National Fire Protection Association, August 2010; available at:* http://nfpaweb2.gvpi.net:8089/assets/files/PDF/OS.fireloss.pdf, *Accessed February 25, 2011.*

Table 28

ARSON FIRES AND REPORTED DAMAGES WITHIN THE CITY OF MILWAUKEE: 2000-2009

Year	Total Number of Arson Fires	Reported Damages					
		Residential Arson Fires	Residential Arson Damages (in thousands of dollars)[a]	Mobile Property Arson Fires[b]	Mobile Property Arson Fire Damages (in thousands of dollars)[a]	Other Arson Fires[c]	Other Arson Damages (in thousands of dollars)[a]
2000	524	172	$ 2,622.2	210	$1,123.8	142	$1,498.4
2001	453	143	1,713.0	232	1,345.9	78	489.4
2002	382	141	2,058.8	158	847.7	83	1,211.1
2003	341	97	594.6	172	535.1	72	356.7
2004	263	79	810.8	132	579.2	52	347.5
2005	257	51	672.2	41	336.1	165	896.2
2006	322	55	923.7	39	101.8	228	413.0
2007	347	50	1,254.0	47	122.9	250	93.2
2008	319	48	487.4	31	117.3	240	23.5
2009	348	25	696.7	42	62.8	281	16.7
Total	3,456	3,456	$11,833.4	1,104	$5,172.6	1,591	$5,345.7

[a]*Dollar values are adjusted to year 2010 by using the Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

[b]*Total includes vehicles, trailers, and boats.*

[c]*Total includes storage facilities and all other arson incidents. For 2005-2009, this was calculated by difference.*

Source: City of Milwaukee Public Safety Report.

Nationwide, an estimated 26,500 intentionally set structure fires occurred in 2009, a decrease of about 13 percent from 2008.[53] In 2009, 348 fires were caused by arson within the City of Milwaukee, resulting in over $776,000 in damages. As shown in Table 28, residential property accounted for the largest dollar loss due to arson, but only accounted for 25 of these fires. Arson loss for residential properties averaged $27,868 per fire. Damages to mobile property, such as vehicles, trailers, and boats, resulting from intentional set fires averaged $1,450 per fires. The majority of intentionally set fires in 2009 did not affect residential or mobile property. Damages resulting from these fires averaged about $60 per fire.

Airline Attack

After the events of September 11, 2001, questions were raised regarding the effectiveness of airport and airline security at the time. Since the September 11 attacks, security at airports and onboard airliners has been escalated. Specific changes include the oversight and supervision of passenger and baggage screening by the Transportation Security Administration, access to airplane boarding areas being restricted to passengers, restrictions being set on articles that can be taken onboard airliners, deployment of additional Federal air marshals on airliners, and improvements to cockpit security. Despite these efforts, it is possible that incidents may occur. Such incidents could include airplane bombing, sabotage or hijacking, airport bombings or shootings, or the tampering with air navigation and control systems, resulting in plane crashes or collisions.

[53]Ibid.

Weapons of Mass Destruction—Chemical/Biological/Nuclear/Radiological Attack
Terrorists can use chemical and biological agents or weapons to either extort or deliberately try to kill in order to further political goals. Toxins, or even some radiological materials, such as water-soluble plutonium chloride, could become a credible threat to municipal water supplies. An example of this would be the sarin gas attack on the Tokyo subway system that occurred in March 1995.

Hostage Taking
The taking of hostages can provide terrorist groups publicity for their political or social objectives, and allow negotiation for furtherance of their aims or result in events which are designed to invoke sympathy for their causes. The main goal of response agencies is to end the incident with the absolute minimum loss of innocent lives as possible. The common belief that most response agencies are willing to agree to any demand to prevent endangering the safety of hostages is not a true statement in all cases.

Infrastructure Attack
An individual or group of terrorists could coordinate an attack against utilities and other public services, such as the water supply, electric power generation and transmission, or telephone service. Another form of infrastructure attack is against computer resources, such as networks, databanks and software by infiltrating computer networks and altering, stealing or destroying programs and data. As society becomes more dependent on computers, this form of cyber-terrorism is a legitimate concern.

The emergency management community in the United States must accept that national security and intelligence organizations may not always be successful in preventing terrorist incidents. It is up to State and local emergency management personnel and services to respond should these attacks occur. The ramifications of responding to a terrorist incident may not be the same as traditional large-scale emergencies. The safety of emergency service providers must be an early, primary consideration. The media will take an active interest in this type of incident. The public has high expectations for emergency managers and service providers in a terrorist situation and extraordinary efforts are demanded. Federal and State government agencies depend directly on local managers and emergency response personnel and their initial and follow-on actions during any terrorist incident.

Historical Terrorism Problems
Historically, the worst case of domestic terrorism in the City of Milwaukee to date occurred on November 24, 1917. A bomb suspected to have been planted by anarchists was discovered by children and brought to a police station in the Third Ward. It detonated in the police station, killing nine police officers.

In 1970, there was a series of five pipe bombings and fire bombings in the City of Milwaukee that were attributed to suspected leftist revolutionaries. Targets included two industrial research laboratories, a building containing Federal offices, a military reserve headquarters, and a fuel line at a petroleum terminal in the harbor. While some of these incidents caused property damage, there were no fatalities or injuries reported. There were also two attempted bombings in the City in 1979. In one incident, a bomb was placed in a telephone booth. No damages or casualties resulted from this incident. In the other incident, a bomb exploded outside of a parochial elementary school, injuring a police officer who was attempting to dismantle it. No property damage resulted from this incident.[54]

Description of Recent Terrorism Events
Since 2000, there has been one terrorism incident documented in the City of Milwaukee. In July 2000, a former Air National Guard pilot broke into the 128th Air Refueling Wing airbase at General Mitchell International Airport, placing a bomb, as well as scrawling graffiti calling for an end to U.S. intervention in Kosovo. The bomb

[54]*National Consortium for the Study of Terrorism, Global Terrorism Database*, http://www.start.umd.edu/gtd/, *accessed February 24, 2011.*

failed to explode and the perpetrator was arrested. There were no injuries or fatalities, and only minor property damage was reported.[55] The National Counterterrorism Center's Worldwide Incidents Tracking System lists no incidents of terrorism having occurred in the State of Wisconsin between 2004 and 2009.[56] However, a number of political activist, domestic terrorist and/or organized hate groups may be operating in or around the State.[57]

Vulnerability and Community Impact Assessment

A review of the community assets described in Chapter II indicate a limited potential for terrorism-related hazard impacts to: 1) a variety of residential, commercial, and other developed land uses; 2) roadway transportation system; 3) utilities; 4) critical community facilities; and 5) historic sites in the vicinity of the incident. It is safe to assume that any type of facility on which a terrorist attack could generate desired publicity or further terrorism objectives could be classified as a potential target for terrorist activity, including large-scale public events, such as a sporting or entertainment event. Based on past events, however, the probability of a terrorist attack occurring in the City of Milwaukee is negligible.

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion.[58] About $24.5 billion of this total is comprised of buildings and other improvements. Due to the unpredictability and lack of precedent concerning terrorism events in the City of Milwaukee, all buildings, infrastructure, and critical facilities within the City are considered at risk. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

VULNERABILITY ASSESSMENT FOR MAJOR FIRE AND EMERGENCY MEDICAL INCIDENTS

Major structure fire or emergency medical incident is an important type of hazardous event that can potentially cause significant serious injuries, fatalities, and property damages. Local authorities and the City of Milwaukee Fire Department (MFD) maintain their own services to those affected by fire incidents, coordinate with various organizations which support emergency services, and have established lines of communication with neighboring fire departments, inclusive of areas outside of the City of Milwaukee. In addition, the City of Milwaukee Fire Department, like all emergency management programs, is required to conduct disaster preparedness exercises. Disaster exercises are valuable from a variety of standpoints, because they test emergency management plans and procedures, bring together people from various emergency response departments who must work together when disaster strikes, help break down barriers and foster communication between departments, allow simulation of emergency incidents, and provide valuable training.

The Milwaukee Fire Department houses 12 Emergency Medical Services (EMS) paramedic units located throughout the City (see Appendix B Table B-2). Although there are no formal agreements between the Milwaukee Fire Department and municipalities outside of the City of Milwaukee, the Milwaukee Fire Department EMS program is countywide: Milwaukee EMS renders assistance to, and receives assistance from other paramedic departments in neighboring municipalities without charge, to the extent of available resources not required for the protection of their own service areas. This is significant in the event of a major fire or emergency medical incident. These

[55]Ibid.

[56]http://wits.nctc.gov/ *accessed January 25, 2010.*

[57]*Federal Bureau of Investigation, "Terrorism in the United States 1998."*

[58]*Wisconsin Department of Revenue.*

agreements enable individual departments to supplement their own personnel, apparatus, and equipment with that from other departments in response to emergencies. Importantly, the agreement allows individual departments to access equipment, such as tankers, aerial trucks, and extrication equipment, which they themselves do not possess and which they may only need infrequently.

The majority of EMS responses required Basic Life Support (BLS), which includes patient evaluation, monitoring of pulse, blood pressure, and breathing, bandaging wounds and splinting fractures, and the performance of Cardio-Pulmonary Resuscitation (CPR) and cardiac defibrillation. All Fire Department vehicles are equipped with defibrillators, a life-saving device used to control irregular heart activity. A Basic Life Support alarm usually results in the dispatch of a single BLS unit, which may be an engine, ladder truck, or fire squad staffed by Firefighter-Emergency Medical Technicians (EMTs). Almost all members of the Milwaukee Fire Department are trained as EMT, and many have received additional training to qualify them as Paramedics.

In addition to traditional fire-fighting and EMS functions, the Milwaukee Fire Department has several specially trained units which perform extra duties. The Dive Rescue Team responds to water incidents. The Hazardous Materials Team responds to incidents involving the unintentional release of hazardous materials. The Heavy Urban Rescue Team (HURT) which responds to building collapses, construction site incidents, confined space emergencies, and similar situations, including rescue of trapped firefighters. Special team responses, while infrequent, may require extensive Fire Department time on scene, as well as advance readiness in the form of specialized training and equipment. Table 29 indicates recent activity of each of these special teams.

Historical Major Fires and Emergency Medical Incidents

Historically, Milwaukee's greatest fire to date occurred in 1892 in what was known as the Irish 3rd Ward**.** The fire originated at what is now 232 North Water Street. More than 440 buildings throughout 16 city blocks were completely destroyed. Calculated in terms of an 1892 appraisal, the loss was in excess of $4.5 million or nearly $100 million in today's terms. Two firemen and five other people died, and more than 1,800 people were made homeless.

Description of Recent Major Fires and Emergency Medical Incidents

In 2009, the Milwaukee Fire Department responded to 13,899 fire alarms and 53,629 Emergency Medical Service (EMS) calls. The combined total of fire alarms and EMS alarms includes 8,840 false alarms. Table 29 illustrates the number of fire and emergency medical service responses between 2000 and 2009. Fire alarms include any dangerous situation which is not classified as medical, including gas leaks, oil spills, water leaks, electrical problems or malfunctioning appliances, extrications from vehicles involved in accidents, and a wide variety of other situations in addition to fires. Of the fire alarms, 305 were for residential and building fires in which structural damage and loss of contents totaled $9.2 million. Seven of these fires resulted in seven fatalities.

For a fire or hazard alarm, the minimum MFD response is a pumping engine and a ladder truck. More typically, the response would include three pumping engines, two ladder trucks, a fire squad, and two battalion chiefs. "Greater alarm" fires are incidents requiring additional equipment and personnel to respond. In 2009, 18 "greater alarms" or major incidents requiring additional equipment and personnel to respond occurred. No estimates are available on the loss or damage to property and value of contents resulting from these fires. Over the period 2000 through 2004, the last period for which data are available, annual damages to property and value of contents resulting from "greater alarm" incidents ranged between $2.0 million and $7.8 million with an annual average of $4.6 million.[59] In December 2003, a fire broke out on the 14th floor at 111 East Wisconsin Avenue (also known as the Bank One building) in downtown Milwaukee. It is believed that welding sparks from building renovation on the 17th floor traveled down a pipe shaft, igniting paper on the 14th floor. This fire caused more than

[59]*Damages were adjusted to 2010 dollars using the Consumer Price Index.*

Table 29

FIRE AND EMERGENCY RESPONSE RATES WITHIN THE CITY OF MILWAUKEE: 2000-2009

Year	Emergency Medical Service Responses	EMS Response per 100,000 Persons	Number of Residential Building Fires	Fire Fatalities Rate per 100,000 Persons	Reported Damages			Special Team Responses		
					Fatalities	Total Property Damages (in millions of dollars)[a,b]	Residential Property Damages (in millions of dollars)[a]	DIVE	HURT	HAZMAT
2000	49,833	8,347.6	1,542	1.17	Seven fatalities in five fires	$ 22.9	$ 15.0	29	13	24
2001	49,452	8,283.8	1,308	1.34	Eight fatalities in seven fires	27.1	14.6	24	18	24
2002	49,188	8,239.6	1,177	1.00	Six fatalities in five fires	25.4	13.7	56	83	209[c]
2003	48,593	8,139.9	1,612	1.70	10 fatalities in eight fires	14.3	10.5	12	15	14
2004	54,028	9,050.3	- -[d]	2.01	12 fatalities in nine fires	19.7	14.7	22	7	17
2005	50,442	8,449.6	641	2.68	16 fatalities in nine fires	17.9	11.4	29	9	20
2006	59,567	9,978.2	493	2.01	12 fatalities in nine fires	17.8	7.6	22	16	25
2007	48,890	8,110.7	583	2.32	14 fatalities in 13 fires	19.0	9.5	38	12	29
2008	55,898	9,273.3	343	1.00	Six fatalities in five fires	13.6	9.6	23	9	25
2009	53,047	8,886.0	305	1.16	Seven fatalities in seven fires	11.7	9.2	37	8	21
Total	518,938	- -	8,004	- -	98 fatalities in 77 fires	$189.4	$115.8	292	190	408

[a]*Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

[b]*Includes buildings (residential and nonresidential), contents, vehicles, and other nonstructural fires.*

[c]*Total includes five responses outside of the City of Milwaukee.*

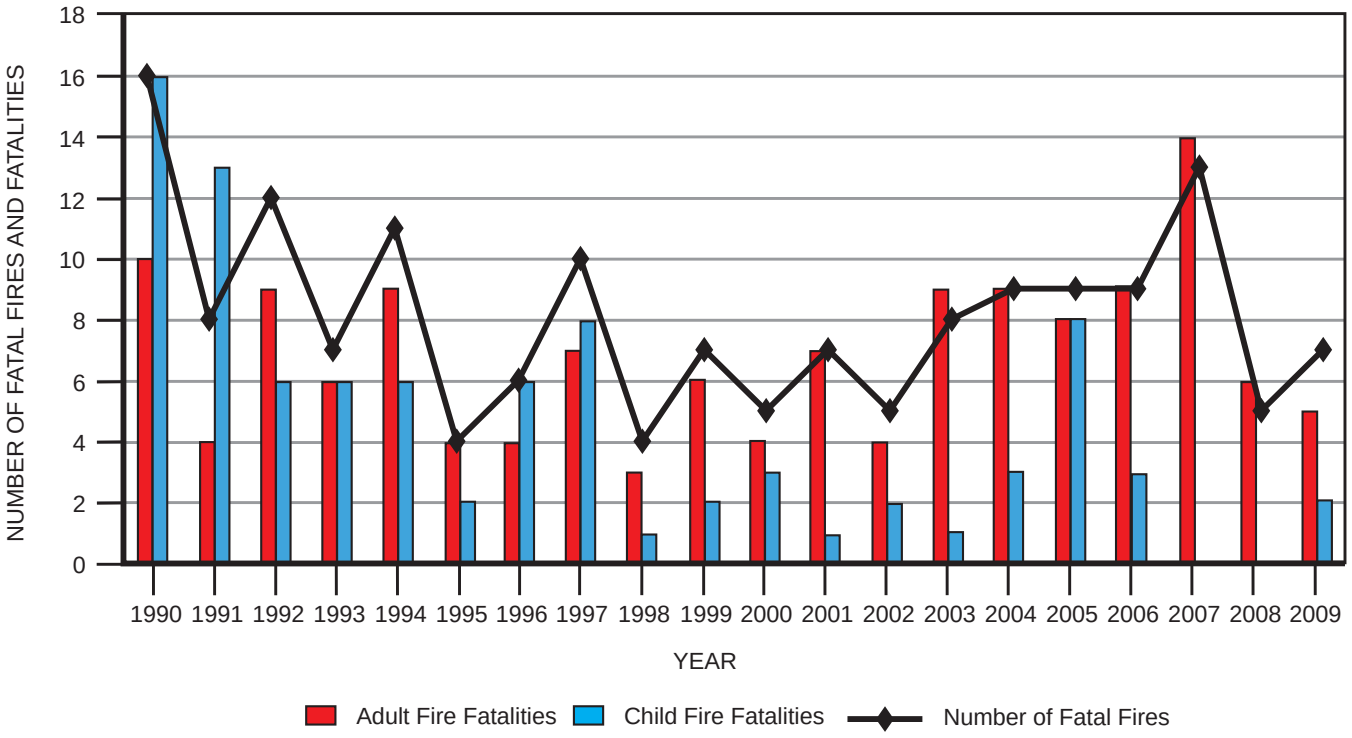
[d]*Data not available*

Source: City of Milwaukee Public Safety Report, Milwaukee Fire Department Annual Report, Milwaukee Fire Department.

FINAL DRAFT

Figure 3

NUMBER OF FATAL FIRES AND FIRE FATALITIES IN THE CITY OF MILWAUKEE: 1990-2009



Source: City of Milwaukee Public Safety Report, City of Milwaukee Fire Department, and City of Milwaukee Police Department.

$1.2 million in damage and injured three people. On December 6, 2006, a gas explosion related to a gas leak occurred at Falk Corporation in the Menomonee Valley. This explosion killed three persons and injured 47. Debris from the explosion landed several blocks away. The incident was classified as a five-alarm fire.

Vulnerability and Community Impact Assessment

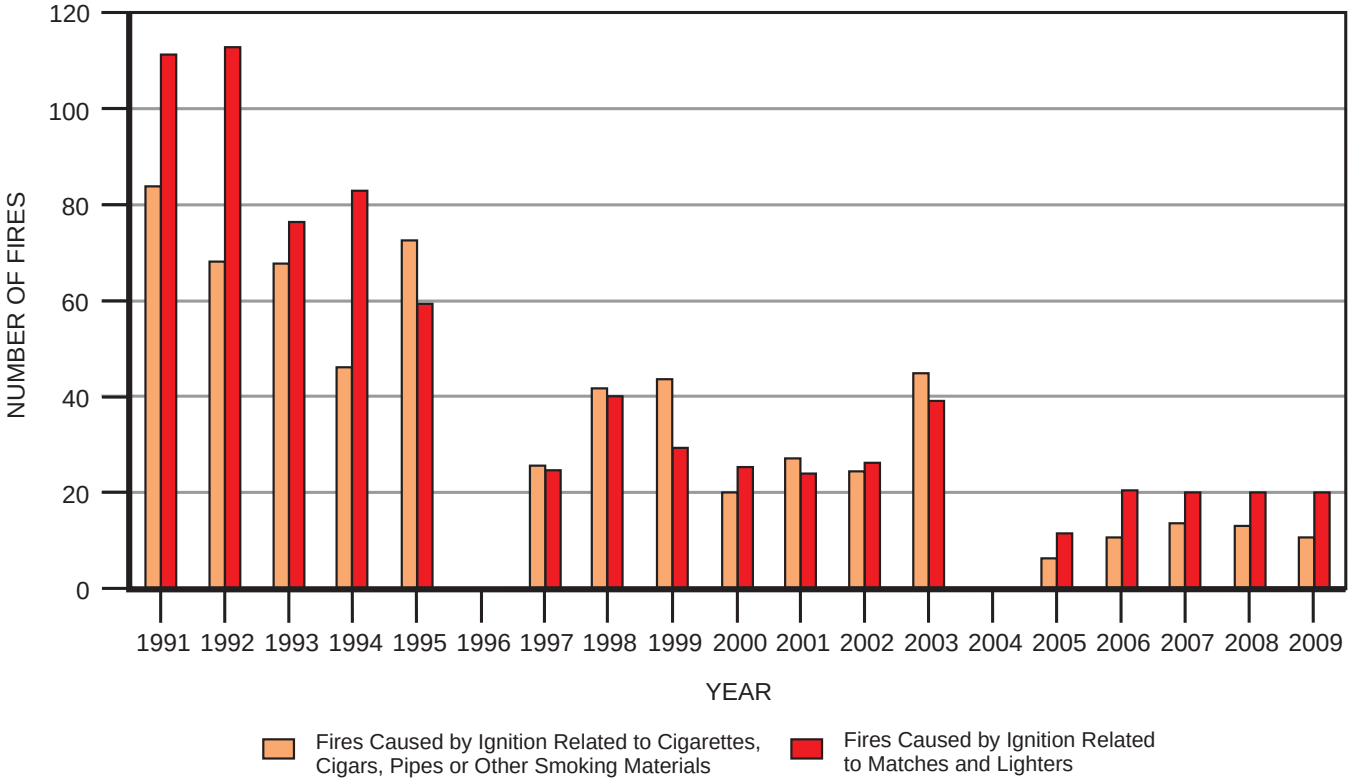
Table 29 shows the number of fire deaths, fires and other hazard incidents, and medical responses, and the rate of fires per 1,000 people. EMS responses account for about three-quarters of Fire Department dispatches. Like fire alarms, the number of emergency medical alarms is usually highest in the summer. Fire and emergency medical incidents are not evenly distributed throughout the City. Densely populated areas may be more at risk for major fire and fire fatalities and injuries than more sparsely populated areas. Children and the elderly are most at risk for fatality or injury due to fire.

Generally, most fire injuries and fatalities occur in home and residential fires. In 2009, about 85 percent of all fire fatalities nationwide occurred in the home.[60] Figure 3 shows the number of fatal fires that occurred between 1990 and 2009 in the City of Milwaukee, and that the number of adults and children that have died in fires has significantly declined over this time period. In addition, fires caused by children playing with matches or other incendiary devices significantly declined during this time period as shown in Figure 4. In 1992, over 110 nonfatal fires were started by children playing with matches, lighters, or other heat sources. The Milwaukee Fire Department reported that in 2003, 38 nonfatal fires were caused by children playing with incendiary devices. In

[60] *Michael J. Karter, Jr., "Fire Loss in the United States During 2009,"* op. cit.

Figure 4

NUMBER OF FIRES IN THE CITY OF MILWAUKEE CAUSED BY IGNITION RELATED TO SMOKING MATERIALS OR MATCHES AND LIGHTERS: 1991-2009



Source: City of Milwaukee Public Safety Report and City of Milwaukee Fire Department.

2009, Milwaukee Fire Department reported that only 20 fires were caused by ignition related to matches, lighters, and similar incendiary devices. Similar declines were seen in fires started by careless smoking: in 1991, over 80 nonfatal fires were reported to have been caused by careless smoking. This number decreased to a low in 2005, with six fires caused by ignition related to smoking materials. While the number of fires caused by ignition related to smoking materials has increased slightly since then, it remains substantially lower than it was in the early 1990s.

Based on fire incidents reported between 2006 and 2009, it is likely that the City of Milwaukee will continue to average approximately 430 fires per year, and over the next few years, an estimated 8.5 fires could result in 9.5 fatalities each year.

In 2010, the total equalized assessed property value in the City of Milwaukee was estimated at over $28.5 billion.[61] Slightly over $24.5 billion of this total is comprised of buildings and other improvements. Based on data from 2000-2009, total property damages due to fire are approximately $18.9 million per year, or less than 0.1 percent of the total assessed property value in the City of Milwaukee. All buildings, infrastructure, and critical facilities within the City are considered at risk for fire. Based on availability, the 2010 assessed values of the identified critical facilities are provided in Appendix B.

[61] *Wisconsin Department of Revenue.*

Potential Future Changes in Major Fire and Emergency Response Conditions

Several fire safety programs were implemented in the early 1990s and results indicate that the number of fatal fires and fatalities have decreased (further details of these programs are included in Chapter V of this report).[62] In 1991, the Milwaukee Fire Department instituted the FOCUS program (Firefighters Out Creating Urban Safety) to educate the public. In FOCUS, firefighters go door-to-door in targeted areas to install smoke detectors, explain their maintenance and replace batteries, provide fire safety tips, and answer questions. In 1992, Milwaukee Fire Education Center's Survive Alive House officially opened. Over 13,000 Milwaukee children visit each year to learn to survive in the event of an actual fire in the home. The house is available to public and private schools located in the City of Milwaukee. Child fatalities have greatly decreased since this program has been implemented. In 1997, the Fire Department also began providing fire inspection services for public buildings. The Fire Department also works with building managers to identify any potential fire hazards.

As the Milwaukee Fire Department continues to teach the public fire safety techniques and further outreach efforts to provide smoke detectors, the City of Milwaukee may continue to see decline in the number fatalities and injuries associated with fires.

[62]*Milwaukee Fire Department community relations programs are described on the department website at* http://city.milwaukee.gov/CommunityRelations.htm.

Chapter IV

HAZARD MITIGATION GOALS AND OBJECTIVES

Planning may be defined as a rational process for formulating and meeting goals and objectives. Consequently, the formulation of goals and objectives is an essential task that must be undertaken before plans can be prepared. This chapter sets forth hazard mitigation goals and objectives for use in consideration of alternative hazard mitigation strategies for the City of Milwaukee and in the selection of recommended strategies from among those alternatives.

It is important to note that Milwaukee County has completed a Pre-Disaster Mitigation Plan that includes specific goals and objectives that were developed through a series of public meetings and stakeholder interviews to assist County residents, local governments, and others in reducing risk and preventing loss from future hazard events.[1] The two goals stated in the Milwaukee County plan that are identified specifically for the City of Milwaukee, are to reduce the impacts from flooding and to enhance emergency response capabilities, both of which have been incorporated into the formulation of goals and objectives for this Plan as shown in Table 30 (see Goals No. 4 and 6 below).

In formulating and setting forth goals and objectives, their differing natures and purposes must be kept in mind. In this regard, the definition of goals and objectives used herein is as promoted by the Federal Emergency Management Agency (FEMA). Goals are general guidelines that explain what a community desires to achieve. Based upon the selected goals, a community can then develop the specific objectives or standards needed to attain the goals. Objectives and standards more narrowly define strategies for meeting the selected goals and are more specific than goals.

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[1] *Milwaukee County Emergency Management,* Milwaukee County Wisconsin Pre-Disaster Mitigation Plan*, August 2004; Milwaukee County Emergency Management,* Milwaukee County Wisconsin Pre-Disaster Mitigation Plan, *draft June 2010.*

Table 30

OBJECTIVES AND STANDARDS FOR THE CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN

OBJECTIVE NO. 1

A spatial distribution of the various land uses that minimizes hazards and dangers to health, welfare, and safety as well as further enhancing the economic base of the City, and which will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety, and public facility systems.

STANDARDS

1. Urban high-, medium-, and low-density residential uses should be located within planning units which are served with centralized public sanitary sewerage and water supply facilities and contain, within a reasonable walking distance, necessary supporting local service uses, such as neighborhood park, local commercial, and elementary school facilities, and should have reasonable access through the appropriate component of the transportation system to employment, commercial, cultural, and governmental centers, and secondary school and higher educational facilities; and should be provided with readily available fire and police protection and emergency medical services.

2. Rural- and suburban-density residential uses should have reasonable access through the appropriate component of the transportation system to local service uses; employment, commercial, cultural, and governmental centers; and secondary school and higher educational facilities and should have reasonable access to fire and police protection and emergency medical services.

3. Industrial uses should be located to have direct access to arterial street and highway facilities and reasonable access through an appropriate component of the transportation system to residential areas and to railway, seaport, and airport facilities, and should not be intermixed with commercial, residential, governmental, recreational, or institutional land uses; and should be provided with readily available fire and police protection and emergency medical services.

4. Major commercial uses should be located in centers of concentrated activity on only one side of an arterial street and should be afforded direct access to the arterial street system; and should be provided with readily available fire and police protection and emergency medical services.

OBJECTIVE NO. 2

A spatial distribution of the various land uses which maintains biodiversity and which will result in the protection and wise use of the natural resources of the City, including its soils, inland lakes and streams, groundwater, wetlands, woodlands, wildlife, and natural areas and critical species habitats.

STANDARDS

1. Urban development should not be located in areas which would cause or be subject to flood damage.

2. No structure or fill should be allowed to encroach upon and obstruct the flow of water in perennial stream channels.

3. The types and distribution of land uses should be developed considering the potential impacts on flood flows, on surface water quality, and on groundwater quality and quantity.

4. All remaining undeveloped lands within the designated primary environmental corridors in the City should be preserved in essentially natural, open uses.

5. All remaining undeveloped lands within the designated secondary environmental corridors and isolated natural areas in the City should be considered for preservation as urban development proceeds and used as drainageways, floodwater storage areas, and parks.

6. All wetlands adjacent to streams or lakes, all wetlands within areas having special wildlife or other natural values, and all wetlands having an area of five acres or greater should not be allocated to any urban development, except limited recreational use, and should not be drained or filled. In addition, City and local units of government may choose to preserve all wetlands.

Table 30 (continued)

OBJECTIVE NO. 3

The provision of facilities necessary to maintain a high quality of fire and police protection and emergency medical services throughout the City.

STANDARDS

1. Because adequate fire and police protection and emergency medical services are essential to the protection of the public health and safety and of real property values, and is a public service which enhances the economic development potential of an area, fire and police stations and emergency medical equipment should be developed and distributed based upon the accepted standards for such services.

OBJECTIVE NO. 4

The development of a stormwater management system, floodland management system, and sanitary sewer systems which reduce the exposure of people to drainage- and flooding-related inconvenience and to health and safety hazards and which reduces the exposure of real and personal property to damage through inundation and basement backup resulting from flooding, inadequate stormwater drainage, or sewerage system capacity.

STANDARDS

1. In order to prevent significant property damage and safety hazards, the major components of the stormwater management system and the floodland management system should be designed to accommodate runoff from a one-percent-annual probability storm event.

2. In order to provide for an acceptable level of access to property and of traffic service, the minor components of the stormwater management system should be designed to accommodate a runoff from a 10-percent-annual-probability storm event in the combined sewer area of the City and a 20-percent-annual-probability storm event in the separate sewer area of the City.

3. In order to provide for an acceptable level of access to property and of traffic service, the stormwater management system should be designed to provide two clear 10-foot lanes for moving traffic on existing arterial streets, and one clear 10-foot lane for moving traffic on existing collector and land access streets during storm events up to and including the 10-percent-annual-probability event in the combined sewer area of the City and a 20-percent-annual-probability event in the separate sewer area of the City.

4. Flow of stormwater along and across the full pavement width of collector and land access streets shall be acceptable during storm events exceeding a 10-percent-annual-probability event in the combined sewer area of the City and a 20-percent-annual-probability event in the separate sewer area of the City when the streets are intended to constitute integral parts of the major stormwater drainage system.

5. Plan components shall be designed to comply with the requirements of Chapter NR 116 of the *Wisconsin Administrative Code*.

6. All new and replacement bridges and culverts over waterways shall be designed so as to accommodate, according to the categories listed below, the designated flood events without overtopping of the related roadway or railway track.

    a. Minor and collector streets used or intended to be used primarily for access to abutting properties: a 10-percent-annual-probability flood discharge.

    b. Arterial streets and highways, other than freeways and expressways, used or intended to be used primarily to carry heavy volumes of through traffic: a two-percent-annual-probability flood discharge.

    c. Freeways and expressways: a one-percent-annual-probability flood discharge.

    d. Railways: a one-percent-annual-probability flood discharge.

7. All new and replacement bridges and culverts along waterways shall be designed so as not to inhibit fish passage in areas especially during low flow time periods which are supporting, or which are capable of supporting, valuable recreational sport and forage fish species.

Table 30 (continued)

8. Provide for the capability to provide fire and police protection and emergency medical services and for adequate operation of wastewater treatment facilities during a one-percent-annual-probability flood event.

9. In order to prevent property losses and health and safety hazards, the sanitary sewerage system and related stormwater and floodland management systems should be designed to minimize basement backups through a) implementing the recommendations of the Milwaukee Metropolitan Sewerage District 2020 facilities plan and b) reducing problem sources of infiltration and inflow to the sanitary sewerage system.

OBJECTIVE NO. 5

The identification of high erosion risk Lake Michigan shoreline areas and the development of a coastal erosion control program which reduces the exposure of people and real and personal property to shoreline erosion and bluff recession.

STANDARDS

1. Erosion risk areas and structure setback distances from the Lake Michigan shoreline should be established based upon the recommendations included in the Milwaukee County coastal erosion management study.[a]

OBJECTIVE NO. 6

The identification and development of programs which complement emergency operations plans from the County and adjacent municipalities, to mitigate the potential exposure to health and safety and the exposure of real and personal property resulting from a broad range of hazards which are unpredictable and not geographically specific in nature.

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[a]*SEWRPC Community Assistance Planning Report No. 163,* A Lake Michigan Shoreline Erosion Management Plan for Milwaukee County, Wisconsin*, October 1989; SEWRPC Technical Report No. 36,* Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin, *December 1997.*

Source: SEWRPC.

RELATIONSHIP OF HAZARD MITIGATION GOALS AND OBJECTIVES TO OTHER RELEVANT PLANNING EFFORTS

The City of Milwaukee has prepared a comprehensive plan that will provide a basis for broad-based decision-making on land use-related issues by City officials and will increase the awareness of City planning goals and objectives by landowners, developers, and other private interests.[2] That plan incorporates elements from other pertinent City, County, and Regional plans as appropriate.

The City of Milwaukee has also prepared and adopted a park and open space plan[3] and regional land use plan[4] to provide guidance in preserving and developing recreational, land use, and other open space uses throughout the City. In addition, comprehensive watershed plans[5] have been developed for each of the major watershed areas which include areas in the City of Milwaukee. These plans included evaluation of alternatives and recommended flood mitigation plans developed on a comprehensive watershedwide basis. As park and open space planning, land use, and floodland management planning is carried out in the City of Milwaukee and in the related watersheds, an integration and coordination of the goals and objectives has taken place. Park and open space and land use planning goals and objectives are integrated and coordinated with floodland management planning. This is accomplished at the watershed level by developing comprehensive watershed plans which include floodland management, land use, park and open space, and water quality planning in one integrated planning program.

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[2]*City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Citywide Policy Plan, *March 2010; City of Milwaukee Department of City Development,* Market Study, Engineering, and Land Use Plan for the Menomonee River Valley, *October 1998; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Fond du Lac and North—A Plan for the Area, *March 2004; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near West Side—A Plan for the Area, *March 2004; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: The Third Ward—A Plan for the Neighborhood, *May 2005; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Washington Park—A Plan for the Area, *June 2006; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Northwest Side—A Plan for the Area, *January 2008; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: An Area Plan for the Southeast Side, *October 2008; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near South Side—A Plan for the Area, *May 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Northwest Side—A Plan for the Area, *July 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Near North Side—A Plan for the Area, *December 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Southwest Side—A Plan for the Area, *December 2009; City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: West Side—A Plan for the Area, *December 2010; and City of Milwaukee Department of City Development,* Milwaukee Comprehensive Plan: Downtown—A Plan for the Area, *October 2010.*

[3]*SEWRPC Planning Report No. 132,* A Park and Open Space Plan for Milwaukee County, *November 1991.*

[4]*SEWRPC Planning Report No. 48,* A Regional Land Use Plan for Southeastern Wisconsin: 2035, *June 2006.*

[5]*SEWRPC Planning Report No. 13,* A Comprehensive Plan for the Milwaukee River Watershed, *Volume One,* Inventory Findings and Forecasts, *December 1970, and Volume Two,* Alternative Plans and Recommended Plan, *October 1971; SEWRPC Planning Report No. 26,* A Comprehensive Plan for the Menomonee River Watershed, *Volume 1,* Inventory Findings and Forecast, *October 1976, and Volume 2,* Alternative Plans and Recommended Plan, *October 1976; SEWRPC Planning Report No. 32,* A Comprehensive Plan for the Kinnickinnic River Watershed, *December 1978; SEWRPC Planning Report No. 37;* A Water Resources Management Plan for the Milwaukee Harbor Estuary, *Volume One,* Inventory Findings , *March 1987, and Volume Two,* Alternative and Recommended Plans, *December 1987; and SEWRPC Community Assistance Planning Report No. 261,* Flood Mitigation Plan for the City of Milwaukee, Milwaukee County, Wisconsin, *October 2000.*

These watershed plans form a potential framework for subwatershed-level planning programs. As an example, the comprehensive watershed planning objectives, principles, and standards for the comprehensive plan for the Menomonee River watershed[6] include several specific objectives and supporting standards related to land use and park and open space use, as well as objectives and standards relating to flood control. Similarly, the City of Milwaukee park and open space plan contains a specific plan element for wetland and floodland preservation.

It is important to note that the flood control element of his hazard mitigation plan relies directly on the Milwaukee Metropolitan Sewerage District (MMSD) Watercourse Management Planning Program. That program includes a set of watercourse management plan objectives which are incorporated herein. The goals and objectives of the MMSD program are summarized as follows and are documented in the MMSD Phase 1 and Phase 2 watercourse management plans.[7]

The overall goal of the MMSD watercourse management plan is to develop environmentally responsible, cost-effective flood management recommendations based upon the following fundamental objectives:

- Utilize and develop watercourse models that are consistent with SEWRPC methodology and anticipate future planning efforts.
- Identify problems and design solutions for the 100-year event.
- Utilize a watershed-based approach.
- Utilize future land use conditions to identify problems and develop solutions.
- Focus on environmentally sensitive and aesthetically acceptable engineering solutions.
- Integrate local stormwater runoff control features.
- Incorporate current regulatory requirements.
- Identify costs and benefits of solutions.
- Identify and resolve policy issues critical to the implementation of the watercourse plan.
- Obtain community input to develop acceptable solutions.

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[6]*SEWRPC Planning Report No. 26,* op cit.

[7]*Milwaukee Metropolitan Sewerage District,* Kinnickinnic River Phase 1 Watercourse System Management Plan, *August 2000; Milwaukee Metropolitan Sewerage District,* Kinnickinnic River Phase 2 Watercourse Management Plan, *May 2005; Milwaukee Metropolitan Sewerage District,* Menomonee River Phase 1 Watercourse System Management Plan, *August 2000; Milwaukee Metropolitan Sewerage District,* Menomonee River Phase 2 Watercourse Management Plan, *July 2002; Milwaukee Metropolitan Sewerage District,* Milwaukee River Watershed Phase 1 Watercourse System Management Plan, *August 2000; Milwaukee Metropolitan Sewerage District*, Lake Michigan Direct Drainage Area Phase 1 Watercourse System Management Plan, *August 2000; Milwaukee Metropolitan Sewerage District,* Oak Creek Phase 1 Watercourse Management Plan, *August 2000; Milwaukee Metropolitan Sewerage District*, Root River Phase 1 Watercourse Management Plan, *August 2000; and SEWRPC Memorandum Report No. 172*, A Watercourse System Plan for the Milwaukee River in Milwaukee County Upstream of the Milwaukee Harbor Estuary, *December 2010.*

HAZARD MITIGATION GOALS AND OBJECTIVES FOR THE CITY OF MILWAUKEE HAZARD MITIGATION PLAN

The following objectives have been established for the City of Milwaukee hazard mitigation planning program. The objectives have been established based, in part, upon goals previously established in watershed, park and open space, and land use planning programs.

1. A spatial distribution of the various land uses that minimizes hazards and dangers to health, welfare, and safety as well as further enhancing the economic base of the City, and which will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety, and public facility systems.

2. A spatial distribution of the various land uses which maintains biodiversity and which will result in the protection and wise use of the natural resources of the City, including its soils, inland lakes and streams, groundwater, wetlands, woodlands, wildlife, and natural areas and critical species habitats.

3. The provision of facilities necessary to maintain high-quality of fire and police protection and emergency medical services throughout the City.

4. The development of a stormwater management system, floodland management system, and sanitary sewer systems which reduce the exposure of people to drainage- and flooding-related inconvenience and to health and safety hazards and which reduces the exposure of real and personal property to damage through inundation and basement backup resulting from flooding, inadequate stormwater drainage, or sewerage system capacity.

5. The identification of high erosion risk Lake Michigan shoreline areas and the development of a coastal erosion management program which reduces the exposure of people and real and personal property to shoreline erosion and bluff recession.

6. The identification and development of programs which complement emergency operations plans from the County and adjacent municipalities, to mitigate the potential exposure to health and safety and the exposure of real and personal property resulting from a broad range of hazards which are unpredictable and not geographically specific in nature.

The population distribution by census block in the year 2010 ranges up to more than 2,300 persons per census block, while most of the City of Milwaukee is dominated by densities of 50 to 300 persons, as shown on Map 3 in Chapter II of this report.

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Chapter V

HAZARD MITIGATION STRATEGIES

Hazard mitigation planning may be defined as the systematic evaluation of the nature and vulnerability of hazards present, along with the development and implementation of sustained actions to reduce or eliminate long-term risks from hazards and their effects. Specific purposes of hazard mitigation include the elimination of loss of life, lessening of danger to human health and safety, minimization of monetary damage to private and public property, reduction in the cost of utilities and services, and minimization of disruption in community affairs. Hazard mitigation also involves the avoidance of intensification of existing and creation of new hazards.

The preparation of an all hazards mitigation plan for the City of Milwaukee involves the development and evaluation of alternative mitigation measures and plan elements, and the synthesis of the most effective elements into an integrated plan. Some of the mitigative measures described are ongoing or committed actions, which do not require the evaluation of alternative measures, but are proposed to be integrated into the mitigation plan as such. For other hazards, there may be only one or a number of integrated viable options. In these cases, alternatives are not presented and cost-effectiveness is not specifically addressed, but is implied by the nature of the mitigation measures. In other instances where there are viable alternatives, such alternatives are described and evaluated. However, flood mitigation alternatives were developed and summarized in the flood mitigation plan for the City of Milwaukee,[1] therefore, only the recommended flood mitigation elements are presented in this report. This chapter describes the hazard mitigation measures considered to resolve the identified hazard problems within the City of Milwaukee.

The recommended hazard mitigation measures identified in the August 2004, Milwaukee County pre-disaster mitigation plan were also reviewed and incorporated herein as appropriate and applicable to the City of Milwaukee.

In preparing the updated plan, the City of Milwaukee Hazard Mitigation Steering Committee reviewed and reevaluated the hazard mitigation goals, objectives, and supporting standards for the City (see Chapter IV of this report). This review included consideration of whether the goals of the initial plan were still applicable and whether additional goals should be added. In addition, the Steering Committee also reviewed and reevaluated hazard conditions within the City (see Chapter III of this report). This review included reevaluation of the identification of the hazards likely to affect the City, updating the data upon which the profiles of the extent and severity of hazard events which occurred in the City were based, reassessment of the vulnerability and risk

[1]*SEWRPC Community Assistance Planning Report No. 261,* Flood Mitigation Plan for the City of Milwaukee, Milwaukee County, Wisconsin, *October 2000, revised April 2003.*

associated with each type of hazard in light of the updated data, and reevaluation as warranted by the updated assessments of the potential for changes in hazard severity and risk under future conditions. This review and reevaluation of hazard mitigation goals and hazard conditions, along with consideration of changes in conditions in the City of Milwaukee since the initial plan was issued (see Chapter II of this report) and progress in implementing the initial plan, served as the basis for the Steering Committee's review and reevaluation of measures to reduce vulnerability to hazards identified in the updated risk assessment and the Committee's selection of priority measures to address those hazards. The activities of the Steering Committee are documented in Appendix A of this report.

Measures have been identified and evaluated for each of the hazards for which a vulnerability analysis was developed as set forth in Chapter III.

HAZARD MITIGATION PLAN COMPONENT FOR FLOODING AND ASSOCIATED STORMWATER DRAINAGE PROBLEMS

The flooding and related stormwater drainage problem mitigation plan for the City of Milwaukee consists of five elements: a floodland and environmentally sensitive lands preservation element, a floodland management element, a stormwater management element, a public information and education element, and a secondary plan element. Each element of the plan is an important component of the overall strategy for reducing flood risk and flood damage. Some aspects of the overall plan are already being implemented in the form of existing and ongoing activities being carried out by the City of Milwaukee and local units of government that contribute toward realizing the flood mitigation goals and objectives.

Floodland and Environmentally Sensitive Lands Preservation Element

Floodland management regulations and programs perform critical roles in assuring that flood mitigation efforts are properly implemented. As detailed in Chapter II, the City of Milwaukee currently has several pertinent floodland management regulations and programs in place, most notably in the form of zoning regulations and other ordinances, and environmentally sensitive area and open space preservation policies. A significant portion of the environmentally sensitive lands within the City of Milwaukee, including wetlands, woodlands, and floodlands, are under protective ownership and/or zoning.

Floodplain Zoning and Regulations

The City of Milwaukee floodplain zoning ordinance is intended to preserve the floodwater conveyance and storage capacity of floodplain areas and to prevent the location of new flood-damage-prone development in flood hazard areas. More information regarding this ordinance is set forth in Chapter II of this report. Implementation of this ordinance on an ongoing basis is an integral part of the City flood mitigation strategy. In this regard, the City will continue to work cooperatively with the Milwaukee County Automated Mapping and Land Information System (MCAMLIS) program, the Milwaukee Metropolitan Sewerage District (MMSD), and the Southeastern Wisconsin Regional Planning Commission (SEWRPC) to incorporate references to updated floodplain mapping and studies which are currently being prepared, or have been prepared under an ongoing floodplain mapping program being conducted by SEWRPC for the MCAMLIS Steering Committee and MMSD. Those studies will ultimately be submitted to the Wisconsin Department of Natural Resources (WDNR) and Federal Emergency Management Agency (FEMA) for review and incorporation in the FEMA digital flood insurance rate maps for Milwaukee County and the City floodplain zoning ordinance. Updating has been completed for the flood hazard areas associated with Lincoln Creek, the Milwaukee River, and some portions of the Menomonee River that are located in the City. In the future it is anticipated that updated SEWRPC studies of the Kinnickinnic River, Lyons Park Creek, Wilson Park Creek, and the portions of Villa Mann Creek and Honey Creek within the City will be incorporated in the FEMA DFIRM and the City zoning ordinance.

In addition, the MMSD has adopted a comprehensive rule, Chapter 13 of the MMSD rules, designed to minimize the potential for new development or redevelopment within or upstream of the City within the MMSD service area to increase flood risk. The rule, which took effect on January 1, 2002 and was amended on October 25, 2010, provides for community ordinances which require the management of the volume and peak rate of stormwater flows from new development and redevelopment in an effort to avoid increases in downstream flooding.

Environmentally Sensitive Area and Open Space Preservation Actions

As noted in Chapter II of this report, the preservation of environmental corridors and important natural features can assist in preventing increased flood flows and associated problems. These areas often include the most significant floodplains and wetlands within a given area. The preservation of wetlands is of particular importance because wetlands often afford natural filtration and floodwater storage. In addition, the intrusion of intensive urban land uses into environmentally sensitive areas may result in the creation of serious and costly problems, such as failing foundations for pavements and structures, wet basements, excessive operation of sump pumps, excessive clear-water infiltration into sanitary sewerage systems, and poor drainage. Destruction of ground cover may result in soil erosion, stream siltation, more rapid runoff, and increased flooding.

The regional land use plan includes provisions to preserve environmental corridors and isolated natural resource areas.[2] This regional plan forms the framework for ongoing local land use planning by the City of Milwaukee and Milwaukee County. Environmental corridors and floodplains are generally linear in nature and are often located along steam corridors within and upstream of the City of Milwaukee. Thus, any viable approach to planning for these lands and other environmentally sensitive areas located partly or wholly within the City of Milwaukee must encompass an area larger than the City alone. Such areas within the City of Milwaukee have been addressed through planning efforts undertaken by and for Milwaukee County. In 1991, the Milwaukee County Board of Supervisors adopted the Milwaukee County Park and Open Space Plan completed by the Southeastern Regional Planning Commission.[3] Milwaukee County has primary responsibility for parks and related open space areas within the County, including within the City of Milwaukee.

Milwaukee County has taken an active role in preserving environmentally sensitive lands and currently owns approximately 15,000 acres of park, parkway, and open space land located in 140 sites. Of this, there are approximately 7,700 acres of park, parkway, and open space located in the City of Milwaukee. The current locations of major parks, primary and secondary environmental corridors, and isolated natural areas are shown on Map 12. Isolated natural areas are physically separated from environmental corridors by intensive urban or agricultural land uses, and are at least five acres in size.

In 2001 the MMSD created the Greenseams program that contributes to the preservation of floodlands and environmentally sensitive areas. This program combines the conservation plan prepared by the MMSD with the "greenway connection plan" developed with assistance from SEWRPC. The conservation plan identified land parcels which are recommended to be protected for multiple purposes, including flood reduction potential and stormwater management benefits, as well as wildlife habitat, water quality, and recreational benefits. The conservation plan identified a number of sites for protection through public acquisition or conservation easements throughout the Menomonee River, Root River, and Oak Creek watersheds within the District.[4] As of the end of

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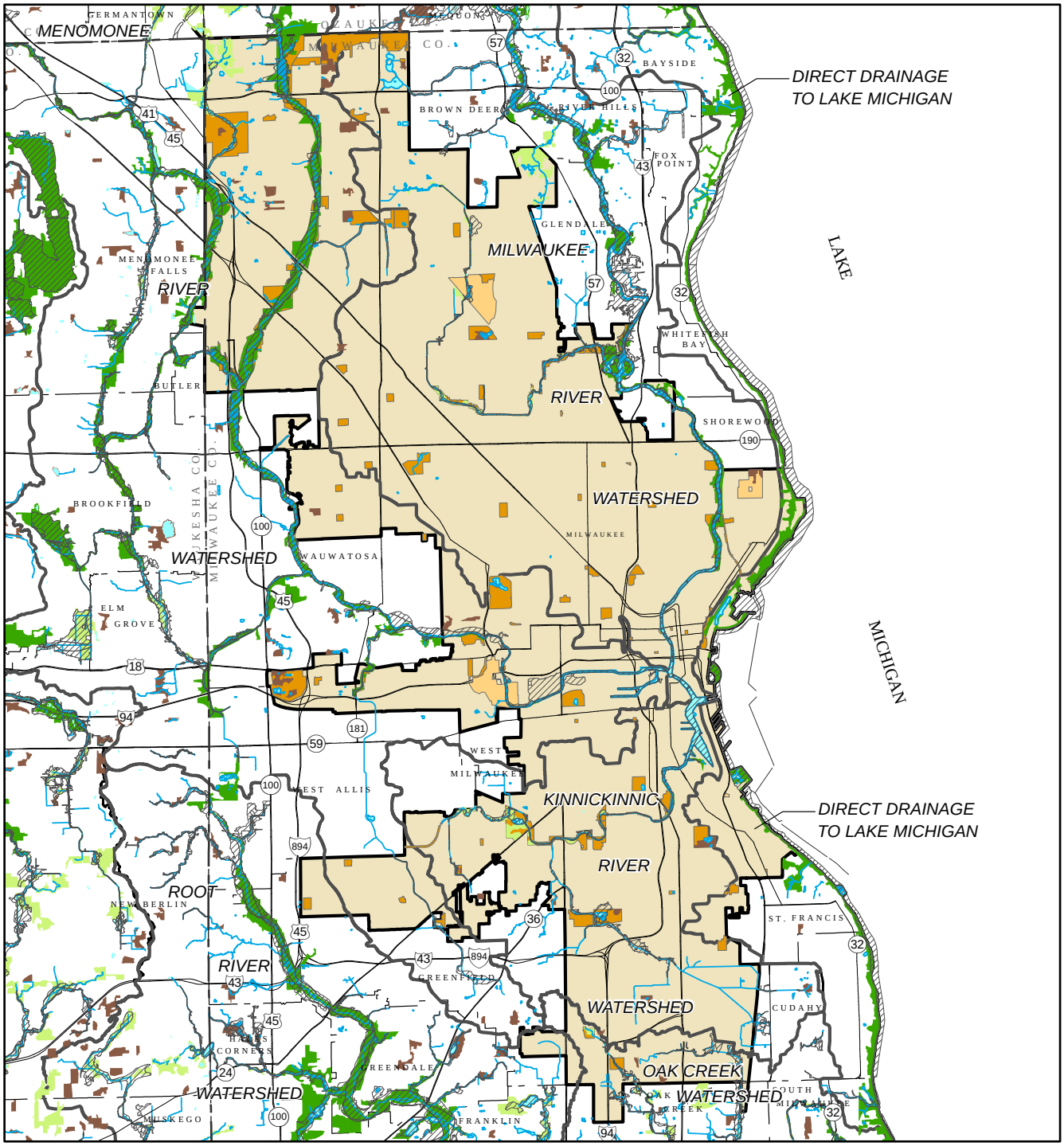
[2]*SEWRPC Planning Report No. 48,* A Regional Land Use Plan for Southeastern Wisconsin: 2035, *June 2006.*

[3]*SEWRPC Community Assistance Planning Report No. 132,* A Park and Open Space Plan for Milwaukee County, *November 1991. This plan is currently being updated and revised.*

[4]*The Conservation Fund; Applied Ecological Service, Inc.; Heart Lake Conservation Associates; Velasco and Associates; and K. Singh and Associates,* Conservation Plan, Technical Report submitted to the Milwaukee Metropolitan Sewerage District, *October 31, 2001; SEWRPC Memorandum Report No. 152,* A Greenway Connection Plan for the Milwaukee Metropolitan Sewerage District, *December 2002.*

Map 12

PARK AND OPEN SPACE SITES IN THE CITY OF MILWAUKEE: 2005



MILWAUKEE COUNTY OWNED OPEN SPACE SITES WITHIN THE CITY OF MILWAUKEE

STATE OWNED OPEN SPACE SITES

PRIMARY ENVIRONMENTAL CORRIDORS

SECONDARY ENVIRONMENTAL CORRIDORS

ISOLATED NATURAL RESOURCES AREA

ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS

SURFACE WATER

CITY OF MILWAUKEE BOUNDARY

MAJOR WATERSHED BOUNDARY

N

GRAPHIC SCALE

0 7,000 14,000

Feet

Source: SEWRPC.

2010, the Greenseams program, which is managed by The Conservation Fund, had acquired 2,254 acres, with 108 acres within the City of Milwaukee.

Floodland Management Element

As noted in Chapter IV, identification, analysis, and recommendation of possible methods of mitigating flooding problems in the City have been the subject of various planning efforts. The most recent effort is the one currently being carried out by the MMSD under its watercourse system management planning program. This planning effort is intended to update and refine the 1990 MMSD watercourse system plan, which in turn was built upon the findings of the comprehensive watershed system plans prepared by SEWRPC for the five major watersheds that lie within the City. As with those earlier efforts, the current planning program uses the watershed as the basic geographic unit for planning. Thus, the floodland management elements set forth below are also presented by watershed in summary form. Additional detail regarding the plan for each watershed is available in the referenced advanced planning reports prepared by various consultants for the MMSD.

Floodland Management Plan for the Kinnickinnic River Watershed

The MMSD is currently in the advanced planning stage of its watercourse system plan for the Kinnickinnic River watershed. As such, final recommendations for flood mitigation are currently being formulated for the three streams for which structural flood damages have been identified. Preliminary information regarding the currently preferred plans is set forth in Table 31 and shown on Maps 13 and 14. As described in Chapters IV and V of the City of Milwaukee flood hazard mitigation plan,[5] in 1985 major channel modifications were completed by the City of Milwaukee and the MMSD along the Kinnickinnic River mainstem.

The MMSD is currently proceeding with removing the concrete lining from the Kinnickinnic River between S. 6th and S. 27th Streets. Stakeholder involvement and preliminary design efforts began in 2007. The Preliminary Engineering Report is expected to be submitted to the Technical Review Committee in 2011. Based on the preliminary design, 82 residences and one commercial building will be deconstructed to accommodate the channel restoration work. This project is designed to provide flood protection to up to 320 floodprone structures during a one-percent-annual-probability flood. Federal Flood Recovery grants totaling $5.9 million will be used for structure deconstruction and resident relocation. The MMSD plans to spend $49.9 million from 2010 to 2020 on the Kinnickinnic River structure deconstruction, resident relocation, removal of 12,000 linear feet of concrete channel, replacement of five road bridges, replacement of four pedestrian bridges, and widening and restoring the channel. As of January 2011, 20 residences had been acquired by MMSD and two have been deconstructed. The 6th Street bridge replacement was part of a separate project and was completed in 2010 by the City of Milwaukee at a cost of $2.8 million. Approximately 1,000 feet of channel work between S. 6th Street and S. Chase Avenue is expected to be done by summer of 2011 under a separate MMSD project.

As shown on Map 13, the currently preferred plan for Lyons Park Creek consists of replacement of existing roadway culverts at S. 57th Street, W. Stack Drive, and W. Cleveland Avenue. At S. 57th Street the existing nine-foot-wide by five-foot-high reinforced concrete box culvert would be replaced with a 12-foot-wide by six-foot-high reinforced concrete box culvert. At W. Stack Avenue the existing 12-foot-wide by eight-foot-high corrugated metal pipe arch would be replaced with a 16-foot-wide by eight-foot-high reinforced concrete box culvert. At W. Cleveland Avenue the existing 10-foot-wide by six-foot-high reinforced concrete box culvert would be replaced with a 12-foot-wide by eight-foot-high reinforced concrete box culvert.

Along the Villa Mann Creek Tributary, the Phase 2 recommended alternative is to floodproof three structures that are in the one-percent-annual-probability floodplain.

[5]*SEWRPC Community Assistance Planning Report No. 261,* op. cit.

Table 31

COMPONENTS AND COSTS OF FLOODLAND MANAGEMENT PLAN FOR THE KINNICKINNIC RIVER WATERSHED

Stream	Plan Components	Estimated Capital Cost[a]	Estimated Benefits for a 1 Percent Probability Flood Event[a]
Lyons Park Creek	1. Replace nine-foot by five-foot reinforced concrete (RC) box under S. 57th Street with 12-foot by six-foot RC box 2. Replace 12-foot by eight-foot RCPA under W. Stack Avenue with 16-foot by eight-foot Racine County box 3. Replace 10-foot by six-foot RC box under W. Cleveland Avenue with 12-foot by eight-foot RC box		
	Subtotal	$ 948,400	$ 1,361,300
Villa Mann Creek Tributary	1. Floodproof three structures[b]	$ 419,300	$ 616,400
Kinnickinnic River	1. Channel rehabilitation from South 6th Street to South 27th Street – concrete removal and restoration[b] 2. 82 residences and one commercial property deconstructed[b]		
	Subtotal	$49,900,000	$ 48,000,000[c]
Wilson Park Creek	1. Four culvert improvements, detention at Central Steel & Wire, channel rehabilitation, and channel concrete removal for two reaches[b]	$33,000,000	$ 77,650,000[d]
	Total	$84,267,700	$127,627,700

NOTE: The Plan Components identified are the recommended alternative from MMSD's Kinnickinnic River Phase 2 Watercourse Management Plan, Volume I, May 2005. Kinnickinnic River and Wilson Park Creek components are based on projects currently in progress in 2010.

[a]*Amounts are shown in 2010 dollars.*

[b]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

[c]*The estimated benefits are based upon removal of 320 structures from the floodplain at a total cost of $150,000 each.*

[d]*The estimated benefits for the Wilson Park Creek project are based on the prorated assessed value of 130 structures in the updated floodplain.*

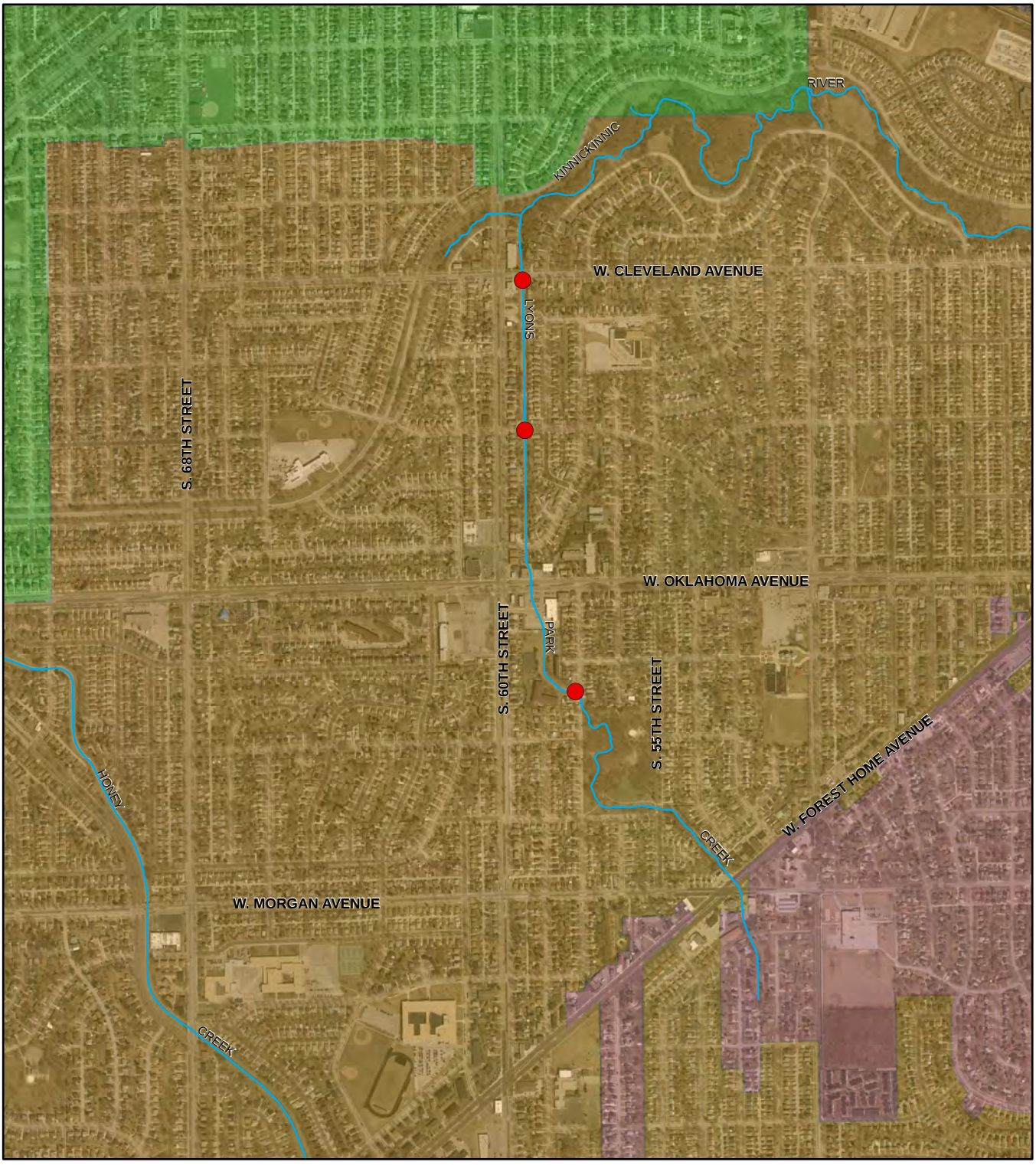
Source: MWH, U.S. Army Corps of Engineers, Milwaukee Metropolitan Sewerage District, and SEWRPC.

No structural flood damages have been identified within the City along the S. 43rd Street Ditch on the effective FEMA Digital Flood Insurance Rate Map. Currently SEWRPC is working on updating the hydrologic and hydraulic models for the S. 43rd Street Ditch for the MCAMLIS Steering Committee and MMSD which will result in an updated one-percent-annual-probability floodplain.

Wilson Park Creek was restudied as part of the MCAMLIS project described in the Secondary Plan Element section later in this chapter. Based on the MCAMLIS update, approximately 130 residences and businesses would be within the one-percent-annual-probability of occurrence floodplain. The MMSD is pursuing improvements to Wilson Park Creek to eliminate flooding. The improvements include four culvert improvements (S. 30th Street, S. 27th Street, W. Howard Avenue, and S. 5th Street), offline storage at the Central Steel and Wire facility, concrete removal from W. Euclid Ave. to S. 20th Street and S. 6th Street to S. 2nd Street, and channel rehabilitation near the Central Steel and Wire facility. Preliminary construction cost estimates for the project total $33 million.

Map 13

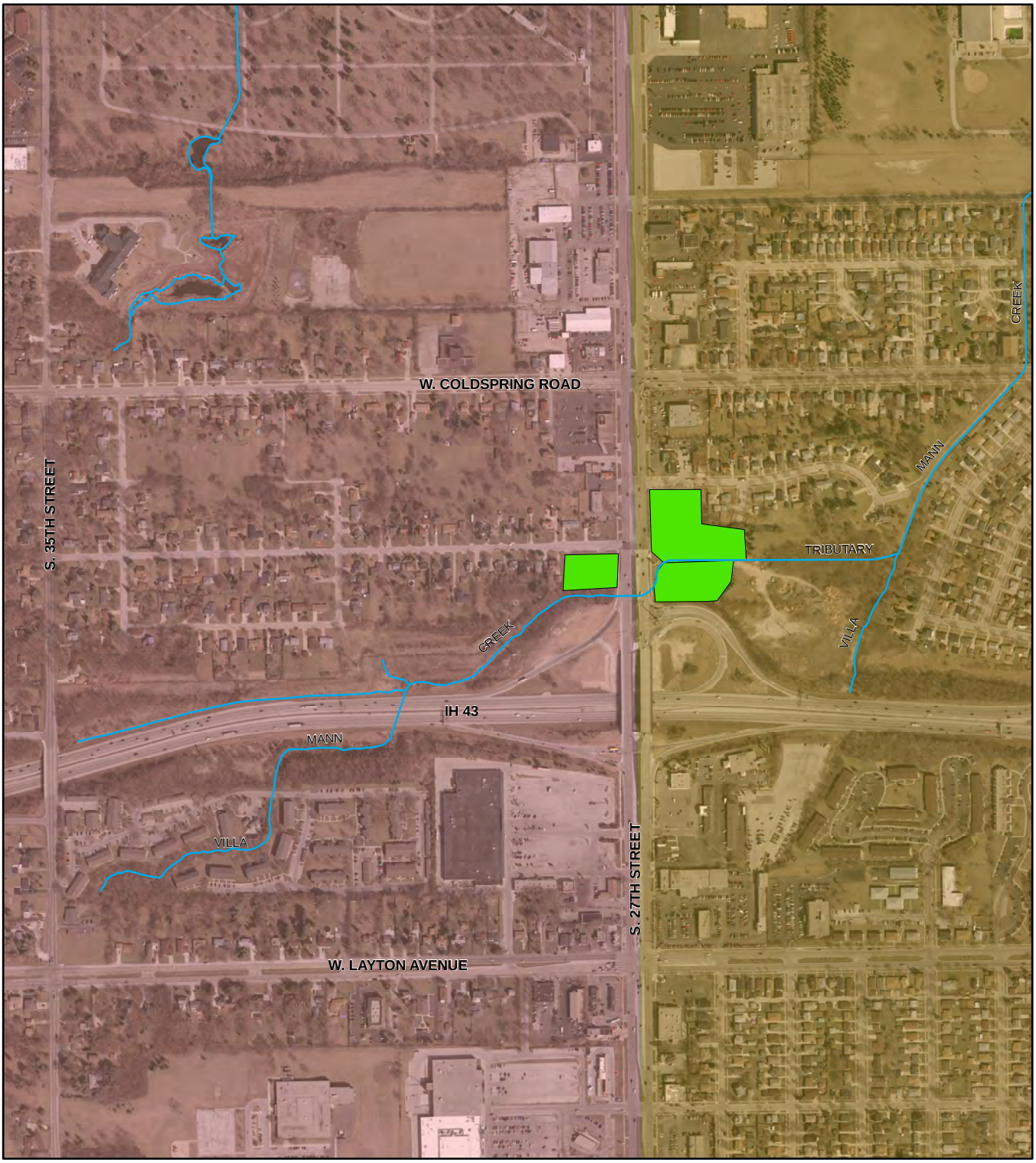
FLOOD CONTROL PLAN FOR LYONS PARK CREEK



Source: Harza Engineering Company and SEWRPC.

Map 14

FLOOD CONTROL PLAN FOR VILLA MANN CREEK TRIBUTARY



Source: SEWRPC.

Full implementation of the floodland management actions for the subwatershed areas involved would eliminate structure flood damages in the City of Milwaukee due to direct overland flooding along the Kinnickinnic River, Lyons Park Creek, Villa Mann Creek Tributary, and Wilson Park Creek for floods up to, and including, the one-percent-annual-probability flood event under planned land use and channel conditions.

In addition to those actions directed at eliminating structural flood damages, the MMSD partnered with the U.S. Army Corps of Engineers on a project to address serious streambank erosion problems along the Kinnickinnic River in the City. The plan as developed by the Corps involves a 2,700-foot reach of the River between S. 43rd and S. 60th Streets. Within this reach, selected portions of the streambank at five locations would be stabilized through the placement of riprap revetments, while existing storm sewer outfall culverts would be extended. This project was completed in 2008.

As shown in Table 31, the estimated capital cost of implementing the currently preferred floodland management plan for the Kinnickinnic River watershed is about $84.3 million. The cost of any additional planning for the S. 43rd Street Ditch is not included in this total.

Floodland Management Plan for the Menomonee River Watershed

In July 2002, the MMSD released the Phase 2 report for its watercourse system plan for the Menomonee River watershed. The floodland management plan resulting from that advanced planning stage, for those stream reaches that impact the City of Milwaukee, is set forth in Tables 32 and 33 and shown on Maps 15 through 17.

As shown on Map 15, the floodland management plan for the Menomonee River calls for a combination of the following measures: 1) acquisition and demolition of eight buildings and construction of 750 feet of earthen berm and 750 feet of concrete floodwall in the Valley Park neighborhood in the City of Milwaukee; 2) acquisition and demolition of 80 properties, lowering the floodplain by one to two feet, and construction of about 6,500 feet of earthen berm in the Hart Park area of the City of Wauwatosa; 3) floodproofing of three municipal buildings in Hart and Jacobus Parks in the City of Wauwatosa; 4) acquisition of approximately 40 acres of riparian land, acquisition and demolition of nine structures, floodplain lowering in two areas, and construction of 4,100 linear feet of berms or floodwalls in western Milwaukee; 5) construction of a 966 acre-foot detention basin on the Milwaukee County Grounds in the City of Wauwatosa; 6) raising the height of the existing levee and floodwall at the Falk Corporation property by up to five feet to prevent overtopping during a one-percent-annual-probability flood event; and 7) removal of an existing access bridge upstream of Hawley Road in the City of Milwaukee. Although some of these plan elements are located outside of the City of Milwaukee, they are integral to the design and function of those elements that are located in the City. In particular, the floodplain lowering along Hart Park and the Milwaukee County Grounds detention basin serve to reduce downstream flood discharges in Milwaukee, thus, reducing the size of the required plan elements in that area. Thus, the plan as a whole is presented herein.

As of mid-2003, the MMSD had completed the property acquisition and construction of the earthen berm and floodwall in the Valley Park neighborhood. Also, the acquisition and removal of the 46 structures in the Hart Park area of the City of Wauwatosa was nearly completed. As of early 2011, the MMSD had completed the Hart Park project, and essentially completed the Milwaukee County Grounds detention basin. The basin is expected to go online in 2011. Menomonee River watershed plan components completed as of 2011 are listed in Table 33.

In 2001, the MMSD completed the construction of the 58 acre-foot dry detention basin for Grantosa Creek at Timmerman Airport in the City of Milwaukee. That detention basin serves to eliminate overland flooding to buildings immediately south of W. Hampton Avenue in the City of Wauwatosa, and to reduce surcharging along the Grantosa Creek enclosure along N. 100th Street and W. Grantosa Avenue. As part of the second phase system planning for Grantosa Creek, field surveys were conducted along the lower Grantosa Creek area and along the channel enclosure. Those surveys indicated that no structures in the City of Milwaukee would be subject to flooding during a one-percent-annual-probability flood event.

Table 32

COMPONENTS AND COSTS OF FLOODLAND MANAGEMENT PLAN FOR THE MENOMONEE RIVER WATERSHED

Stream	Plan Components	Estimated Capital Cost[a]	Estimated Benefits for a 1 Percent Probability Flood Event[a,b,c]
Menomonee River	1. Floodproof two municipal structures in Hart Park and one structure in Jacobus Park in the City of Wauwatosa[d]	$ 1,050,000	
	2. Acquisition and demolition of nine structures, floodplain lowering, and construction of 4,100 feet of berms or floodwalls in the western Milwaukee area[d]	58,000,000	
	3. Raise the height of the existing levee and floodwall at the Falk Corporation property[d]	1,000,000	
	Total	$60,050,000	$15,909,200

[a]*Amounts are shown in 2010 dollars.*

[b]*The estimated benefits are based upon the reduction in flood damages during a 1 percent probability flood event for all elements of the Menomonee River plan. The damage estimates were developed by the Commission staff based upon structure values, flood stage, and depth of flooding data documented in the MMSD Phase I Watercourse Management Plan dated August 2000. The same information is included in the document, SEWRPC Community Assistance Planning Report No. 261, Flood Mitigation Plan for the City of Milwaukee, Milwaukee County, Wisconsin, dated April 2003.*

[c]*Benefits taken from MMSD Menomonee River Phase 1 system plan and reflects reduction of damages in both the Cities of Milwaukee and Wauwatosa.*

[d]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

Source: Milwaukee Metropolitan Sewerage District; Earth Tech, Inc.; and SEWRPC.

Table 33

FLOODLAND MANAGEMENT PROJECTS COMPLETED FOR THE MENOMONEE RIVER WATERSHED

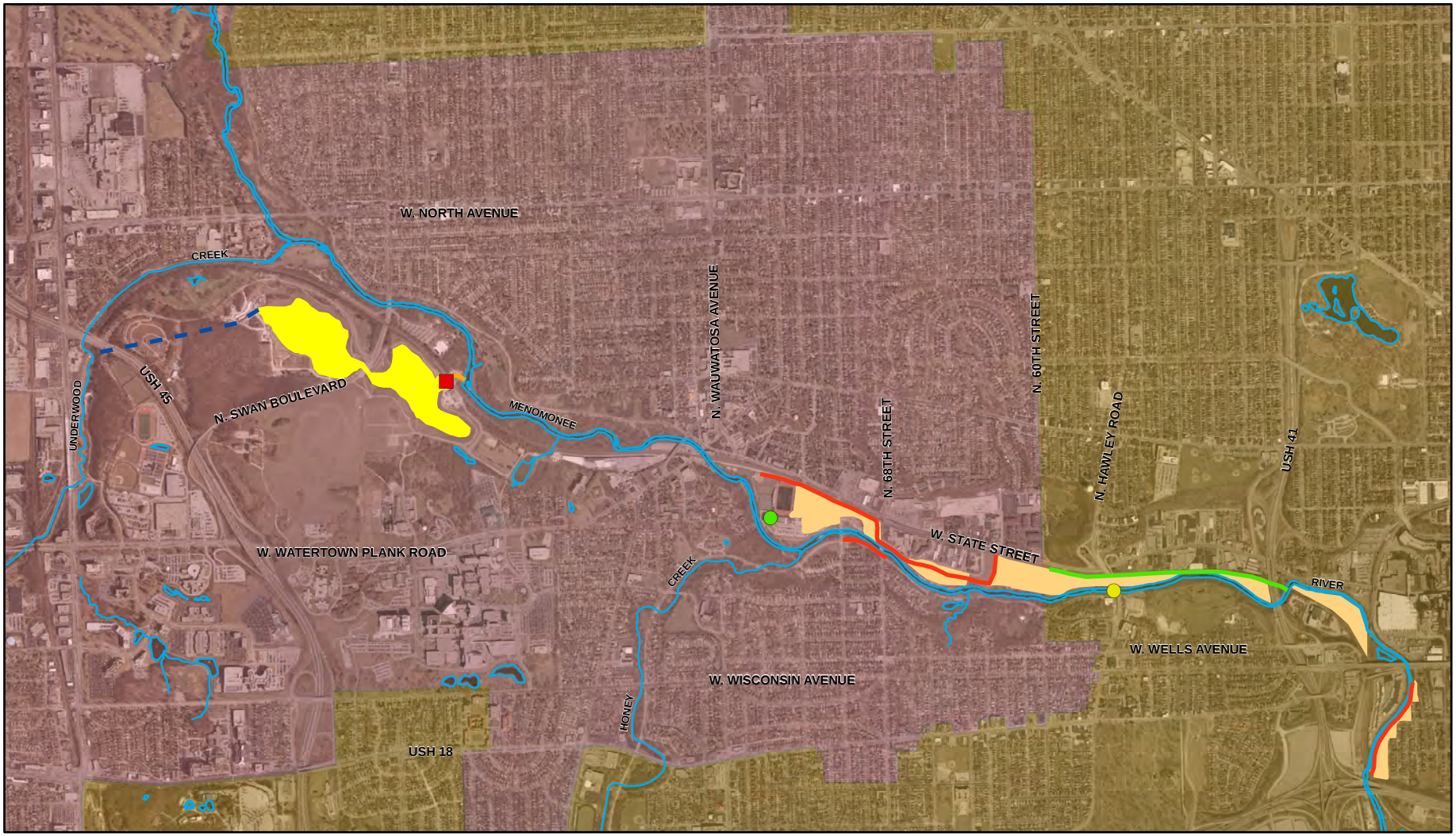
Stream	Plan Components
Menomonee River	1. Acquire and demolish eight residential properties in the Valley Park neighborhood[a]
	2. Construct 750-foot-long berm and 750-foot-long reinforced concrete floodwall along Valley Park neighborhood[a]
	3. Acquire and demolish 80 structures in the Hart Park neighborhood[a]
	4. Lower floodplain by one to two feet in the Hart Park area and western Milwaukee area[a]
	5. Construct 6,500 feet of earthen berm in the Hart Park area[a]
	6. Construct 966 acre-foot detention basin on Milwaukee County Grounds[a]
	7. Remove or replace access bridge located upstream of Hawley Road
Grantosa Creek	1. Construct 58 acre-foot detention basin at Timmerman Airport[a]
Little Menomonee River	1. Acquire and demolish one residential property[a]

[a]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

Source: Milwaukee Metropolitan Sewerage District; Earth Tech, Inc.; and SEWRPC.

Map 15

FLOOD CONTROL FEATURES IMPLEMENTED OR PLANNED FOR THE MENOMONEE RIVER



STRUCTURE FLOODPROOFING
ACQUISITION AND DEMOLITION AREA
966 ACRE-FOOT STORAGE BASIN
BRIDGE REMOVAL
BASIN OUTLET

LEVEE AND/OR FLOODWALL
PROPOSED LEVEE AND/OR FLOODWALL
OUTFALL CHANNEL
DIVERSION CHANNEL
SURFACE WATER

CITY OF MILWAUKEE
CITY OF WAUWATOSA

NOTE: The flood control features east of N. 60th Street are proposed in the Western Milwaukee Project portion of the Menomonee River Phase 2 Watercourse Management Plan.

N

GRAPHIC SCALE
0 1,000 2,000 4,000 Feet
0 0.25 0.5 1 Miles

Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

FINAL DRAFT

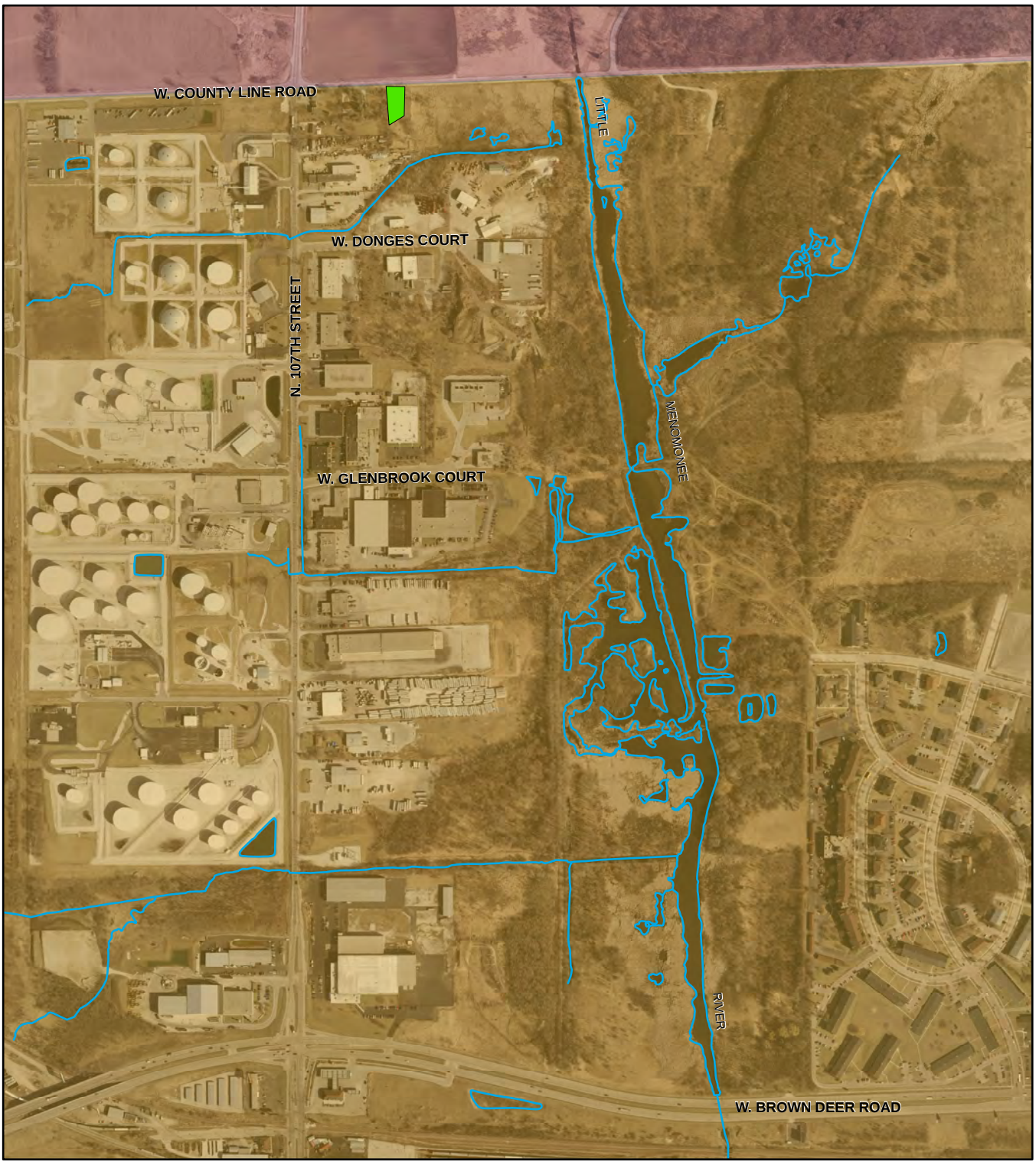
Map 16

FLOOD CONTROL FEATURES IMPLEMENTED FOR GRANTOSA CREEK

Source: Earth Tech, Inc., and SEWRPC.

Map 17

FLOOD CONTROL FEATURE IMPLEMENTED FOR THE LITTLE MENOMONEE RIVER



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

The floodland management measures for the Little Menomonee River are shown on Map 17, and include the acquisition of one residential property. As of 2011, this property has been acquired and demolished.

Full implementation of the floodland management actions recommended for the subwatershed areas would eliminate structure flood damages in the City of Milwaukee due to direct overland flooding along the Menomonee River, Grantosa Creek, and the Little Menomonee River for floods up to, and including, the one-percent-annual-probability flood event under planned land use and channel conditions.

As shown in Table 32, the estimated capital cost of implementing the remaining components of the recommended floodland management plan for the Menomonee River watershed that directly impacts the City of Milwaukee are approximately $60 million. In addition to the specific mitigation measures recommended above, it is important to note that the City has completed a number of stormwater management projects as outlined below.

Floodland Management Plan for the Milwaukee River Watershed

Flood mitigation projects have been implemented by MMSD for Lincoln Creek and Southbranch Creek as set forth in Table 34, and shown on Maps 18 and 19, respectively. As of 2004, the plans for both streams had been fully implemented.

Full implementation of the floodland management actions for the subwatershed areas involved should eliminate structure flood damages due to direct overland flooding along Lincoln Creek and Southbranch Creek for floods up to, and including, the one-percent-annual-probability flood event under planned land use and channel conditions. Roadway flooding during that flood event should also be eliminated. Of note is the fact that 211 of the 218 repetitive-loss properties reported in Chapter III are located within the Lincoln Creek subwatershed. This includes three properties that meet the FEMA high-priority criteria. The 2004 MMSD Lincoln Creek flood mitigation and stream rehabilitation project, which is designed to provide protection during flood events with probabilities of one percent or more, resulted in many of those repetitive loss structures being removed from the one-percent-probability floodplain. Also, of the 211 documented repetitive-loss properties in the Lincoln Creek subwatershed, seven have been acquired and demolished by FEMA.

A watercourse system plan for the Milwaukee River in Milwaukee County was completed by SEWRPC.[6] The goal of the plan was to mitigate structures within the one- percent-annual-probability floodplain shown on the Milwaukee County effective Digital Flood Insurance Rate Maps. The recommended alternative for the City of Milwaukee was to floodproof the three residential buildings in the one- percent-annual-probability floodplain. The floodproofing would be done voluntarily by the building owner. MMSD would lead the effort and coordinate with the City of Milwaukee as appropriate. As shown in Table 35, the estimated capital cost of implementing the currently preferred floodland management plan for the Milwaukee River watershed is $50,000.

Floodland Management Plan for the Oak Creek Watershed

The MMSD is currently in the advanced planning stage of its watercourse system plan for the Oak Creek watershed. As such, final recommendations for flood mitigation are now being formulated for the two streams for which structural flood damages have been identified in the City of Milwaukee portion of the watershed. Information regarding the preliminary recommendations is set forth in Table 36 and shown on Map 20.

As shown on Map 20, the preliminary recommendation pertaining to the City of Milwaukee portion of the North Branch of Oak Creek consists of floodproofing three nonresidential buildings.

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[6]SEWRPC Memorandum Report No. 172, *A Watercourse System Plan for the Milwaukee River in Milwaukee County Upstream of the Milwaukee Harbor Estuary*, December 2010.

Table 34

FLOODLAND MANAGEMENT PROJECTS COMPLETED FOR THE MILWAUKEE RIVER WATERSHED

Stream	Plan Components
Lincoln Creek	1. Lower floodplain along 0.70-mile-long reach between N. Teutonia Avenue and a point downstream from W. Villard Avenue 2. Replace existing concrete lining with turf and add low-flow aquatic habitat along 0.60-mile-long reach between N. Teutonia Avenue and N. 32nd Street 3. Modify channel with selected floodplain lowering and add low-flow aquatic habitat along 2.34-mile-long reach between N. 32nd Street and N. 60th Street 4. Replace existing concrete lining with turf and add low-flow aquatic habitat along 1.56-mile-long reach between N. 60th Street and a point upstream from W. Silver Spring Drive[a] 5. Channel modification along 2.65-mile-long reach between a point upstream from W. Silver Spring Drive and the Union Pacific Railroad crossing located east of N. 60th Street 6. Construct 85 acre-foot detention basin north of W. Greentree Road[a] 7. Construct 90 acre-foot detention basin at Havenwoods State Forest[a] 8. Create detention storage by lowering the north overbank north of W. Silver Spring Drive[a] 9. Replace, modify, or remove 13 bridges and culverts
Southbranch Creek	1. Construct 19 acre-foot detention basin south of W. Bradley Road[a] 2. Construct 17 acre-foot detention basin at Brown Deer Village Library[a] 3. Construct 11 acre-foot detention basin south of Dean Elementary School[a] 4. Construct 22 acre-foot detention basin along Churchill Lane between N. 48th and N. 51st Streets[a] 5. Modify channel along 1,300-foot-long reach between W. Bradley Road and a point about 560 feet downstream from N. 55th Street 6. Replace culvert under N. 51st Street with two 10-foot by seven-foot reinforced concrete box culverts 7. Replace existing culvert under N. 53rd/54th Street with open channel 8. Replace culvert under N. 55th Street with two 12-foot by six-foot reinforced concrete box culverts

[a]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

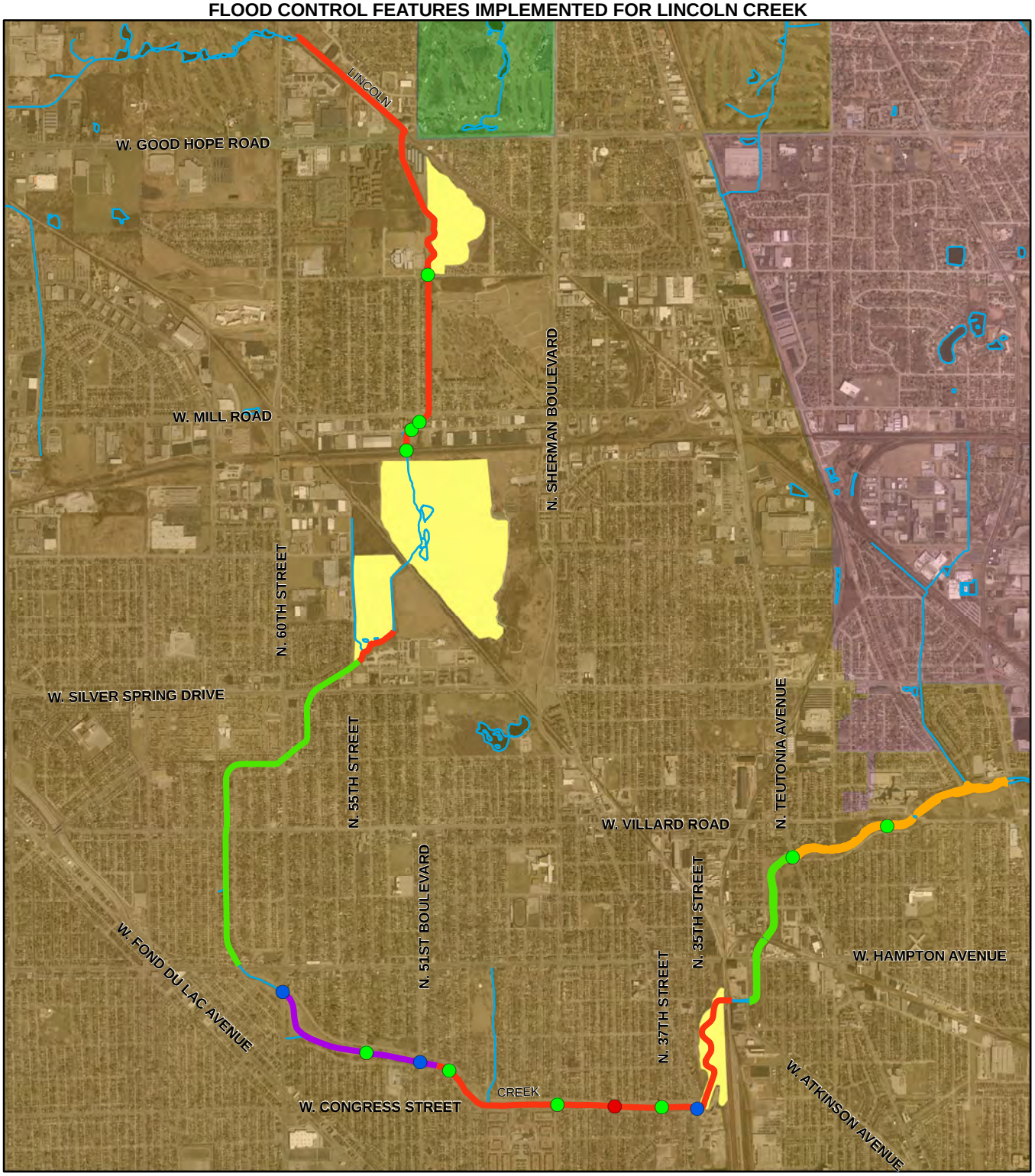
Source: CH2M Hill; Earth Tech, Inc.; and SEWRPC.

The preliminary floodland management recommendation for the Mitchell Field Drainage Ditch consists of constructing a floodwall and interior drainage facilities to protect three structures located at General Mitchell International Airport. This recommendation is subject to change as MMSD investigates additional plan options. Determination of a final plan will be based upon coordination with all parties involved, including the MMSD, Milwaukee County, and the City of Milwaukee.

Full implementation of the preliminary floodland management actions recommended for the subwatershed areas involved would eliminate structure flood damages in the City of Milwaukee due to direct overland flooding along the North Branch of Oak Creek and the Mitchell Field Drainage Ditch in the City of Milwaukee for floods up to, and including, the one-percent-annual-probability flood event under planned land use and channel conditions.

Map 18

FLOOD CONTROL FEATURES IMPLEMENTED FOR LINCOLN CREEK



BRIDGE REPLACED
BRIDGE MODIFIED
BRIDGE REMOVED
FLOODWATER DETENTION
CHANNEL MODIFICATION
CREEK BANK WIDENING

FLOODPLAIN LOWERING AND ADDITION OF LOW FLOW AQUATIC HABITAT
CONCRETE LINING REMOVAL AND ADDITION OF LOW FLOW AQUATIC HABITAT
SURFACE WATER

CITY OF MILWAUKEE
CITY OF GLENDALE
VILLAGE OF BROWN DEER

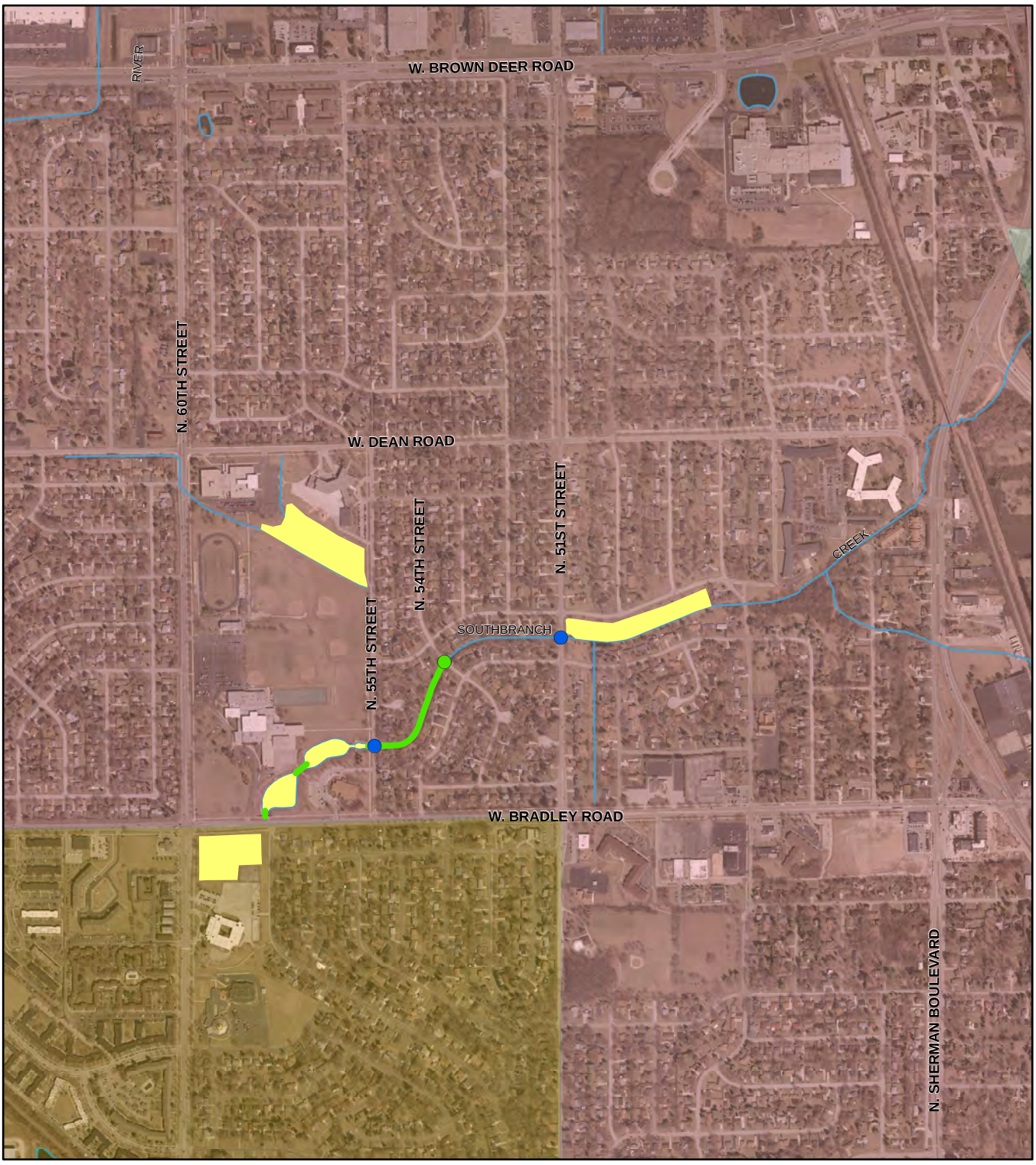
N

GRAPHIC SCALE
0 500 1,000 2,000 Feet

Source: Camp, Dresser & McKee, Inc., and SEWRPC.

Map 19

FLOOD CONTROL FEATURES IMPLEMENTED FOR SOUTHBRANCH CREEK



CULVERT REPLACEMENT

CULVERT REMOVAL

DETENTION STORAGE BASIN

REMOVAL OF CONCRETE CHANNEL LINING

SURFACE WATER

CITY OF MILWAUKEE

VILLAGE OF BROWN DEER

N

GRAPHIC SCALE

0 250 500 1,000 Feet

Source: Earth Tech, Inc., and SEWRPC.

Table 35

COMPONENTS AND COSTS OF FLOODLAND MANAGEMENT PLAN FOR THE MILWAUKEE RIVER WATERSHED

Stream	Plan Components	Estimated Capital Cost[a]	Estimated Benefits for a 1 Percent Probability Flood Event[a,b]
Milwaukee River	1. Floodproof three residential buildings[c]	$50,000	$50,000
	Total	$50,000	$50,000

[a]*Amounts are shown in 2010 dollars.*

[b]*The estimated benefits are based upon the reduction in flood damages during a 1 percent probability flood event. The damage estimates were developed by the Commission staff based upon structure values, flood stage, and depth of flooding data documented in A Watercourse System Plan for the Milwaukee River in Milwaukee County Upstream of the Milwaukee Harbor Estuary, Memorandum Report No. 172, December 2010.*

[c]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

Source: Milwaukee Metropolitan Sewerage District; and SEWRPC.

Table 36

COMPONENTS AND COSTS OF FLOODLAND MANAGEMENT PLAN FOR THE OAK CREEK WATERSHED

Stream	Plan Components	Estimated Capital Cost[a]	Estimated Benefits for a 0.2 or 1 Percent Probability Flood Event[a]
North Branch of Oak Creek	1. Floodproof three nonresidential buildings[b]		
	Subtotal	$ 697,000[c]	$105,600[c]
Mitchell Field Drainage Ditch	1. Construct an 1,800-foot-long, seven-foot-high floodwall along south side of three General Mitchell International Airport buildings and storm sewer for interior drainage[b]		
	Subtotal	$1,350,100[d]	$575,300[d]
- -	Total	$2,047,100	$680,900

[a]*Amounts are shown in 2010 dollars.*

[b]*This mitigation measure is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

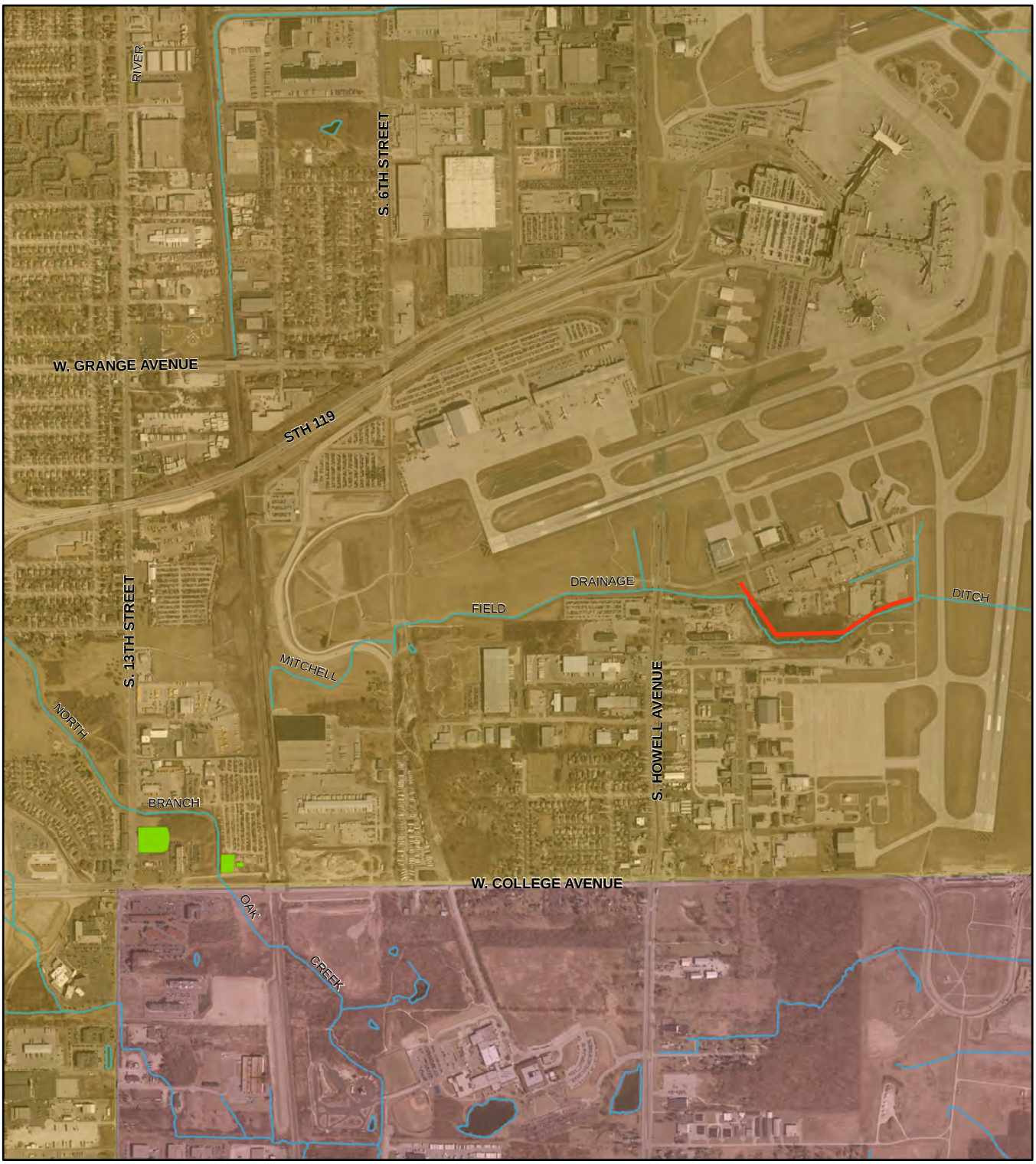
[c]*The estimated benefits are based upon the reduction in flood damages during an 0.2 percent probability flood event. The capital costs and damage estimates were developed by the Commission staff based upon structure values and flood stage and depth of flooding data documented in the draft SEWRPC Staff Memorandum entitled Oak Creek Updated Phase 1 Watercourse Management Plan – North Branch of Oak Creek above Canadian Pacific Railway Crossing, March 28, 2011.*

[d]*The estimated capital cost was included in a Tetra Tech memorandum dated July 5, 2001 to MMSD regarding the Structure Floodproofing Analysis for GMIA Buildings from Tetra Tech. No benefit updates were included in the Tetra Tech memo. The estimated benefits are based upon the reduction in flood damages during a one percent-probability-flood event as developed by SEWRPC staff based upon structure values, flood stage, and depth of flooding data as documented in the MMSD Phase I Watercourse Management Plan dated August 2000.*

Source: Milwaukee Metropolitan Sewerage District, CDM, Tetra Tech, and SEWRPC.

Map 20

FLOOD CONTROL PLAN FOR THE NORTH BRANCH OF OAK CREEK (PRELIMINARY) AND THE MITCHELL FIELD DRAINAGE DITCH



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

As shown in Table 36, the estimated capital cost of implementing the City of Milwaukee portion of the Oak Creek watershed floodland management plan is about $2.05 million.

Stormwater Management Element

Because of the relationship between stormwater management and floodland management, stormwater management actions are an important element of the flood mitigation plan. This element of the plan includes the status of stormwater management planning and stormwater ordinances and related regulations.

Stormwater-Related Planning

Stormwater drainage problems are known to exist throughout the urbanized portions of the City. The City has undertaken stormwater management planning programs or initial stormwater management system inventories as the first step in developing comprehensive stormwater management plans. The intense storm events of 2008 through 2010 caused significant surface flooding problems as the capacities of the minor and major local storm drainage systems were exceeded in some locations. The City of Milwaukee should identify specific locations where the major stormwater management system is inadequate to handle the runoff from storms with annual probabilities of occurrence of one percent or greater and prepare stormwater management plans to address those deficiencies.

Stormwater-Related City Regulations

The City, through Chapter 120 of the municipal code, seeks 1) the promotion of the public health, safety, and general welfare; 2) the establishment of procedures to control the adverse impacts associated with stormwater runoff; 3) assistance in the attainment and maintenance of water quality standards; 4) reduction of the effects of development on land and stream channel erosion; 5) maintenance of runoff characteristics after development as nearly as possible to predevelopment runoff characteristics; and 6) the minimization of damage to public and private property. The specific provisions involved are noted in Chapter II of the flood hazard mitigation plan for the City of Milwaukee.[7] The City has also enacted a construction site erosion control ordinance based on the State of Wisconsin model ordinance. As in the case of the floodplain and shoreland-wetland zoning provisions noted above, implementation of these ordinances on an ongoing basis is an integral part of the City's flood mitigation strategy and is to continue under this plan.

Stormwater-Related MMSD Regulations

The MMSD has adopted and is implementing a comprehensive rule designed to minimize the potential to increase flood risk due to development or redevelopment in the District's service area. The rule applies to the City of Milwaukee and the communities within the MMSD service area which lie upstream of the City in the tributary watershed areas. The Chapter 13 rule became effective on January 1, 2002 and was amended on October 25, 2010. Chapter 13 provides for community ordinances which require the management of the volume and peak rate of stormwater flows from new development and redevelopment in such a way that peak flows in a watershed do not increase downstream flooding.

Recent Local Actions

The City has completed numerous stormwater management projects since the initial City hazard mitigation plan was issued in 2005. These are listed below in chronological order.

- 2003-2007 – Menomonee Valley Industrial Center and Community Park – Development at this site created 60 acres of developable land and 40 acres of greenspace. The greenspace includes the stormwater treatment train which accepts water from the adjacent businesses for treatment before it flows into the Menomonee River. As of 2010, 48 of the 60 acres have been developed for private businesses and are conveying water to the stormwater treatment train.

[7] *SEWRPC Community Assistance Planning Report No. 261*, op. cit.

- 2006 – The Canal Street Extension – This project extended Canal Street from S. 26th Street west to Selig Drive. The extension includes a stormwater bioretention pond at S. 26th Street and a stormwater treatment train at S. 35th Street. Both of these features manage stormwater from W. Canal Street.

- 2008 – N. 27th Street Green Street Project – Bio-infiltration project from W. Capitol Drive to W. Roosevelt Avenue.

- 2009 – N. 91st -92nd Streets Green Street Project –Bio-infiltration project from W. Capitol Drive to W. Good Hope Road.

- 2010 – W. Grange Avenue Green Street Project –Bio-infiltration project from S. 19th Street to S. 26th Street.

- 2010 – Hartung Quarry Regional Wet Detention Facility.

- 2010 – Destiny High School Bioretention Facilities.

Public Information and Education Element

Public information, education, and participation constitute an integral aspect of the City of Milwaukee's flood mitigation and related efforts. As discussed in Chapter II of the flood mitigation plan for the City of Milwaukee,[8] informational and educational efforts oriented toward resolving the flooding and related stormwater drainage and sanitary sewer backup problems in the City have been addressed primarily through the combined efforts of the City, the MMSD, and Milwaukee County. This element has been carried out under ongoing activities which are expected to be continued. These three subelements include MMSD stakeholder groups and related public education activities and public participation programming and coordination associated with detailed stormwater and floodland management plans.

MMSD Stakeholder Groups

The first subelement involves the creation and activity of MMSD stakeholder groups as described in Chapter II of the flood mitigation plan for the City of Milwaukee.[9] These groups have been formed by the MMSD on a watershedwide basis and include representatives of the City of Milwaukee and other concerned local units of government, including Milwaukee County, SEWRPC, and the WDNR, as well as other public and/or private agencies and organizations, such as environmental and neighborhood organizations and concerned private businesses. Stakeholder meetings allow the various parties involved to offer feedback to the MMSD regarding development of its stormwater and floodland management plans. Stakeholder meetings have been held since 1998 and continue to be held through the planning process.

Public Education Activities

The second subelement involves preparation and distribution of educational and self-help materials and provision of educational programs. Under this subelement of the flood mitigation plan, the MMSD has prepared and distributed various public informational and educational materials, including materials oriented toward local homeowners and local government agencies and designed to help them consider and potentially undertake actions to mitigate damage caused by stormwater flooding and sanitary sewer backups throughout the District, including the City of Milwaukee. In addition, the MMSD has established an internet site aimed at keeping interested parties

[8]Ibid.

[9]Ibid.

up-to-date on its planning activities. The District has also undertaken an extensive public informational and educational program directed toward reducing infiltration and inflow into its sanitary and combined sewer systems. That program includes radio programming, public educational materials, and the financing of pilot demonstration projects for I/I removal in eight communities.

In addition to the MMSD efforts, Milwaukee County Office of the Sheriff, Emergency Management Bureau, prepares and distributes a number of public educational materials and self-help booklets for local property owners (see Appendix C). The guide sets forth potential preventive measures that may be taken by homeowners to mitigate flood damages. The booklet also provides basic information about flood warnings, as well as National Flood Insurance Program (NFIP) and various Federal and State aid programs that may be available to flood victims. In addition to the booklet, a corresponding videotape is available through the Milwaukee County Federated Library System and Milwaukee County Office of the Sheriff, Emergency Management Bureau.

The City of Milwaukee Office of Emergency Management, in collaboration with the MMSD and Nechama, a nationally recognized flood response team, is currently in the process of producing a "self-help" video for individuals and business owners who may be affected by future flooding. This video will outline actions to be taken before a flood to reduce the impact of possible flooding. In addition, the video will demonstrate how a homeowner or business owner can conduct mold-remediation efforts in order to reduce long-term property damage and additional financial loss on a structure that has been flooded. The video will be made available for download via the Office of Emergency Management's website and distributed without charge through community groups and business and faith based organizations.

Public Participation Activities and Coordination with Other Agencies and Units of Government

The third subelement of this program involves direct public participation and coordination with other agencies during detailed stormwater and floodland management plan development. As previously noted, the MMSD has formed stakeholder groups to help guide the planning process for each of the major watersheds within its jurisdiction. These groups allow local officials and neighborhood groups an opportunity to provide information regarding flooding and drainage problems, as well as comments regarding potential solutions for those problems. In some municipalities, the MMSD has also held community workshops to obtain input regarding possible solutions to flooding problems in the context of what area residents desire regarding their watercourse.

Toward further informing the public regarding flood mitigation, stormwater and floodland management, and related issues, the plan calls for concerned units and agencies of government, including the City of Milwaukee and all cities and villages within Milwaukee County, to involve members of the general public and to seek public input in the preparation and implementation of recommendations regarding such issues.

Secondary Plan Element

In addition to the abovenoted measures, several secondary measures are also to be implemented. These secondary measures are described below.

National Flood Insurance Program and Floodplain Map Updating Efforts

The City of Milwaukee has been designated by FEMA as having flood hazard areas and has taken the steps needed to make its residents eligible to participate in the NFIP. As part of its Map Modernization program, FEMA incorporated the City of Milwaukee Flood Insurance Study (FIS) information into a countywide FIS that became effective on September 26, 2008. The City will continue to participate in the NFIP and, as necessary, will request that FEMA revise the FIS to reflect new flood hazard data. Furthermore, owners of property in floodprone areas within the City should purchase flood insurance to provide some financial relief for losses sustained in floods that may occur before the implementation of any recommended flood control measures. Finally, as flood control measures are implemented, the City intends to work with MMSD and SEWRPC to submit revisions to the flood insurance study to FEMA.

In 1990 a cooperative agreement was executed between Milwaukee County and three local utility companies for the development and maintenance of a Milwaukee County Automated Land Information System (MCAMLIS). Under that program, large-scale digital topographic mapping has been prepared for all of Milwaukee County, including the City of Milwaukee. The MCAMLIS Steering Committee has also requested that SEWRPC carry out a digital floodplain mapping program. That program is being conducted as a cooperative effort between SEWRPC and the MMSD. As part of that program, hydrologic and hydraulic analyses are being conducted to update flood flows and stages to reflect current channel conditions, as well as a uniform land use condition. The updated analyses and floodplain mapping reflect completed flood mitigation projects and other changed conditions, such as the removal of the North Avenue dam. The City of Milwaukee is currently in the process of coordinating the preparation, approval, and adoption of updated mapping for all streams as they are completed. Within the City of Milwaukee MCAMLIS mapping was incorporated into the 2008 FIS for the Milwaukee River mainstem, Lincoln Creek, North Branch Oak Creek, and the Mitchell Field Drainage Ditch.

Upon completion of the floodplain studies for the remaining streams to be mapped under the MCAMLIS program, the City will submit its proposed floodplain revisions and additions to the WDNR for approval and also request revision of the applicable flood insurance rate maps by the FEMA Federal Insurance Administration. Following WDNR and FEMA approval, the City will amend its floodplain zoning ordinance to reflect the updated one-percent-annual-probability water surface profiles.

Lending Institution and Real-Estate-Agent Policies

The plan calls for lending institutions to continue their practice of determining the floodprone status of properties before mortgage transactions and that the principal sources of flood hazard information be the most recent available studies for the watersheds and subwatersheds located partly or wholly within the City. Furthermore, real-estate brokers and salespersons are to continue to inform potential purchasers of property of any flood hazard that may exist at the site being traded in accord with rules of the Wisconsin Department of Regulation and Licensing, Bureau of Direct Licensing and Real Estate.

Community Utility Policies and Emergency Programs

The policies of the governmental units and agencies responsible for the design, construction, operation, and maintenance of public utilities and facilities, such as water supply and sewerage facilities, drainageways, and streets and highways, are to carry out those functions in a manner fully consistent with the land use and floodland regulation recommendations set forth or noted in this plan. Also, the City of Milwaukee and Milwaukee County will continue to implement existing emergency procedures and develop appropriate new emergency procedures as needed to provide residents of the City with timely information about floods in progress and to help them in taking appropriate action.

Stream Channel Maintenance

The City of Milwaukee will work cooperatively with the MMSD to continue and expand a program of regular stream channel maintenance. This program includes the periodic removal of sediment deposits, selected heavy vegetation, and debris from all watercourses within the City, including bridge openings and culverts. Under a 1999 revision to its watercourse policy plan,[10] the MMSD would assume responsibility for carrying out channel maintenance duties for the streams under its jurisdiction, but only under certain conditions. Specifically, the MMSD would conduct channel clearing only for those instances where the deposition of sediment or debris

[10]*A policy for MMSD stormwater drainage and flood control was initially set forth in SEWRPC Community Assistance Planning Report No. 130,* A Stormwater Drainage and Flood Control Policy Plan for the Milwaukee Metropolitan Sewerage District, *March 1986. In 1998 the Milwaukee Metropolitan Sewerage Commission formed a Watercourse Policy Advisory Group to review and revise the District's policy plan. The recommendations of that committee were adopted by the Sewerage Commission in 1999.*

would materially raise the elevation of the one-percent-annual-probability flood profile as established under its watercourse system plan such that additional structures would be placed within the resulting floodplain. In no instance would the MMSD assume responsibility for the clearing of bridge and culvert openings. While the criteria used by the MMSD would address the most severe problems associated with channel obstructions, it does not address the potential for other problems that may arise, such as an increase in the incidence and severity of roadway flooding and the obstruction of storm sewer outlets. Those problems will need to be addressed by the City of Milwaukee. Therefore, the City will work with the MMSD in identifying those instances where channel maintenance would meet the MMSD criteria. The City will also develop its own program for providing channel maintenance where the MMSD jurisdiction is not in place.

Stormwater Management Facilities Maintenance

The effectiveness of stormwater management conveyance and detention facilities and other management measures can be sustained only if proper operation, repair, and maintenance procedures are carefully followed. Important maintenance procedures include the periodic repair of storm sewers, clearing of sewer obstructions, maintenance of open vegetation channel linings, clearing of debris and sediment from open channels, maintenance of detention facility inlets and outlets, maintenance of detention basin vegetative cover, and periodic removal of sediment accumulated in detention basins. The plan calls for these maintenance activities to be carried out on a continuing basis to maximize the effectiveness of the stormwater management facilities and measures, and to protect the capital investment in the facilities. The City of Milwaukee will carry out, or cause to carry out by others in the case of privately owned facilities, necessary stormwater management facility maintenance activities on a continuing basis to maximize the effectiveness of stormwater management facilities and measures, and to protect the capital investment in the facilities.

Basement Backup Problems

As described in Chapter III, there are still areas where sanitary sewers backup into basements. In the case of the most severe problem areas, the cause and potential solutions to those basement backup problems are being investigated by the City of Milwaukee, the MMSD, and Veolia, which is a private firm under contract to the MMSD for operating the MMSD sewerage system. As part of the solution, the City of Milwaukee is conducting a pilot project in the area where a large number of the 2004 basement backup problems occurred. In order to address ongoing inflow and infiltration (I/I) entering sanitary sewers and resulting in basement backups, the City of Milwaukee conducted one pilot project in 2011 and is initiating another pilot project to be conducted in 2011 and 2012. Both projects examine I/I originating from private property sources.

The first pilot project was conducted in early 2011 and involved rehabilitating the plumbing in five city-owned homes in an area near W. Capitol Drive between N. 39th Street and N. 42nd Street. A major goal of this project was to identify the costs and challenges associated with lining sanitary sewer building laterals, disconnecting foundation drains from the sanitary sewer, installing sump pumps, and installing backflow preventers. The average per home cost to disconnect the existing foundation drain and rehabilitate the sanitary sewer lateral was approximately $14,200. In addition, the project demonstrated several challenges that are expected to be encountered in conducting large-scale projects of this type. These challenges include the potential need for an electrical service upgrade to provide dedicated service for a sump pump, locating areas in basements where a sump pump can be installed, and handling the sump discharge within the property.

The second pilot project will apply the lessons learned in the first project to the rehabilitation of laterals in an area that has had basement backups in the past and has been identified by the MMSD as being located in a poorly performing sewershed due to high levels of I/I. The area selected consists of 564 properties and is located approximately between W. Center Street, W. Burleigh Street, N. 85th Street, and N. 92nd Street. In 2010, the City completed the rehabilitation of all public sewer mains in this area. The City currently is obtaining permission from the property owners in the project area to inspect their sanitary sewer laterals. Once these inspections are completed, the City will award a contract to have needed sanitary laterals rehabilitated, disconnect the foundation drains from the sanitary sewer, and install sump pumps. It is anticipated that this project will be completed in 2012.

Flow monitoring is also being conducted as part of the second pilot project to determine how much reduction in I/I was achieved by rehabilitation of the public sewer mains only and to quantify the reduction following the addition of the private property improvements.

Due to the continuing large number of basements flooded in the 2008-2010 events, the MMSD is currently pursuing a long term Private Property Infiltration and Inflow Reduction Program (PPII) in collaboration with the City of Milwaukee and the other 27 communities. As of the end of 2010, the PPII effort was slated to run from 2010 to 2020 with a proposed budget of $151 million to be prorated to the 28 participating communities.[11] Through 2011, the City of Milwaukee has been allocated $3.98 million for the PPII program. The municipal allotment can be spent on any reasonable effort on private property to reduce infiltration and inflow. These efforts may include sewer and lateral investigation, lateral repair, sump pump installation, among others. Each municipality will prioritize the work within their jurisdiction. The percentage of the work paid for by the MMSD allotment versus private resident contributions will be decided by the City of Milwaukee.

City of Milwaukee Flooding Study Task Force
In response to the flooding, stormwater management, and basement backup problems that occurred during July 2010, the City formed a Flooding Study Task Force. The Task Force included representatives from the staffs of the City Engineering Department, the City Office of Sustainability the WDNR Wastewater Section, MMSD, and SEWRPC, along with City Council members and a State Representative. As of June 2011, the Task Force was in the process of adopting recommendations to be included in its report to the City of Milwaukee Common Council.

HAZARD MITIGATION PLAN COMPONENT FOR THUNDERSTORM, HIGH-WIND, HAIL, AND LIGHTNING HAZARDS

As described in Chapter IV, thunderstorms, high winds, hail, and lightning are natural hazard events of significant concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternative and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
All thunderstorms and related hazard events are potentially dangerous and are the most common type of severe weather event compared to other natural hazards within the City of Milwaukee as discussed in Chapter III. However, only about 10 percent of the thunderstorms and related hazard events that occur within the City of Milwaukee each year are classified as severe. Severe thunderstorm fronts can often be tracked, which generally provides ample warning for potentially affected areas to take preventative actions. In addition, when severe thunderstorms and related hazard events occur, they generally last for relatively short periods of time.

Thunderstorms and High Wind
While it may not be possible to accurately identify specific areas where there is significant risk from thunderstorm and high-wind events, measures can be taken to reduce the potential damage caused by thunderstorm and related hazards wherever they may occur in the City. High-wind events associated with thunderstorms are very similar to tornadoes, except they are more common and usually less powerful than tornadoes. Through review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to thunderstorms and high winds have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

[11]*As of May 2011, MMSD was reconsidering the level of funding for this program because of proposed State budget cuts that, if adopted, could affect the District's ability to fund the program at the originally-intended level.*

- Review local building codes to determine if revisions are needed to improve the structures ability to withstand greater wind velocities and encourage provision of safe rooms, especially in structures that do not have a basement. Building code provisions considered may include requirements, such as construction methods that employ cross-bracing, anchoring of walls to foundations, and anchoring roof rafters to walls (also mitigates tornado risk) and measures to provide wind protection and retrofits for vulnerable features, such as windows, garage doors, patio doors, double-wide entry doors, siding, and bracing for walls and rafters (also mitigates tornado risk). Additional building code requirements may include requirements related to using tie-downs and proper anchoring of mobile and manufactured homes and anchoring of attachments, such as carports and porches, to mobile and manufactured homes.

- Establish, update, and/or monitor public early warning systems and networks;

- Trim and maintain the health of trees near vulnerable infrastructure, such as utility lines, essential facilities and roads, as well as near homes and businesses;

- Bury and protect power and utility lines;

- Public Informational and Educational Programming

    — Increase public education and awareness of the potential severity of thunderstorms;

    — Increase the coverage and use of National Oceanic and Atmospheric Administration (NOAA) weather radios;

    — Promote inclusion of safety strategies for severe weather events in driver education classes and materials;

    — Encourage residents to develop a Family Emergency Preparedness Plan which would include the preparation of a Disaster Supply Kit (Appendix D);

    — Produce and distribute emergency preparedness information related to thunderstorm hazards; and

    — Encourage the use and expansion of NOAA severe weather alert systems.

Hailstorms

Hailstorms tend to occur in conjunction with severe thunderstorms. A severe thunderstorm weather advisory or advance warning system may indicate that large or damaging hail is imminent. During a hail storm personal safety is the first priority and persons should seek shelter and stop driving to avoid any accidents. The aforementioned advance warning systems allows some actions to reduce hail damage to vehicles and some property, but little can be done to protect structures. Through review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to hail are identified as viable for this update of the City hazard mitigation plan.

- Review local building codes to determine if revisions are needed to increase requirements for hail-impact-resistant roofing and other materials.

- Increase public education and awareness of the potential severity of hailstorms.

Lightning

The entire City of Milwaukee is at risk from lightning and personal protection is paramount for lightning safety. Many people incur injuries or are killed due to misinformation and inappropriate behavior during thunderstorms. A few simple precautions can reduce many of the dangers posed by lightning. The individual is ultimately responsible for his/her personal safety and has the right to take appropriate action when threatened by lightning. Through review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to lightning are identified as viable for this update of the City hazard mitigation plan.

- Enforce existing local ordinances, in terms of adequate grounding of newly constructed buildings;
- Local fire suppression departments obtain and maintain equipment to help detect or mitigate lightning-related fires, such as thermal imaging devices;
- Using surge protectors on critical electronic equipment;
- Install lightning grade surge protection devices for critical electronic components used by government, public service, and public safety facilities, such as warning systems, control systems, communications, and computer;
- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and
- Public Informational and Educational Programming
    - — Promote public awareness of proven lightning safety guidelines to reduce the risk of lightning hazards;
    - — Support public information regarding lightning hazards and cost effective mitigation measures;
    - — Help produce and distribute educational materials on lightning safety to the public;
    - — Encourage residents to develop a Family Emergency Preparedness Plan and to use proper fire alarm systems; and
    - — Encourage the use and expansion of NOAA severe weather alert systems.

Current Programs

Federal and State Programs

The National Weather Service issues severe thunderstorm watches and warnings when there is a threat of severe weather conditions, including high winds, hail, lightning, and tornadoes. The National Weather Service also has an extensive public information program to educate people about the dangers of thunderstorms and related hazards and assist in preventing related deaths and injuries. Wisconsin Emergency Management, in conjunction with the National Weather Service and State and local government agencies, provides both preparedness information and severe weather information to the public. Preparedness information is provided during three severe weather awareness campaigns conducted during the year, each focusing on the prevalent weather hazard at that time. In addition, numerous other organizations, including the American Red Cross, provide public safety information regarding lightning.

The National Weather Service recognizes the need for programs that assist communities in implementing procedures and plans that would reduce risk during a weather disaster. The National Weather Service has developed StormReady, a voluntary program that assists communities with weather-related disaster planning and management. This program encourages communities to take a pro-active approach to develop local hazardous weather operations plans and public awareness for all types of severe weather threats. By participating in StormReady, local agencies can earn recognition for their communities by meeting criteria established by the National Weather Service in partnership with Federal, State, and local emergency management professionals. The Milwaukee/Sullivan National Weather Service Office promotes and administers the StormReady program that assists community or county emergency management agencies in Southeastern Wisconsin, including Milwaukee County. The Milwaukee County Office of the Sheriff, Emergency Management Bureau, has taken the necessary actions to qualify Milwaukee County for StormReady designation and is pursuing such designation for the County.

In 2004, the Department of Homeland Security set forth the National Incident Management System (NIMS) as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the Incident Command System (ICS), multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, including weather-related incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

The National Weather Service sponsors several different weather-related information and education awareness campaigns throughout the year. During each awareness campaign, the Milwaukee/Sullivan National Weather Service Office distributes information to the media and local emergency management agencies from the Wisconsin Office of Emergency Management. Most schools participate in the Tornado and Severe Weather Awareness Week activities. This event usually occurs in April. The Milwaukee/Sullivan National Weather Service Office sponsors a NOAA Weather Awareness Day in May, and a Heat Awareness Day and a Lightning Awareness campaign in June. The Wisconsin Winter Awareness Week occurs in November each year.

The City of Milwaukee's website provides links to brochures and websites that are available for the public on severe weather safety.

The City of Milwaukee is currently covered by NOAA Weather Radio for severe thunderstorm and related hazard warnings. NOAA Weather Radio has a transmitter in the Town of Delafield, approximately 25 miles west of the City of Milwaukee. This transmitter operates at a frequency of 162.400 megahertz and covers much of southeastern Wisconsin and all of Milwaukee County. In addition, southern portions of the City are covered by a second NOAA Weather Radio transmitter located in Racine County which transmits at a frequency of 162.450 megahertz. Severe thunderstorm and related hazard warnings from NOAA Weather Radio are relayed to other media via the Federal Communication Commission's Emergency Alert System (EAS). The EAS allows officials to send emergency information targeted to specific geographical areas. The EAS sends alerts out to broadcast media, cable television providers, satellites, pagers, direct broadcast satellites, high definition television, and video dial tone. This system uses the same digital protocols as NOAA Weather Radio. Nationally, the National Weather Service generates about 80 percent of EAS activations, primarily for short-duration weather warnings and watches. Federal, State, and local emergency personnel can also access this system to disseminate nonweather emergency messages through the National Weather Service's HAZCollect system.

As described in Chapter II, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and the Milwaukee County Office of the Sheriff, Emergency Management Bureau, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including thunderstorms, high winds, hail, and lightning.

The Milwaukee County Office of the Sheriff operates and maintains a total of 57 outdoor warning sirens throughout Milwaukee County. The City of Milwaukee is covered by this warning system. The Milwaukee County Office of the Sheriff tests the system daily and makes upgrades as required. This system of sirens, however, is not designed to be heard inside closed buildings and the Office of the Sheriff, Emergency Management Bureau, encourages supplemental use of weather alert radio systems for residents and businesses.

Evaluation of Alternatives and Identification of Mitigation Actions

Based upon review of the above, the refinement and expansion of current ongoing programs represents a major component of the planned mitigation action with regard to early warning systems. Milwaukee County has taken and continues to take steps to assess and correct weaknesses within the outdoor warning siren system.[12] In addition, informing the public of the significance of thunderstorm watches and warnings so that they take thunderstorm warnings and related hazards seriously and know where to seek shelter in emergency situations are important, ongoing components for minimizing the risks associated with these natural hazards. Community- and school-based informational programs should also continue to be conducted by the City of Milwaukee in partnership with Federal, State, County and other local authorities.

In addition, feasible mitigation actions include ordinance review and possible refinement, which may encourage use of appropriate building codes; provision of surge protection for sensitive electronic equipment; and other precautions that will limit possible future bodily injuries, deaths, or property damages due to severe weather events. The majority of these measures are currently in place, indicating an emphasis on informational programming and enforcement.

Thunderstorms and their related hazards can potentially cause damage to a variety of infrastructure, including, transmission lines, communication lines, transportation routes, buildings, or structures due to flooding or high winds. Hence, the City of Milwaukee and relevant businesses should coordinate hazard mitigation activities through a cooperative partnership in citywide disaster planning and response mechanisms. Such measures are already well underway through the coordinated emergency operations planning program involving Milwaukee County Emergency Management and coordinated local community emergency operations programs.

The Milwaukee County Office of the Sheriff, Emergency Management Bureau, maintains the Emergency Operations Plan (EOP) for Milwaukee County. Updated annually, the EOP provides overall guidance in response to major disasters throughout Milwaukee County, including the City of Milwaukee. This plan addresses direction and control, warning and communications, resource management, law enforcement, evacuation and shelter, human services, public works and engineering, public information and education, public health and emergency medical services, radiological protection, fire and rescue, and damage assessment and recovery. It also specifies procedures in the event of any incidents involving hazardous materials or terrorism, provides guidance for division standard operating procedures, and includes the countywide Master Notification List.

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[12] *Milwaukee County Sheriff's Department Emergency Management Bureau,* Pre-Disaster Mitigation Plan, *August 2004; Milwaukee County Sheriff's Department Emergency Management Bureau,* Milwaukee Pre-Disaster Mitigation Plan *(Draft), June 2010.*

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see Natural and Other Hazard Risk Analysis included under a later section of this chapter), and review and action by the City of Milwaukee Hazard Mitigation Steering Committee as part of the updating process (see Appendix A), the following mitigation measures related to thunderstorms, high-wind, hail, and lightning events are included in the City of Milwaukee hazards mitigation plan:

- Maintenance and expansion of early warning and communication systems that includes Emergency Alert System (EAS) capabilities and expanded use of emerging technologies. In this regard, the expanded use of the NOAA Weather Radio among residents is encouraged. This weather radio continuously broadcasts National Weather Service forecasts, warnings and crucial weather information. NOAA Weather Radio also provides direct warning to the public for natural, man-made, or technological hazards, and is the primary trigger for activating the EAS on commercial radio, television, and cable systems;

- Promotion of educational and informational programming, especially related to the early warning network, NOAA Weather Radio and EAS broadcasts, and to individual actions to protect citizens, property, and businesses. Community Organizations Active in Disaster (COAD) may be able to provide assistance in these educational efforts;

- Ongoing review and enforcement of building code ordinance requirements;[13]

- Continue to work towards compliance with the National Incident Management System; and

- Continued coordination of emergency operations and response plans among governmental units.

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR TORNADOES

As described in Chapter III, tornadoes are natural hazard events of moderate concern relative to this update of the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
All tornadoes are potentially dangerous hazards within the City of Milwaukee as discussed in Chapter IV. Tornadoes have been shown to impact the City of Milwaukee about once every 40 months and these are most likely to be of EF1 magnitude or less. In addition, when tornadoes and related hazard events occur, they generally last for short periods of time and impact relatively small areas upon the landscape.

[13]*The State Uniform Dwelling Code (UDC) is a statewide regulation that sets standards for fire safety, structural strength, energy conservation, erosion control, heating, plumbing, and electrical systems, and general health and safety in dwellings constructed or altered after 1980. The UDC applies uniformly throughout the State, and local governments may not adopt a more or less stringent code. Consequently, should review of local ordinances reveal that a change in the building code would be a viable mitigation measure, the City would need to pursue a change in the UDC at the State level.*

While it may not be possible to accurately identify specific areas where there is significant risk from tornado events, or the number or severity of the events, measures can be taken to reduce the potential damage caused by tornados wherever they may occur in the City of Milwaukee. Based upon review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to tornadoes have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

- Review local building codes to determine if revisions are needed to improve the structures ability to withstand greater wind velocities and encourage provision of safe rooms, especially in structures that do not have a basement. Building code provisions considered may include requirements, such as construction methods that employ cross-bracing, anchoring of walls to foundations, anchoring roof rafters to walls, and measures to provide wind protection and retrofits for vulnerable features, such as windows, garage doors, patio doors, double-wide entry doors, siding, and bracing for walls and rafters;

- Conduct an inventory and inspection of facilities to ensure the quality, quantity, and accessibility of adequate tornado shelters;

- Ensure that mobile and manufactured housing is securely anchored;

- Establish safe and appropriate locations for temporary debris disposal sites;

- Establish, update, and/or monitor public early warning systems and networks;

- Evaluate the need to retrofit existing or install new structures to ensure adequate shelters from tornadoes for public buildings, major industrial sites, and other large businesses or complexes, such as shopping malls, fairgrounds, and other vulnerable public areas;

- Trim and maintain the health of trees near vulnerable infrastructure, such as utility lines, essential facilities and roads, as well as near homes and businesses;

- Bury and protect power and utility lines;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and

- Public Informational and Educational Programming

    — Increase public education and awareness of the potential severity of thunderstorms;

    — Increase the coverage and use of NOAA Weather Radios and Emergency Alert System broadcast awareness;

    — Promote inclusion of safety strategies for severe weather events in driver education classes and materials;

    — Encourage residents to develop a Family Emergency Preparedness Plan which would include the preparation of a Disaster Supply Kit (Appendix D); and

    — Produce and distribute emergency preparedness information related to tornado and thunder-storm hazards.

Current Programs

Federal and State Programs

The National Weather Service issues severe thunderstorm watches and warnings when there is a threat of severe weather conditions, including high winds, hail, lightning, and tornadoes. The National Weather Service issues tornado watches when conditions are favorable for the development of thunderstorms that have a strong capability of producing tornadoes and issues tornado warnings when a tornado has been spotted by a trained observer or Doppler radar has indicated the presence of a developing tornado. The National Weather Service also has an extensive public information program to educate people about the dangers of tornadoes and related hazards and assist in preventing related deaths and injuries. Wisconsin Emergency Management, in conjunction with the National Weather Service and State and local government agencies, provides both preparedness information and severe weather information to the public. Preparedness information is provided during three severe weather awareness campaigns conducted during the year, each focusing on the prevalent weather hazard at that time. In addition, numerous other organizations, including the American Red Cross, provide public safety information regarding tornadoes.

The National Weather Service recognizes the need for programs that assist communities in implementing procedures and plans that would reduce risk during a weather disaster. As noted in the preceding section of this report, the National Weather Service has developed StormReady, a voluntary program that assists communities with weather-related disaster planning and management. This program encourages communities to take a proactive approach to develop local hazardous weather operations plans and public awareness for all types of severe weather threats. By participating in StormReady, local agencies can earn recognition for their communities by meeting criteria established by the National Weather Service in partnership with Federal, State, and local emergency management professionals. The Milwaukee/Sullivan National Weather Service Office promotes and administers the StormReady program that assists community or county emergency management agencies in Southeastern Wisconsin, including Milwaukee County. The Milwaukee County Office of the Sheriff, Emergency Management Bureau, has taken the necessary actions to qualify Milwaukee County for StormReady designation and is pursuing such designation for the County.

In 2004, the Department of Homeland Security set forth the National Incident Management System (NIMS) as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, including tornado incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

The National Weather Service sponsors several different weather-related awareness campaigns annually. During each awareness campaign, the Milwaukee/Sullivan National Weather Service Office distributes information to the media and local emergency management agencies from the Wisconsin Emergency Management. Most schools participate in the Tornado and Severe Weather Awareness Week activities. This event usually occurs in April. The Milwaukee/Sullivan National Weather Service Office sponsors a NOAA Weather Awareness Day in May, and a Heat Awareness Day and a Lightning Awareness campaign in June. The Wisconsin Winter Awareness Week occurs in November each year.

The City of Milwaukee's website provides links to brochures and websites that are available for the public on severe weather safety.

The Milwaukee County Office of the Sheriff, Emergency Management Bureau, has a number of brochures, booklets, and pamphlets available for the public on tornado safety and other general emergency management-related topics.

The City of Milwaukee is currently covered by NOAA Weather Radio for tornado and related hazard warnings. NOAA Weather Radio has a transmitter located in the Town of Delafield, located approximately 25 miles east of the City of Milwaukee. This transmitter operates at a frequency of 162.400 megahertz and covers much of southeastern Wisconsin, including all of Milwaukee County. In addition, southern portions of the City are covered by a second NOAA Weather Radio transmitter located in Racine County which transmits at a frequency of 162.450 megahertz. Severe thunderstorm and related hazard warnings from NOAA Weather Radio are relayed to other media via the Federal Communication Commission's Emergency Alert System (EAS). The EAS allows officials to send emergency information targeted to specific geographical areas. The EAS sends alerts out to broadcast media, cable television providers, satellites, pagers, direct broadcast satellites, high definition television, and video dial tone. This system uses the same digital protocols as NOAA Weather Radio. Nationally, the National Weather Service generates about 80 percent of EAS activations, primarily for short-duration weather warnings and watches. Federal, State, and local emergency personnel can also access this system to disseminated nonweather emergency messages through the National Weather Service's HAZCollect system.

As described in Chapter II, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and the Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including tornados. In addition, many local institutions, including Milwaukee Public Schools,[14] have developed emergency operations plans and programs to deal with tornado events.

As previously noted, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, operates and maintains a total of 57 outdoor warning and communication sirens throughout Milwaukee County.

Evaluation of Alternatives and Identification of Mitigation Actions

Based upon review, the refinement and expansion of the current ongoing programs represents a major component of the planned mitigation action with regard to early warning systems. In the event of a tornado, the countywide early warning system will be sounded, warning people to seek shelter. The best shelters are specifically designed tornado shelters or safe rooms. Lacking such shelters, taking refuge in a basement near supporting walls or pillars, and away from windows, or, if there is no basement, taking shelter in smaller interior, windowless rooms, such as hallways or closets, can offer some protection and are the next best options. Cars, mobile homes, garages, and outbuildings are not safe shelters from tornadoes. In addition, informing the public of the significance of tornado watches and warnings so that they take tornado warnings seriously and know where to seek shelter in emergency situations, are important, ongoing components for minimizing the risks associated with these natural hazards. Community- and school-based informational programs should also continue to be conducted by the City of Milwaukee in partnership with Federal, State and local authorities.

[14] *Milwaukee Public Schools*, Emergency Operations Plan, *August 2010.*

In addition, feasible mitigation actions include ordinance review and possible refinement, which may be applicable to encourage use of appropriate building codes; incorporation of wind resistant construction methods for the protection of buildings and infrastructure; and other precautions that will limit possible future bodily injuries, deaths, or property damages due to tornado and related hazard events.

Tornado events can potentially cause damage to a variety of infrastructure, including transmission lines, communication lines, transportation routes, and buildings or structures due to flooding or high winds. Hence, the City of Milwaukee, Milwaukee County, and relevant agencies and businesses are encouraged to coordinate hazard mitigation activities through a cooperative partnership in citywide disaster planning and response mechanisms. Such measures are already well underway through the coordinated emergency operations planning program involving the Milwaukee County Office of the Sheriff, Emergency Management Bureau, and coordinated local community emergency operations programs.

Priority Mitigation Measures

Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 section below), and review and action by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to tornado hazard events are included in the updated City of Milwaukee hazards mitigation plan:

- Continue developing effective means of warning at-risk populations, including installation and maintenance of early warning systems that incorporate EAS capabilities and expanded use of emergency technologies;

- Evaluate the need to retrofit existing or install new structures to ensure adequate shelters from tornadoes for public buildings, major industrial sites, and other large businesses or complexes, such as shopping malls, fairgrounds, and other vulnerable public areas;

- Promotion of educational and informational programming, especially related to the early warning network, including NOAA Weather Radio and EAS broadcasts, and to individual actions to protect citizens, property, and businesses. COAD may be able to provide assistance in these educational efforts;

- Ongoing review and enforcement of building code ordinance requirements; [15]

- Continue to work towards compliance with the National Incident Management System;

- Continued coordination of emergency response and operations plans among governmental units and first responders; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (Community Emergency Response Teams (CERT), Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

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[15] *The State Uniform Dwelling Code (UDC) is a statewide regulation that sets standards for fire safety, structural strength, energy conservation, erosion control, heating, plumbing, and electrical systems, and general health and safety in dwellings constructed or altered after 1980. The UDC applies uniformly throughout the State, and local governments may not adopt a more or less stringent code. Consequently, should review of local ordinances reveal that a change in the building code would be a viable mitigation measure, the City would need to pursue a change in the UDC at the State level.*

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR EXTREME TEMPERATURES

As described in Chapter III, extreme temperatures are natural hazard events of significant and high concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
Extreme temperature events pose a serious threat to the City of Milwaukee. Extreme heat and cold events combined are the number one most deadly natural hazard within the City of Milwaukee. Temperature extremes should be expected with each summer and winter season making this hazard the easiest to plan and prepare for. Extreme heat and cold events do not typically occur suddenly and are generally connected to a weather system that can be forecast days in advance. When temperature extreme events do occur, they commonly last for extended periods of time (days or weeks) and impact entire areas larger than the City of Milwaukee.

While it may not be possible to accurately identify specific areas where there is significant risk from extreme temperature, extreme heat will have the greatest impact in densely developed areas of the City. Demographically, the elderly, poor, and debilitated are most vulnerable to excessive heat and cold. Fatalities are usually related to age because excessive heat is stressful and can overwhelm those who are weakened because of age or illness. Measures can be taken to reduce the potential injuries and fatalities caused by temperature extremes wherever they may occur in the City. Based upon review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to extreme temperature events have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

- Organize neighborhood outreach groups who look after vulnerable groups and individuals;
- Provide special arrangements for payment of heating bills;
- Increase coverage and use of NOAA Weather Radio and EAS broadcasts;
- Conduct an inventory and inspection of facilities to ensure the quality, quantity, and accessibility of adequate heating and/or cooling centers in the community;
- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and
- Public Informational and Educational Programming
    - — Increase public education and awareness of the potential severity of temperature extreme events; and
    - — Produce and distribute emergency preparedness information related to temperature extremes; and
    - — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Current Programs

Federal and State Programs

The National Weather Service issues advisory statements to media, emergency management, and public health officials in advance of and during conditions of excessive heat. Heat waves cannot be prevented, therefore, it is important to provide notice of adverse conditions so that the public can anticipate and avoid health-threatening situations. Excessive heat alert thresholds are being tailored at major metropolitan centers based on research results that link unusual amounts of heat-related deaths to city-specific meteorological conditions. The alert procedures are as follows:

- Include Heat Index values in zone and city forecasts.
- Issue Special Weather Statements and/or Public Information Statements presenting a detailed discussion of 1) the extent of the hazard, including Heat Index values, 2) who is most at risk, and 3) safety rules for reducing the risk.
- Assist State and local health officials in preparing civil emergency messages prior to and during severe heat waves. Meteorological information from Special Weather Statements will be included, as well as medical information, advice, and names and telephone numbers of health officials.
- Release to the media and over the NOAA Weather Radio all of the above information.

Wisconsin Emergency Management, in conjunction with the National Weather Service and State and local government agencies, provide both preparedness information and severe weather information to the citizens of Wisconsin. Preparedness information is provided during several severe weather awareness campaigns conducted during the year, each focusing on the prevalent weather hazard at that time. This includes two involving extreme temperature-related campaigns: a Heat Awareness Day in June, and Wisconsin Winter Awareness Week in November. In addition, numerous other organizations, such as the American Red Cross, provide public safety information.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, including extreme temperature incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

Led by the City of Milwaukee Health Department, the Milwaukee Heat Task Force is a coordinated effort committed to reducing the public health threat from heat waves. The Heat Task Force is comprised of members from the Milwaukee County Office of the Sheriff, Emergency Management Bureau, the Milwaukee/Sullivan regional office of the National Weather Service, the Milwaukee County Department on Aging, as well as interested parties from local government and community organizations. Together, the City of Milwaukee Health

Department and the Milwaukee Heat Task Force collaborated on and instituted a plan for excessive heat conditions.[16] This plan outlines the roles and responsibilities of each participating group during excessive heat conditions. This plan was most recently updated in Spring 2010.

As described in Chapter II, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including extreme temperature events.

Evaluation of Alternatives and Identification of Mitigation Actions
Based upon review of the above, the current ongoing informational and educational programs represent a major component of the planned mitigation action. The City of Milwaukee should promote basic strategies to reduce injuries and fatalities, hazard awareness, and community involvement. Temperature hazards are faced by the City of Milwaukee residents annually and the ability to make positive decisions concerning exposure limits will depend on safety awareness. Analysis of the vulnerability of humans, infrastructure, and economic production caused by extreme temperature events demonstrates that the provision of advanced weather forecasting systems; availability of adequate shelter from the heat and cold in public buildings, major industrial sites, and other large businesses or complexes, such as shopping malls, and public informational and educational programming, are the most important mitigation actions to be considered. Public service announcements regarding avoiding heat stress help to minimize exposure. The City of Milwaukee supports measures presently implemented by the National Weather Service; Federal, State, and local health organizations; and the media preceding and during excessively hot weather. It is also important to continue to encourage concern for, and awareness of, elderly neighbors. Community and school-based informational programs should continue to be conducted by the City of Milwaukee in partnership with Federal, State and local authorities.

Extreme temperature events are a public health concern and ultimately prevention should fall to the local authorities. These events affect individuals, typically the elderly, sick, and invalid, who cannot access shelter with decent heat or air conditioning. Continued coordinated effort involving the City of Milwaukee Health Department and the Milwaukee Heat Task Force and local community emergency operations programs should be supported to identify and protect individuals vulnerable to temperature related hazards.

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 section below), and review and action by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to extreme temperature events are included in the updated hazard mitigation plan for the City of Milwaukee:

- Organize neighborhood outreach groups who look after vulnerable groups and individuals;
- Continue support of the Milwaukee Heat Task Force;
- Encourage the provision of special arrangements for payment of heating bills;

[16] *City of Milwaukee Health Department and Milwaukee Heat Task Force, "Plan for Excessive Heat Conditions 2010," Spring 2010. This can be accessed at* http://city.milwaukee.gov/ImageLibrary/Groups/healthAuthors/DCP/PDFs/ExtremeHeat/2010_Heat_PlanNo_logl_final07012010.pdf.

- Identify and advertise a list of available heating and or cooling shelters in the immediate area;

- Increase coverage and use of NOAA Weather Radio and EAS broadcasts;

- Promotion of educational and informational programming. COAD may be able to provide assistance in these educational efforts;

- Continue to work towards compliance with the National Incident Management System; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR LAKE MICHIGAN COASTAL HAZARDS

As described in Chapter III, Lake Michigan shoreline erosion and flooding are natural hazard events of low concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies

As reported in Chapter III, a number of studies and planning programs have been carried out relating to Lake Michigan coastal erosion and related hazards.[17] A review of those plans and materials developed under the State of Wisconsin Coastal Management Program indicates a range of alternative shoreline erosion control mitigation measures. The following measures to reduce the vulnerability to shoreline erosion and related hazards are considered as viable for incorporation into the City of Milwaukee hazard mitigation plan.

- Development and adoption of shoreland zoning ordinances incorporating bluff setback provisions. (Guidance on setback provisions is available from the Wisconsin Coastal Management Program).

- Construction and maintenance of shoreline protection structures and bluff stabilization measures where urban development commitments have been made dictating the need for structures. Effective shore protection requires a combination of bluff stabilization, surface water and subsurface water control, and bluff toe protection. Structural shore protection measures should be provided if it can be shown that such measures will effectively reduce shoreline erosion and not adversely affect adjacent sections of the shoreline to impair public rights in navigable waters; that there will be no significant reduction in public access, use, and enjoyment of the shoreline environment; and that any adverse impacts on fish and wildlife resources caused by the structure will be compensated for by providing fish and wildlife preservation measures.

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[17] *SEWRPC Community Assistance Planning Report No. 163,* A Lake Michigan Shoreline Erosion Management Plan for Milwaukee County, Wisconsin, *October 1989;* SEWRPC Technical Report No. 36, *Lake Michigan Shoreline Recession and Bluff Stability in Southeastern Wisconsin: 1995*, December 1997; and The H. John Heinz III Center for Science, Economics and the Environment, *Evaluation of Erosion Hazards,* April 2000.

- Public informational and educational programming covering:

  — Information on shoreland erosion and related hazards to serve as a "fair warning" guide for, and a valuable service to, groups, such as realtor-brokers, shoreline property owners, developers, lending institutions, and prospective buyers.

  — Property owner guidance on proper shoreline and bluff management actions, such as vegetation and drainage practices.

  — Permitting and zoning: A number of educational materials have been developed through the cooperative efforts with the State Coastal Management Program.

Current Programs

Federal Programs

A long-term project to assess the economic impact of the water levels in the Great Lakes has been coordinated by the Army Corps of Engineers, Detroit District. In cooperation with the University of Wisconsin-Madison's Sea Grant Institute, Department of Civil and Environmental Engineering, Land Information and Computer Graphics Facility, the WDNR, several private consultants and agencies from the State of Michigan, the Corps organized the Lake Michigan Potential Damages Study (LMPDS). The objective of this research project is to create a modeling procedure and engineering-management tool for estimating economic effects of lake level changes and related social, environmental and cultural impacts. The LMPDS modeling approaches provide the framework for economic assessments for each of the other Great Lakes. The LMPDS is also intended to be a forum for concerted information system development between international, Federal, State, city, township, and municipal governance about the Lake Michigan resource base.

The U.S. Army Corps of Engineers is the primary Federal agency responsible for the regulation of structures and work related to surface waters. Initial Corps authority to regulate structures or work affecting navigable waters stems from the River and Harbor Act of 1899. Corps regulatory authority was expended with the passage of the Federal Water Pollution Control Act amendments in 1972. Section 404 of this act authorized the Corps to administer a permit program to regulate the deposition of dredged and fill materials into waters and related wetlands of the United States, as well as to regulate the construction of shore protection structures.

In January 2010 FEMA produced a Draft Great Lakes Coastal Guidelines Update which includes new methodology to determine flood hazard zones within the FEMA Region V coastal zone. The public comment period ended in November 2010. Future steps will include pilot studies to evaluate the new methodologies at specific Great Lakes locations and then a prioritization of coastal mapping needs within the FEMA Region for future analyses. The ultimate goal of these efforts will be a remapping of the flood hazards along the Great Lakes coastal areas that would subsequently be reflected in revised Flood Insurance Studies.

State and Local Programs

Wisconsin's Shoreland Management Program is a partnership between State and local government that requires the adoption of shoreland zoning ordinances to regulate development near navigable lakes and streams, in compliance with statewide minimum standards. These minimum statewide standards are set forth in Chapter NR 115, *Wisconsin Administrative Code*.

The Wisconsin Coastal Management Program oversees management of the State's coastal resources and strives to maintain a balance between preservation and economic needs. Established in 1978 under the Federal Coastal Zone Management Act, the Wisconsin Coastal Management Program works to preserve, protect, and wisely use the resource of the Lake Michigan and Lake Superior coastline for this and future generations. The Wisconsin Coastal Management Program (WCMP) provides guidance and grants to encourage the management and protection of Wisconsin's coastal resources and to increase public access to the Great Lakes. The WCMP is housed at the

Wisconsin Department of Administration, Bureau of Housing and Intergovernmental Relations. The WCMP has constituted an interagency coastal hazards work group formed by staff from the WDNR, University of Wisconsin-Madison's Sea Grant Institute, State Cartographer's Office, and the Wisconsin Emergency Management Program as a forum to coordinate initiatives related to coastal management in the State.

The University of Wisconsin Sea Grant is a statewide program of basic and applied research, education, and outreach and technology transfer dedicated to the stewardship and sustainable use of the Great Lakes. The Sea Grant staff has, over the years, provided substantial support to the City of Milwaukee in dealing with Lake Michigan shoreline management issues.

The State of Wisconsin, through the WDNR, regulates shore protection-related activities under the provisions of Chapter 30 of the *Wisconsin Statutes*. State regulatory authority with respect to shore protection and erosion control projects is largely confined to projects initiated at or below the ordinary high water mark. For example, Chapter 30 provides for the establishment of bulkhead lines by local units of government, which delineate an artificial shoreline and allow the deposit of materials or filling up to the bulkhead line if standards for the protection of fish, wildlife, and water quality are met. Under Chapter 30, the installation of riprap and shore protection structures on the bed and bank of the water, or the unbroken slope from the ordinary high water mark requires a WDNR permit.

Although the WDNR regulates shore protection-related activities throughout most of the Lake Michigan shoreline of the State, 93 percent of the immediate shoreline in Milwaukee County is regulated under lakebed grants made to the City of Milwaukee or to Milwaukee County between 1909 and 1973. The only two shoreline areas not regulated under lakebed grants are the 2,920-foot reach of shoreline within the City of Milwaukee just north of the City of Milwaukee Linnwood Avenue water treatment plant, and the 9,070-foot reach of shoreline along the Fox Point terrace near N. Beach Drive.

The lakebed grants made to the City of Milwaukee or to Milwaukee County govern submerged lands extending into Lake Michigan, and under the terms of the grants are to be held and used by the City or the County for navigation or harbor facilities, public parks, or highway purposes.

The City of Milwaukee, under Chapter 8 of the Code of Ordinances, requires that a City permit be obtained for the construction of dock improvements within the City lakebed grant areas. The State of Wisconsin does not regulate shore protection-related activities under Chapter 30 of the *Wisconsin Statutes* within the lakebed grant area.

Evaluation of Alternatives and Identification of Mitigation Actions
A review of the alternative measures noted above and the status of ongoing programs indicates that all of the measures noted above are considered to be appropriate for inclusion in the City of Milwaukee hazard mitigation plan. The measures noted have been developed, evaluated, and recommended in other studies and programs.

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 section below), and action by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to Lake Michigan coastal hazards are included in updated hazard mitigation plan for the City of Milwaukee:

- Continued enforcement and review of the City of Milwaukee shoreland regulations and policies relating to structural shoreline erosion protection.

- Continued construction and maintenance of shoreline protection structures to protect urban development in selected areas of the City of Milwaukee.

- In cooperation with other programs, such as the Wisconsin Coastal Management program, carry out public informational and educational programming on shoreline erosion hazards and proper property owner shoreline and bluff management actions.

Because these measures are intended to be ongoing efforts, the Steering Committee decide to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR WINTER STORMS

As described in Chapter III, winter storms are natural hazard events of moderate concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate this type of hazard. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
As discussed in Chapter III, winter storm events can pose a serious threat to the City of Milwaukee. Severe winter weather can include blizzards, freezing sleet, and dangerous combinations of temperatures and wind. Winter storms may last for days or weeks completely shutting down businesses and government, while isolating residents in their homes. Extreme cold temperature, often connected to winter storm events, is the number two leading natural hazard cause of deaths in the State. Additionally, unsuspected fatalities associated with winter storms include heart attacks while shoveling snow and fires caused by the improper use of space heaters. Severe winter storm fronts can often be tracked, which generally provides ample warning for potentially affected areas to take preventative and cautionary actions.

While it may not be possible to accurately predict the number or severity of winter storm events, measures can be taken to reduce the potential damage caused by winter storms and their related hazards whenever they may occur in the City of Milwaukee. High-wind, freezing rain, sleet and snow may be associated with a winter storm. In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to these dangers have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

- Review local building codes to determine if revisions are needed to improve the structures ability to withstand greater wind velocities and snow weight. Building code provisions considered may include requirements, such as construction methods that employ cross-bracing, anchoring of walls to foundation, and anchoring roof rafters to walls (also mitigates tornado risk) and measures to provide wind protection and retrofits for vulnerable features, such as windows, garage doors, patio doors, double-wide entry doors, siding, and bracing for walls and rafters.

- Review the energy efficiency and winter readiness of critical facilities and housing in the community.

- Work with utility companies to assess and improve, as needed, electric service systems reliability;

- Consider burying utilities at critical and vulnerable junctions to avoid power loss due to downed lines;

- Establish, update, and/or monitor public early warning systems and networks;

- Trim and maintain the health of trees near vulnerable infrastructure, such as utility lines, essential facilities and roads, as well as near homes and businesses;

- Promote planting windbreaks and installing snow fence to protect highways;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and

- Public Informational and Educational Programming

  — Promote winter hazard awareness, including home and travel safety measures, such as avoiding travel during winter storms, and having a shovel, sand, warm clothing, food, and water, if travel cannot be avoided, and installing a back-up heating system in at least one room in the home;

  — Increase the coverage and use of NOAA Weather Radio and EAS broadcasts;

  — Promote inclusion of safety strategies for severe weather events in driver education classes and materials;

  — Encourage residents to develop a Family Emergency Preparedness Plan, including the preparation of a Disaster Supply Kit (Appendix D);

  — Produce and distribute emergency preparedness information related to winter storm hazards; and

  — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Current Programs

Federal and State Programs

Wisconsin Emergency Management, in conjunction with the National Weather Service, other State agencies, and local emergency management organizations, provides awareness and preparedness information to the public. This information is provided in three severe weather awareness campaigns conducted throughout the year, each focusing on the prevalent weather hazard at that time. In November of each year, Winter Awareness Week focuses on informing and educating people concerning the hazards presented by severe winter weather and information on preparedness for extreme weather conditions during winter.

The Wisconsin Building Code specifies design requirements to minimize vulnerability to winter storms by setting the load capacity of roofs by region based on likely maximum snowfall. The National Weather Service reports that 70 percent of winter storm fatalities occur in automobiles, therefore, listening to weather advisories and avoiding travel during winter storms would help prevent many fatalities.

In the event of severe winter weather, the National Weather Service posts winter weather bulletins. These bulletins consist of advisories, watches, and warnings that are issued concerning expected winter weather conditions. Some are used to alert the public of potentially dangerous weather related advisories for events, such as snow, winter weather, freezing rain or freezing drizzle, and blowing and drifting snow. Others are used to warn the public of more serious weather situations which could pose a threat to life and property: winter storm watch and winter storm, heavy snow, blizzard, ice storm, and sleet warnings. These bulletins are disseminated over a number of telecommunication channels, including the NOAA Weather Radio, the NOAA Weather Wire and the State law enforcement TIME system. These weather information sources are routinely monitored by local media, which rebroadcast the weather bulletins over public and private television and radio stations.

The National Weather Service recognizes the need for programs that assist communities in implementing procedures and plans that would reduce risk during a weather disaster. The National Weather Service has developed StormReady, a voluntary program that assists communities with weather-related disaster planning and management. This program encourages communities to take a pro-active approach to develop local hazardous weather

operations plans and public awareness for all types of severe weather threats. By participating in StormReady, local agencies can earn recognition for their communities by meeting criteria established by the National Weather Service in partnership with Federal, State, and local emergency management professionals. The Milwaukee/ Sullivan National Weather Service Office promotes and administers the StormReady program that assists community or county emergency management agencies in Southeastern Wisconsin, including Milwaukee County. Milwaukee County Office of the Sheriff, Emergency Management Bureau, has taken the necessary actions to qualify Milwaukee County for StormReady designation and is pursuing such designation for the County.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, including winter storm incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

One of the greatest concerns with winter storms is maintaining a safe and clear transportation network. Safety measures include plowing, salting and sanding roads in order to improve both public and emergency response access during winter storms. The Wisconsin Department of Transportation (WisDOT) contracts with the Milwaukee County Highway Department and is responsible for plowing over 1,100 miles of interstate, Federal, and State highways within Milwaukee County. The City of Milwaukee Department of Public Works is responsible for maintaining the 1,400 miles of secondary roads throughout the City.

Preventative community strategies include maintaining the health of urban trees to minimize damage from ice storms and promoting sound levels of home insulation. Older homes can be vulnerable to heat loss and any home is vulnerable to power loss, therefore, possession of an alternative heat and power source is a consideration in protecting against winter storm hazards.

As described in Chapter II, Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including winter storms.

Evaluation of Alternatives and Identification of Mitigation Actions

Analysis of the vulnerability of humans, infrastructure, and economic production to winter storms and related hazard events demonstrates that the provision of advanced weather forecasts and warning systems, as well as public informational and educational programming, are the most important mitigation actions to be considered. In addition, informing the public of the significance of winter storm watches and warnings so that they take these events seriously and know where to seek shelter in emergency situations, are important, ongoing components to minimizing the risks associated with these natural hazards. The formation of a neighborhood outreach program to locate isolated, vulnerable or special-needs populations likely to be affected by winter storms is an important element in ensuring that these vulnerable population groups are protected during these events. Community and school based informational programs are currently being conducted by the City of Milwaukee and Milwaukee Public Schools in partnership with Federal, State and local authorities.

Winter storms and their related hazards can potentially impact all of the City of Milwaukee. In addition, these severe events can potentially cause multiple damages to a variety of infrastructure, including transmission lines, communication lines, and transportation routes due to blinding and ice. The City of Milwaukee, Milwaukee County, and relevant agencies and businesses are encouraged to coordinate hazard mitigation activities through local government participation in countywide disaster planning and response mechanisms. Such measures are already well underway through the coordinated emergency operations planning program involving Milwaukee County Office of the Sheriff, Emergency Management Bureau, and coordinated local community emergency operations programs.

Priority Mitigation Measures

Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 section below), and review and action by the City of Milwaukee Hazard Mitigation Plan Steering Committee (see Appendix A), the following mitigation measures related to winter storm events are included in the updated hazard mitigation plan for the City of Milwaukee:

- Organize neighborhood outreach groups who look after vulnerable groups and individuals;
- Provide special arrangements for payment of heating bills;
- Identify and advertise a list of available heated shelters in the immediate area;
- Increase coverage and use of NOAA Weather Radio and EAS broadcasts;
- Promotion of educational and informational programming. COAD may be able to provide assistance in these educational efforts;
- Ongoing review and enforcement of building code ordinance requirements; [18]
- Work with agencies, such as the American Red Cross, to establish a system to provide for short-term shelters and shelter operations during severe winter storm event situations;
- Continued coordination of emergency response plans among governmental units and first responders;
- Continue and refine State, County, and City road maintenance programs;
- Work with utilities to assess and improve, as needed, electrical service systems reliability;
- Continue to work towards compliance with the National Incident Management System; and
- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

[18] *The State Uniform Dwelling Code (UDC) is a statewide regulation that sets standards for fire safety, structural strength, energy conservation, erosion control, heating, plumbing, and electrical systems, and general health and safety in dwellings constructed or altered after 1980. The UDC applies uniformly throughout the State, and local governments may not adopt a more or less stringent code. Consequently, should review of local ordinances reveal that a change in the building code would be a viable mitigation measure, the City would need to pursue a change in the UDC at the State level.*

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR EARTHQUAKES

As described in Chapter III, earthquakes are natural hazard events of minimal concern relative to the City of Milwaukee Hazard Mitigation Plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
Earthquakes pose a very minor threat to the City of Milwaukee and as discussed in Chapter III, the community impacts are considered not to be significant. Historically, earthquakes have only caused moderate shaking felt in the City of Milwaukee and have not resulted in any major destruction. The New Madrid fault is the nearest major, active fault and it lies approximately 500 miles south of the City of Milwaukee. Earthquake tremors have occurred in the City of Milwaukee, but are very rare events and of a weak magnitude. They are, therefore, a low-priority hazard in the City of Milwaukee mitigation plan.

Earthquakes can cause considerable damage to life and property if they originate close and reach a strong magnitude. Measures can be taken to reduce the potential injuries and fatalities caused by earthquakes wherever they may occur in the City of Milwaukee. In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to earthquake events have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

- Review local building codes to determine if revisions are needed to improve the structures ability to withstand moderate shaking. Building code provisions considered may include requirements, such as construction methods that employ cross-bracing, anchoring of walls to foundation, and anchoring roof rafters to walls and retrofits for vulnerable features, such as windows, garage doors, patio doors, double-wide entry doors, siding, and bracing for walls and rafters;

- Use safe interior designs and furniture arrangements;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and

- Public Informational and Educational Programming

    — Increase public education and awareness of the potential of earthquakes;

    — Increase the coverage and use of NOAA Weather Radio and EAS broadcasts;

    — Encourage residents to develop a Family Emergency Preparedness Plan, including the preparation of a Disaster Supply Kit (Appendix D); and

    — Produce and distribute emergency preparedness information related to earthquake hazards.

Current Programs
Federal and State Programs
The City of Milwaukee is not likely to suffer directly from a severe earthquake. The primary concern to the City of Milwaukee is the disruption in the provision of essential goods and services from the direct-impact area of a major earthquake. The Central United States Earthquake Consortium (CUSEC), under FEMA, is engaged in an

ongoing effort to reduce the hazards associated with earthquakes. Although Wisconsin is not one of the states directly involved in this program, Wisconsin Emergency Management and the State indirectly benefit from its planning and actions. The program's hazard reduction efforts focus on determining the potential consequences of major earthquake events in the New Madrid seismic zone, reducing or managing negative consequences through use of zoning or building codes, increasing enforcement of local mitigation codes or regulations, and significantly increasing public awareness of earthquake consequences and actions that can be taken to minimize adverse effects.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas, including: training; resource management; personnel qualification and certification; equipment certification; communications and information management; technology support; and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity that would include earthquake incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Priority Mitigation Measures

Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 Section below), and review and action by the City of Milwaukee All Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to earthquake events are included in the updated City of Milwaukee hazards mitigation plan:

- Ongoing review and enforcement of building code ordinance requirements; [19]
- Continued coordination of emergency response plans among governmental units and first responders;
- Continue to work towards compliance with the National Incident Management System; and
- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR CONTAMINATION AND LOSS OF WATER SUPPLY

As described in Chapter III, contamination and loss of water supply are hazard events of moderate concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

[19] Ibid.

Identification of Alternative Mitigation Strategies

The City of Milwaukee is richly endowed with surface water resources of Lake Michigan, as noted in Chapter III of this report. However, these sources of freshwater are not unlimited and surface water resources are subject to contamination, as well as over-use. Contamination and loss of water supply events generally provide no warning making it difficult for potentially affected areas to take preventative actions. In some cases, industries may be particularly vulnerable to loss of water supply, due to equipment and processing needs. In addition, fire protection is an important related issue. If contamination and loss of water supply events would occur, they could potentially last for extended periods of time (weeks or months) and likely would impact a specific water source (well, reservoir, utility, etc.). In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to water supply contamination events have been identified as viable for this update of the City of Milwaukee hazard mitigation plan.

- Promote development of a thorough drinking water supply risk and threat assessment that identifies potential vulnerabilities and targets for sabotage and terrorism attack;
- Manage sewage sludge, chemicals, and hazardous materials effectively in areas that are susceptible to surface water contamination with emphasis on surface water related water quality management areas;
- Develop a standard emergency operation plan for the public water supply system in order to plan procedures for mechanical failures, power outages, unsafe samples, and threats or acts of terrorism;
- Maintenance and potential upgrading water treatment capabilities, including disinfection equipment;
- Maintain municipal water and sewer infrastructure at acceptable operating standards;
- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs below); and
- Public Informational and Educational Programming
    - — Encourage residents to develop a Family Emergency Preparedness Plan, including the preparation of a Disaster Supply Kit (Appendix D); and
    - — Train operators and plant personnel in security awareness and reporting protocols.

Current Programs

Federal and State Programs

There are various governmental and agency programs to help address and fund surface water and groundwater contamination-related issues. The U.S. Environmental Protection Agency administers multiple programs designed to clean up the worst contaminated watersheds throughout the Great Lakes Region. The Milwaukee Harbor estuary and portions of the Milwaukee River, Lincoln Creek, the Menomonee River, and the Little Menomonee River are included in a designated area of concern from pollution and ongoing efforts are being made to mitigate surface water and sediment contamination within this area.

The WDNR oversees several programs related to water supply contamination issues.

Relative to groundwater, the Department oversees several programs. One program is administered by the Department's Bureau for Remediation and Redevelopment (RR). This bureau oversees response actions at spills, hazardous substance release sites, abandoned containers, drycleaners, brownfields (including the Site Assessment Grant Program), "high priority" leaking underground storage tanks, closed wastewater and solid waste facilities, hazardous waste corrective action and generator closures, and sediment cleanup actions. It has primary

responsibility for implementing and aiding cleanups under the Spill Law, the Environmental Repair Law, Federal programs (Superfund, Hazardous Waste Corrective Action, Leaking Underground Storage Tanks (LUST), and Brownfields), the Land Recycling Law and State Brownfield Initiatives, the Drycleaner Environmental Response Fund, and at closed landfills. The RR program provides technical assistance, helps to clarify legal liability, provides financial assistance primarily to local governmental units, and provides technical project oversight of cleanup projects. Another program is the Well Compensation Program, which provides financial assistance through grant monies to remediate or seal contaminated private wells.

The Department also oversees the Source Water Assessment Program which was completed in May 2003, as required by the 1996 reauthorization of the Federal Safe Drinking Water Act (SDWA). The 1996 amendments to the SDWA require states to: 1) delineate assessment area boundaries from which public water systems receive supplies of drinking water, 2) inventory significant potential sources of contamination within those boundaries, 3) determine the susceptibility of the public water systems to those potential sources of contamination, and 4) provide the assessment results to the public. This required assessment was completed for the Milwaukee Waterworks.[20] The WDNR has also sent letters to all municipal water supply system operators recommending steps to be taken for system security purposes.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity that could include contamination of water supply incidents. By 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions will be conditioned by full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

The City of Milwaukee water treatment plants have been upgraded within the past 10 years to include state-of-the-art disinfection systems. In addition, the plants are generally considered to be well maintained and have recently installed substantial security facilities and programs.

The City of Milwaukee operates two facilities where residents can recycle or safely dispose of a wide variety of items, many of which can contaminate water if disposed of improperly. These items include electronics, waste motor oil and other automotive fluids, and scrap metal. In addition, the MMSD has three year-around collection centers for the disposal of household hazardous waste and sponsors periodic mobile collection events for residents of Milwaukee County. The District also sponsors an annual event for unused prescription medication.

Evaluation of Alternatives and Identification of Mitigation Actions

Based upon review of the above, the current ongoing programs represent the planned mitigation action with regard to the continued provision of advanced protection and monitoring measures.

[20]*Wisconsin Department of Natural Resources,* Source Water Assessment for Milwaukee Waterworks, *March 27, 2003.*

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 section below), and review and action by the City of Milwaukee All Hazard Mitigation Steering Committee (see Appendix A), the mitigation measures recently taken and underway by the City of Milwaukee are considered related to contamination or loss of water supply are considered adequate. These include:

- Promotion of educational and informational programming related to water safety issues. COAD may be able to provide assistance in these educational efforts;
- Continued maintenance, operation, and upgrading of the state-of-the-art treatment facilities;
- Continued maintenance, operation, and upgrading of water supply facility security facilities programs and procedures. The WDNR correspondence on this element, including basic security measures to be considered can be found in Appendix E;
- Continued coordination of emergency response plans among governmental units and first responders;
- Continue to work towards compliance with the National Incident Management System; and
- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service);

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR HAZARDOUS MATERIAL INCIDENTS

As described in Chapter III, hazardous material incidents are human-induced hazard events of limited concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
As described in Chapter II, a significant number of fixed facilities that store hazardous substances are located within the City of Milwaukee. In addition, a transportation system is in place to move hazardous materials throughout the City of Milwaukee. There have been a limited number of minor hazardous material incidents, all of which have been properly handled through local emergency response actions.

Hazardous materials are present in quantities of concern in business and industry, universities, hospitals, utilities, and other facilities in the City of Milwaukee. Despite extensive precautions taken to ensure careful handling during manufacture, transport, storage, use, and disposal, accidents and inadvertent releases may occur. In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to hazardous material incidents have been identified as viable for the updated City of Milwaukee hazard mitigation plan.

- Promote community and operator compliance with industry safety regulations and standards;
- Promote control, enforcement, and cleanup of hazardous materials, including proper disposal of chemicals;

- Promote development of site emergency plans for schools, factories, office buildings, shopping malls, hospitals, and other appropriate sites;

- Promote proper design, construction, maintenance and inspections of hazardous material storage facilities, pipelines, and other related facilities;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below); and

- Public Informational and Educational Programming

  — Promote the current household hazardous waste management program; and

  — Promote public awareness of hazardous material dangers and personal protection actions for these dangers; and

  — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Current Programs

Federal and State Programs

In accordance with The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 and Chapter 166 of the *Wisconsin Statutes*, a Local Emergency Planning Committee (LEPC) has been established in Milwaukee County and in other counties in Wisconsin. Wisconsin Emergency Management has been charged with the duties of the State Emergency Response Commission and is the oversight organization for the EPCRA grant program, the emergency response system, and establishes training standards for the State and the LEPCs. In Wisconsin, the Federally mandated local planning districts have countywide jurisdiction, and the LEPCs develop emergency response plans and prepare for hazardous material emergencies within their individual counties. Each LEPC is required to coordinate its planning activities with local response agencies and local industries that handle extremely hazardous substances above threshold planning quantities (TPQs), and to develop emergency response plans for the transportation of hazardous materials through their communities. Additionally, facilities are required to make emergency release notification to the National Response Center, the State EPCRA program and LEPC whenever there is a release of an “extremely hazardous substance” or other hazardous substances listed under the Comprehensive Environmental Resources and Conservation Liability Act (CERCLA).

The National Pipeline Mapping System (NPMS) is a geographic information system (GIS) dataset of locations of hazardous liquid and gas transmission pipelines, breakout tanks, and liquefied natural gas plants. The system was created by the U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration, and Office of Pipeline Safety in cooperation with other Federal and State government agencies and the pipeline safety industry. This dataset consists of geospatial data, attribute data, public contact information, and metadata pertaining to the interstate and intrastate hazardous liquid trunklines and hazardous liquid low-stress lines, as well as gas transmission pipelines, liquefied natural gas plants, and hazardous liquid breakout tanks within the legal authority of the Pipeline and Hazardous Materials Safety Administration.

In the State of Wisconsin, there are eight regional emergency response teams that mitigate Level A releases at fixed facilities, as well as transportation incidents. One of these Level A response teams is located in the City of Milwaukee. A Level A release involves the most hazardous types of materials and requires the highest degree of protection for the emergency responder, including both respiratory and skin protection. Registration fees assist with equipping the City of Milwaukee Level A team. Wisconsin Emergency Management develops policy and administers the programs that support regional emergency response teams.

Through public educational programs, emergency managers in Wisconsin counties are required to make the public aware of certain hazardous materials located at local facilities. Information about these facilities is shared with the public through the Milwaukee County Local Emergency Planning Committee (LEPC). The LEPC consists of representatives of a cross-section of individuals from Milwaukee County, including, but not limited to, elected officials, members of emergency response agencies, media representatives, community and environmental groups, and facility representatives from the community. Types of material, quantities stored, and their inherent dangers are discussed during quarterly LEPC meetings. Facilities having these hazardous materials are required to give this information to Wisconsin Emergency Management and to prepare written plans to respond to possible spills.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity that could include hazardous material incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

The Milwaukee County Office of the Sheriff, Emergency Management Bureau, and the LEPC are responsible for developing, maintaining, and updating emergency response plans for offsite facilities that use, receive, and store hazardous materials. This applies to both fixed facilities and vehicles used for transporting hazardous materials. Milwaukee County Office of the Sheriff, Emergency Management Bureau, and the LEPC are also responsible for receiving and maintaining files. The LEPC also maintains a countywide hazardous materials emergency response plan that contains information on protective actions, such as how to reach the facility coordinator in an emergency, evacuation, and in-place sheltering. The LEPC coordinates annual training exercises for emergency response agencies and other local government officials in the release of hazardous chemicals from both fixed facilities and vehicles.

The City of Milwaukee Fire Department Bureau of Special Operations maintains a hazardous materials response team (HAZMAT). This team is comprised of firefighters that have received specialized training and certification to respond to chemical-related emergencies. In the event of a Level A hazardous materials incident, the City of Milwaukee is served by one of eight regional hazardous material response teams: the Milwaukee Regional Hazardous Materials Response Team. This response team is comprised of members of the Milwaukee Fire Department, and includes members of the City of Milwaukee Fire Department's HAZMAT team. The Milwaukee Regional Hazardous Materials Response Team mitigates releases at fixed facilities, as well as transportation incidents in a five-county area that includes Milwaukee, Jefferson, Ozaukee, Washington, and Waukesha Counties. A Level A release involves the most hazardous types of materials and requires the highest degree of protection for the emergency responder, including both respiratory and skin protection. Wisconsin Emergency Management develops policy and administers the programs that support regional emergency response teams

As described in Chapter II, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and the Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including hazardous materials incidents.

Evaluation of Alternatives and Identification of Mitigation Actions
Based upon review of the above, the current ongoing programs represent the major component of the planned mitigation action with regard to the continued compliance with safety regulation standards and enforcement and public informational and educational programming systems. Other potential mitigation actions include expansion of the current household hazardous waste management program.

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 Section below), and review and action by the City of Milwaukee All Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures, related to hazardous material incidents, which are largely a continuation of existing programs, are included in the updated City of Milwaukee hazards mitigation plan:

- Promotion of educational and informational programming related to hazardous material safety, and to individual actions to protect citizens, property, and businesses. COAD may be able to provide assistance in these educational efforts;

- Promote community and operator compliance with industry safety regulations and standards;

- Promotion of ongoing enforcement of Federal, State, and City of Milwaukee regulatory standards;

- Support existing household waste management control programs;

- Continued support of training, equipment, planning, and preparedness of first responders;

- Continue to work towards compliance with the National Incident Management System;

- Continued coordination of emergency response plans among governmental units, businesses and first responders; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers in Police Service).

Because these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR PUBLIC HEALTH EMERGENCIES

As described in Chapter III, public health emergencies involving natural and human-induced hazard events are of moderate concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
As described in Chapter III, a range of public health emergencies from the individual level, through multi-casualty, to mass-casualty levels can occur throughout the City of Milwaukee. Within the City, the vast majority of the reported emergency medical incidents were associated with infectious diseases compared to any other natural or human-induced hazard events. The 2002 West Nile Virus situation is a good example of a potential health incident. In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to emergency medical incidents and related hazards have been identified as viable for the updated City of Milwaukee hazard mitigation plan.

- Continue to maintain the community public health system with adequate numbers of medical staff, sufficient disease monitoring and surveillance capabilities to adequately protect the population from small- and large-scale epidemics;

- Promote development of site emergency plans for schools, factories, office buildings, shopping malls, hospitals, and other appropriate sites;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below);

- Provide community support of clinics and school health services;

- Direct preventive actions toward specific medical situations as needed. For example, preventive actions considered for West Nile Virus include: mosquito abatement measures, such as catch basin cleaning or spraying and general spraying; standing water reduction actions; and individual actions, such as covering and use of repellents;

- Promote pollution control, enforcement, and cleanup, including proper disposal of chemicals and scrap materials;

- Improve ventilation techniques in areas or facilities prone to crowding, or areas that may involve exposure to contagion or noxious atmospheres;

- Promote demolition and clearance of vacant, condemned structures to prevent rodent infestations;

- Continue to maintain community water and sewer infrastructure at high operating standards; and

- Public Informational and Educational Programming

    — Promote public awareness of the causes, symptoms, and protective actions for disease outbreaks and other potential public health emergencies;

    — Promote public awareness of radon dangers and personal protection actions for these dangers;

    — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Medical Reserve Corps, and Volunteers In Police Service);

    — Encourage residents to receive immunizations against communicable diseases, including annual flu shots; and

    — Promote preventive actions for specific medical situations, such as West Nile Virus actions involving reducing public unprotected exposure to mosquitoes.

Current Programs

Federal and State Programs

The Department of Health and Human Services (HHS) is the United States government's principal agency for protecting the health of all Americans and providing essential human services, especially for those who are least able to help themselves. The Department includes more than 300 programs, covering a wide spectrum of activities Some highlights include:

- Medical and social science research;
- Preventing the outbreak of infectious disease, including immunization services;
- Assuring food and drug safety;
- Medicare (health insurance for elderly and disabled Americans) and Medicaid (health insurance for low-income people);
- Financial assistance and services for low-income families;
- Improving maternal and infant health;
- Head Start (pre-school education and services);
- Preventing child abuse and domestic violence;
- Substance abuse treatment and prevention;
- Services for older Americans, including home-delivered meals; and
- Comprehensive health services for Native Americans.

HHS is the largest grant-making agency in the Federal government, providing almost 87,000 grants in fiscal year 2009. The HHS Medicare program is the nation's largest health insurer, handling more than one billion claims per year.

HHS works closely with State, local and tribal governments, and many HHS-funded services are provided at the local level by State, city, or tribal agencies, or through private sector grantees. The Department's programs are administered by 11 HHS operating divisions, including eight agencies in the U.S. Public Health Service and three human services agencies. In addition to the services they deliver, the HHS programs provide for equitable treatment of beneficiaries nationwide, and they enable the collection of national health and other data.

The Centers for Disease Control and Prevention (CDC) is an agency of the Department of Health and Human Services and recognized as the lead Federal agency for protecting the health and safety of people both at home and abroad. The CDC provides credible information to enhance health decisions, and promotes health through strong partnerships. CDC serves as the national focus for developing and applying disease prevention and control, environmental health, and health promotion and education activities designed to improve the health of the people of the United States.

The CDC's mission is to promote health and quality of life by preventing and controlling disease, injury, and disability. CDC seeks to accomplish its mission by working with partners throughout the nation and world to monitor health, detect and investigate health problems, conduct research to enhance prevention, develop and advocate sound public health policies, implement prevention strategies, promote healthy behaviors, foster safe and healthy environments, and provide leadership and training. In addition, the CDC has developed and sustained many vital partnerships with public and private entities that improve service to the American people.

The Wisconsin Department of Health Services (WDHS)[21] works in partnership with local governments, health and human services agencies, private providers, and concerned and affected citizens to:

- Foster the availability and accessibility of care, treatment and other assistance for persons most in need through careful planning of services and efficient distribution and use of resources.

- Promote individual, family and community well-being and health through vigorous programs to reduce or prevent avoidable illness, disability or dependency and their associated costs.

- Encourage local public and private initiative and support for human service programs.

- Give priority to the interests and needs of vulnerable persons, including children and the elderly, those in need of long-term support, and families.

- Provide for public safety and protection through programs for adult criminal offenders who are mentally or emotionally impaired.

- Provide incentives and oversight so that public funds are put to effective use. Programs must be characterized by acceptable quality without unnecessary cost, accountability without needless paperwork, creativity and innovation without loss of purpose, and efficiency without jeopardizing access, equity or availability.

- Carryout these responsibilities with the participation and advice of communities, providers, clients, and citizens in a way that respects the dignity and self-reliance of everyone involved.

The WDHS' mission is to protect and promote the health and safety of the people of Wisconsin. The Department's goals are to assure the health, safety, and well-being of Wisconsin citizens, while emphasizing prevention; make Wisconsin a national leader in reforming health care; improve the lives of Wisconsin seniors and people with disabilities; increase opportunities for children to grow up safe, healthy, and successful in strong families; and create a high-performing organization that is customer-focused and values their partners and employees.

In addition to these aforementioned programs there are a number of other related programs within the State of Wisconsin that include: Wisconsin Division of Public Health (WDPH), Wisconsin Hospital Association (WHA), Wisconsin Association of Local Health Departments and Boards (WALHDAB), Wisconsin Medical Society (WMS), University of Wisconsin and The Medical College of Wisconsin, Bureau of Local Public Health Practice and Emergency Management Services, Wisconsin Emergency Management (WEM), Wisconsin Primary Health Care Association (WPHCA), Rural Wisconsin Health Cooperative (RWHC), Wisconsin Office of Rural Health (WORH), and the Children's Hospital of Wisconsin Poison Center.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and

[21]*As of July 1, 2008, the former Wisconsin Department of Health and Family Services became the Wisconsin Department of Health Services (WDHS) and the Wisconsin Department of Children and Families (WDCF) was created. The WDHS continues to provide the health-related programs that were the responsibility of the old department, while the WDCF provides programs that serve children and families, such as child welfare services, child support services, child care programs, and Wisconsin Works (W-2).*

disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, and could include public health emergency incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

Local Programs

As described in Chapter II, there are a total of 36 fire houses with 12 paramedic units and three fire department special teams, seven hospitals, and seven police stations distributed throughout the City of Milwaukee (see Appendix B for more details). In the event of a major public health emergency, these units along with the City of Milwaukee Health Department are the primary responders for the health and safety of the residents of the City of Milwaukee.

The City of Milwaukee Health Department's mission is to ensure that services are available to enhance the health of individuals and families, promote healthy neighborhoods, and safeguard the health of the Milwaukee community. Their goal is to ensure that the City of Milwaukee has the best personal and environmental health care, and population-based preventive services possible.

The City of Milwaukee Health Department is comprised of three multidisciplinary divisions: disease control and environmental health, family and community health, and laboratory services. These divisions assess public health needs, develop public policy on health related issues, and provide services to the public. The City of Milwaukee's Health Department foster cooperation between public, private and nonprofit sectors of the health industry in order to accomplish public health-related goals. The Health Commissioner serves as the Department's medical and executive director and is the City's legal health officer. The Health Commissioner is assisted by the Health Operations Administrator, the Medical Director and Chief Medical Officer, and Directors of Public Health Research and Policy, Disease Control and Environmental Health, Family and Community Health Services, and Public Health Laboratories. In addition, the Department employs epidemiologists who track health and disease trends within the community.

As described in Chapter II, Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including hazardous materials incidents.

Evaluation of Alternatives and Identification of Mitigation Actions

Based upon review of the above, the current ongoing programs represent the major component of the planned mitigation action with regard to the continued prevention, control, and preparedness for medical emergency incidents, and public informational and educational programming systems.

Priority Mitigation Measures

Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 Section below), and review and action by the City of Milwaukee All Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to public health emergencies are included in the updated City of Milwaukee hazards mitigation plan:

- Promotion of educational and informational programming related to general public health and safety issues. In this regard, increasing awareness of specific public health issues is important. For example, topics, such as radon dangers and viable prevention efforts and West Nile Virus prevention measures, should be specifically covered;

- Strengthen public health infrastructure to support surveillance, response, reporting, and research, and to implement prevention and control programs;

- Provide the public health work force with the knowledge and tools needed for the early detection and control of diseases and disease vectors;

- Continue to support and review policies for vacant structure demolition to minimize potential rodent infestation;

- Implement specific health issue mitigation and prevention strategies;

- Ensure prompt implementation of prevention strategies and enhance communication of public health information about emerging diseases, their vectors, and control measures;

- Continue to work towards compliance with the National Incident Management System; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Fire Corps, Medical Reserve Corps, and Volunteers In Police Service).

Because most of these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR TERRORISM INCIDENTS

As described in Chapter III, terrorism involving human-induced hazard events is of moderate concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies
As described in Chapter III, a range of terrorism incidents from the individual level, through multi-casualty, to mass-casualty levels have the potential to occur throughout the City of Milwaukee. The magnitude and scope of a terrorism incident is also dependent upon the technological means available to the terrorists, nature of the political issue motivating the act, and points of weakness of the terrorism target. In review by the City of Milwaukee All Hazards Mitigation Plan Steering Committee, the following measures to reduce vulnerability to terrorism incidents and related hazards have been identified as viable for the updated City of Milwaukee hazard mitigation plan.

- Promote development of a thorough community risk and threat assessment that identifies potential vulnerabilities and targets for sabotage, terrorism, and/or weapons of mass destruction (WMD) attack;

- Promote development of site emergency plans for schools, factories, office buildings, shopping malls, hospitals, and other appropriate sites;

- Promote alertness, awareness, and monitoring of organizations and activities that may threaten the community;

- Establish clear communication lines with the State of Wisconsin Department of Military Affairs, Wisconsin Emergency Management, as the means to access assistance from the Wisconsin National Guard;

- Continue to participate in Federal programs, such as the Urban Area Security Initiative and the Law Enforcement Terrorism Prevention Program;

- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below);

- Provide legitimate channels of political and public expression;

- Establish avenues of reporting (and potential rewards) for information preventing terrorist incidents and sabotage;

- Promote consistent use of computer data back-up systems and anti-virus software;

- Develop and promote workable population protection plans, such as evacuation and in-place sheltering plans, as appropriate;

- Promote increased security measures at water supply facilities that could include increased security patrols, and/or increased monitoring for pathogens and chemical toxins;

- Heighten security at public gatherings, special events, and critical community facilities and industries; and

- Public Informational and Educational Programming

    — Promote public awareness of terrorism-related dangers and personal protection actions for these dangers;

    — Promote community awareness of designated shelters and accident warning systems;

    — Promote greater awareness of, and provision for, mental health services in schools, workplaces, and institutional settings;

    — Increased coverage and use of NOAA Weather Radio, which can provide notification to the community during any period of emergency, including enemy attack;

    — Promote adequate training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments, and other responders for a variety of terrorist/sabotage/WMD attacks;

    — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Medical Reserve Corps, and Volunteers In Police Service); and

    — Promote development and testing of internal emergency plans and procedures by businesses and organizations.

Current Programs

Federal and State Programs

At the Federal level, initiatives to combat terrorism are coordinated through the Department of Homeland Security (DHS), Since its establishment, DHS has been the lead Federal agency responsible for preparing for and responding to terrorist attacks, in addition to being the lead Federal agency for preparing for, responding to, and recovering from any accidental man-made or natural disasters.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity that could include terrorism incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

The Urban Area Security Initiative (UASI) program provides financial assistance to address the multi-discipline planning, operations, equipment, training, and exercise needs of high-threat, high-diversity urban areas. The program assists these areas in building and sustaining capabilities to prevent, protect against, respond to, and recover from threats or acts of terrorism. Priorities include:

- Enhancing citizen preparedness and participation;
- Enhancing information sharing;
- Enhancing mass prophylaxis capabilities;
- Enhancing medical surge capabilities;
- Enhancing regional collaboration;
- Implementing the National Infrastructure Protection Program;
- Implementing the National Incident Management System; and
- Improving interoperable communications.

Since Federal fiscal year 2004, the Milwaukee metropolitan area has been designated a UASI site. Expanded in FFY 2006, the UASI region now covers the City of Milwaukee and the Counties of Milwaukee, Ozaukee, Racine, Washington, and Waukesha. Since FFY 2004, approximately $42 million has been allocated to numerous agencies across the Milwaukee UASI Region.

In coordination with Wisconsin's investment justifications, in FFY 2010, the Milwaukee UASI allocated:

- Approximately $1,319,285 to enhance the Southeast Wisconsin Terrorism Alert Center (STAC), the UASI intelligence fusion center;
- Over $981,000 to enhance the region's Chemical, Biological, Radiological, Nuclear, and Explosive (CBRNE) capability by upgrading fire service equipment, enhancing law enforcement's explosive ordinance disposal (EOD) equipment, and enhancing regional public health laboratory analysis capability; and
- Approximately $531,000 on several public health and community preparedness projects. Such projects include regional tactical EMS training, buying and stocking a mass casualty trailer, a disaster life support training course, buying and stocking a special needs population trailer, and purchasing equipment for other projects (including WI-TRAC and the 211 phone system).

Wisconsin anti-terrorism efforts are coordinated by the Department of Military Affairs, Wisconsin Emergency Management in cooperation with various other Federal, State, and local agencies. A Wisconsin Interagency Working Group on Terrorism, which includes numerous State agencies and advisory members from Federal agencies, was initiated by the Governor in 1997. This group has been working with Wisconsin Emergency Management on Weapons of Mass Destruction and other terrorism related issues.

The response to terrorism is initially local, with response assistance from Federal and State agencies. Therefore, counties have been requested to add an Anti-Terrorism Response Appendix to their existing Emergency Operations Plan (EOP). This appendix was added to the Milwaukee County EOP. This plan is updated annually. Initially in 1999, 13 of the largest counties in Wisconsin, including the City of Milwaukee, were the focus of additional training, assessment and planning efforts, specifically including the development of a the City of Milwaukee WMD plan and exercises to test the plans.[22] These counties make up 61 percent of the population of Wisconsin.

In 1996, U.S. Congress passed the "Defense Against Weapons of Mass Destruction Act". Under this legislation, the Cities of Milwaukee and Madison were chosen to receive equipment and training from the United States Department of Defense and other Federal agencies to prepare for a WMD event. Since then, the City of Milwaukee has received over $300,000 in Federal aid in training and exercise assistance. The program has since been expanded.

During the year 2000, all counties were offered the opportunity to obtain funding to conduct weapons of mass destruction assessments and develop county emergency operations plans. The availability of funding allowed approximately 50 Wisconsin counties to receive training and begin to conduct weapons of mass destruction assessments as part of the Department of Justice's assessment program. These assessments continued into the fiscal year of 2001. Part of this overall assessment includes the identification of potential targets, as well as threat and risk potentials within the City of Milwaukee and Milwaukee County. The assessments also included determinations of the current and needed capabilities of local response agencies with regard to WMD incidents. These capabilities will include a review of equipment, training and exercise needs. These county assessments, along with similar assessments being conducted at the State level, will provide the information necessary for the development of a statewide WMD strategy to enhance response to potential WMD incidents.

Since the late 1990s, WMD training has been provided by the Wisconsin Technical College System through the National Fire Academy. The Wisconsin Technical College System received a Federal Emergency Management Agency funding grant to provide Weapons of Mass Destruction training to first responders. This grant provides funding for the Emergency Response to Terrorism series of courses developed by the National Fire Academy. Wisconsin Emergency Management in partnership with the Wisconsin Technical College System has coordinated the delivery of these courses and the delivery of training courses to develop a cadre of instructors in the State. In addition, the Wisconsin Department of Health Services provides online training in response to weapons of mass destruction through the WI-Train training website.[23]

As counties develop their WMD plans, many are conducting local exercises to test these plans. Limited funding has been available to counties for conducting these exercises. Wisconsin Emergency Management is coordinating the development and conduct of WMD table top and functional exercises to test and further refine the State WMD plan.

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[22]http://www.mkesheriff.org/rapidcat/catalog/pagetemplate.cfm?template=/rapidcat/common/viewPage.cfm&PageId=2425&CompanyId=1138

[23]http://wi.train.org/

Another important State program is the availability of the Wisconsin National Guard, which can be accessed through the State of Wisconsin Department of Military Affairs, Wisconsin Emergency Management.

Local Programs

As described in Chapter II, there are a total of 36 fire houses with 12 paramedic units and three specialty teams, seven hospitals, and seven police stations distributed throughout the City of Milwaukee (see Appendix B for more details). In the event of a terrorism attack, these units are the primary responders for the health and safety of the residents of the City of Milwaukee.

The Milwaukee Police Department's Intelligence Fusion Center (IFC) was created in 2009 by combining several units from the Milwaukee Police Department, including the Crime Analysis Section and the Southeastern Wisconsin Threat Analysis Center (STAC). State and major urban area fusion centers serve as focal points within the state and local environment for the receipt, analysis, gathering, and sharing of threat-related information between the Federal government and state, local, and private sector partners. Located in states and major urban areas throughout the country, fusion centers are situated to empower front-line law enforcement, public safety, fire service, emergency response, public health, critical infrastructure and key resources protection, and private sector security personnel to understand local implications of national intelligence, enabling local officials to better protect their communities. Fusion centers provide interdisciplinary expertise and situational awareness to inform decision-making at all levels of government. They conduct analysis and facilitate information sharing while assisting law enforcements and homeland security agencies in preventing, protecting against, and responding to terrorism.

As also described in Chapter II, the Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and the Milwaukee County Office of the Sheriff, Emergency Management Bureau, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including terrorist attacks. The City of Milwaukee All Hazards Mitigation Plan Steering Committee intends that the City of Milwaukee all-hazards mitigation plan be consistent with and complement the procedures and actions set forth by these plans.

Evaluation of Alternatives and Identification of Mitigation Actions

Based upon review of the above, the current ongoing programs represent a major component of the planned mitigation action with regard to the continued prevention, control, and preparedness for terrorist incidents, and public informational and educational programming systems. Feasible mitigation actions include development of a thorough community risk and threat assessment that identifies potential vulnerabilities, heightening security at special events and critical community facilities, development of site emergency plans, and development of emergency water supply source protection measures which may be applicable at the municipality level.

Terrorism incidents could potentially impact the City of Milwaukee. These events can potentially cause multiple damages to a variety of infrastructure, including, transmission lines, utilities, and transportation routes, as well as other critical community facilities in the vicinity of the incident. Hence, there is a need to coordinate hazard mitigation activities through the local government participation in city- and countywide disaster planning and response mechanisms. Such measures are already well underway through the coordinated emergency operations planning program involving the Milwaukee County Office of the Sheriff, Emergency Management Bureau, and coordinated local community emergency operations programs.

Priority Mitigation Measures

Based upon the foregoing evaluation, consideration of risk (see the Hazard Risk Analysis and Prioritization: 2011 Section below), and action by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to terrorism incidents are included in the City of Milwaukee hazards mitigation plan:

- Continue and expand educational and informational programming related to public health and safety issues due to terrorist incidents;

- Continue to participate in Federal programs, such as the Urban Area Security Initiative and the Law Enforcement Terrorism Prevention Program;

- Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential chemical and bio-terrorism attacks;

- Continued support of training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments, and other emergency management services;

- Continued coordination of emergency response plans among Federal, State, and local governmental units, businesses, and emergency management services;

- Continue to work towards compliance with the National Incident Management System; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Medical Reserve Corps, and Volunteers In Police Service).

Because most of these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD MITIGATION PLAN COMPONENT FOR MAJOR FIRE AND EMERGENCY MEDICAL INCIDENTS

As described in Chapter III, major fire and emergency medical incident hazard events are of high concern relative to the City of Milwaukee hazard mitigation plan. This section describes alternate and selected strategies to mitigate these types of hazards. As part of the updating process, these strategies were reviewed and reevaluated by the City of Milwaukee All Hazards Mitigation Plan Steering Committee in light of the updated hazard conditions and hazard mitigation goals documented in Chapters III and IV, respectively.

Identification of Alternative Mitigation Strategies

As described in Chapter III, a range of fire and emergency medical incidents from the individual level, through noncasualty, to mass-casualty levels have the potential to occur throughout the City of Milwaukee. The magnitude and scope of any event is dependent upon the area affected and the type of incident that occurs. Although the annual number of major structure fires in the City of Milwaukee appears to be declining due to educational efforts, the possibility of a major incident occurring continues to exist. The following measures to reduce vulnerability to major fire and emergency medical incidents have been identified as viable for the City of Milwaukee hazard mitigation plan.

- Promote development of site emergency and evacuation plans for schools, factories, office buildings, shopping malls, hospitals, and other appropriate sites;

- Support community outreach and educational programs by the City of Milwaukee Fire Department; these include but are not limited to F.O.C.U.S. (Firefighters Out Creating Urban Safety), Mobile Fire Safety House, Fire Safe Kids School Program, Elder Safe Program, Survive Alive House, and Sesame Street Fire Safety program;

- Promote public programs that support alertness, awareness, and education in regards to fire safety;
- Continue to work towards compliance with the National Incident Management System (see Federal and State Programs section below);
- Promote consistent use of computer data back-up systems and anti-virus software;
- Develop and promote workable population protection plans, such as evacuation plans, as appropriate;
- Heighten security at public gatherings, special events, and critical community facilities and industries; and
- Public Informational and Educational Programming
    - — Promote public awareness of terrorism-related dangers and personal protection actions for these dangers;
    - — Promote community awareness of designated shelters and accident warning systems;
    - — Increased coverage and use of NOAA Weather Radio, which can provide notification to the community during any period of emergency;
    - — Promote adequate training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments, and other responders for a variety of terrorist/sabotage/WMD attacks;
    - — Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Medical Reserve Corps, and Volunteers In Police Service);
    - — Promote development and testing of internal emergency plans and procedures by businesses and organizations.

Current Programs

Federal and State Programs

At the Federal level, there are many programs that provide assistance and aid to fire departments. The United States Fire Administration (USFA), which is within the Department of Homeland Security and FEMA, sponsors the Assistance to Firefighter Grant (AFG) program. In 2009, this program dispersed over $400 million worth of assistance, vehicles, and EMS equipment to over 5,200 fire departments nationwide. As part of the AFG program, the Fire Prevention and Safety Grant specifically provides assistance for fire prevention and safety, and is focused on programs that mitigate fire-related injuries to high-risk populations. The Staffing for Adequate Fire and Emergency Response Grant program (SAFER) provides funding directly to fire departments and volunteer firefighter interest organizations in order to help them increase the number of trained, front line fire fighters available in their communities. The goal of SAFER is to enhance the ability of local fire departments to comply with staffing, response, and operational standards established by the National Fire Protection Association (NFPA) and the Federal Occupational Health and Safety Administration. The Department of Homeland Security also offers Emergency Management Performance Grants for All-Hazards Emergency and Terrorism preparedness. Within the Department of Homeland Security and FEMA, the Emergency Management Institute sponsors training programs, such as CERT and Disaster Field Training Operations (DTFO).

NFPA also offers various programs and awards of assistance, and is a resource for Federal firefighting data.

In 2004, the Department of Homeland Security set forth the NIMS as a directive to increase efficiency and effectiveness in emergency incident management. The NIMS provides a set of standardized organizational structures, such as the ICS, multi-agency coordination systems, and public information systems, as well as requirements for processes, procedures, and systems designed to improve interoperability among jurisdictions and disciplines in various areas. This includes: training, resource management, personnel qualification and certification, equipment certification, communications and information management, technology support, and continuous system improvement. The NIMS integrates existing best practices into a consistent, nationwide approach to domestic incident management that is applicable at all jurisdictional levels and across functional disciplines in an "all-hazards" context in terms of preparing for, preventing, responding to, and recovering from domestic incidents, regardless of cause, size, or complexity, and could include major fire and emergency medical incidents. As of 2007, Federal preparedness assistance funding for State, territorial, local, and tribal jurisdictions is conditioned on full compliance with the NIMS. The City of Milwaukee has complied with the implementation of NIMS.

At the State level, Wisconsin Emergency Management (WEM) within the Department of Military Affairs coordinates with Federal, State, county and local agencies for emergency and disaster response. WEM provides training sessions for emergency managers, law enforcement, fire, EMS, public health, public works, local officials and volunteer organizations. WEM in partnership with the Wisconsin Technical College System has coordinated the delivery and training of courses aimed at firefighting and emergency response throughout the State of Wisconsin. Another important State program is the availability of the Wisconsin National Guard, which can also be accessed through the Wisconsin Department of Military Affairs. The Governor holds the authority to call the Wisconsin National Guard into action during local, county or statewide emergencies.

Local Programs

As described in Chapter II, there are a total of 36 fire houses with 12 paramedic units and three specialty squads, seven hospitals, and seven police stations distributed throughout the City of Milwaukee (see Appendix B for more details). In the event of a major fire or emergency medical incident, these units are the primary responders for the health and safety of the residents of the City of Milwaukee.

As described in Chapter II, Milwaukee County Office of the Sheriff, Emergency Management Bureau, has developed an emergency operations plan, which sets forth an all-hazards action plan. In addition, many of the local municipal departments, such as the fire and police departments and Milwaukee County Office of the Sheriff, have developed emergency operations plans and/or programs which set forth procedures and actions to deal with a range of situations and events, including major fire and medical emergency incidents.

In response to increasing numbers of fatalities related to fires, the Firefighters Out Creating Urban Safety (F.O.C.U.S.) program was created in 1991. Firefighters travel door-to-door in targeted areas to install smoke detectors, explain detector maintenance, replace batteries, provide fire safety tips, and answer questions. Over the last 20 years, F.O.C.U.S. has visited over 71,000 homes and installed over 20,000 smoke detectors. F.O.C.U.S. visited 1,166 homes and installed 1,183 smoke detectors in 2009. The average yearly number of fire deaths has decreased since its inception. Other Milwaukee Fire Department education and prevention efforts include the Survive Alive House, where about 13,000 elementary school children annually learn fire safety and prevention techniques and "Survive Alive" techniques for escaping from a fire, and the Mobile Fire Safety House, which is also used to teach escape practices children and adults. Since the inception of the Survive Alive program, over 300,000 children have received this training. The Milwaukee Fire Department presents other residential, school, and workplace fire safety, extinguisher, and evacuation programs, including the Elder Safe Program and the Sesame Street Fire Safety Program. Through these programs, the Milwaukee Fire Department made contact with almost 312,000 people in 2009 who were educated on fire safety. The City of Milwaukee Fire Department also works with City Building Inspection and the Red Cross to identify homes without smoke detectors.

Evaluation of Alternatives and Identification of Mitigation Actions
Based upon review of the above, the current ongoing programs represent a major component of the planned mitigation action with regard to the continued prevention, control, and preparedness for major fire and emergency medical incidents, and public informational and educational programming systems. Feasible, mitigation actions include development of a thorough community risk and threat assessment that identifies potential vulnerabilities, heightening security at special events and critical community facilities, development of site emergency plans, and development of emergency water supply source protection measures which may be applicable at the municipal level.

Priority Mitigation Measures
Based upon the foregoing evaluation, consideration of risk (see Natural and Other Hazard Risk Analysis included in the following section of this chapter), and review and action by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A), the following mitigation measures related to major fire and emergency medical incidents are included in the updated City of Milwaukee hazards mitigation plan:

- Continue educational and informational programming related to public health and safety issues due to major fire and emergency medical incidents;

- Continue support of training, equipment, planning, and preparedness for local law enforcement, fire, and rescue departments, and other emergency management services;

- Continue building safety inspection efforts;

- Raze condemned buildings;

- Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential fire and major medical emergencies;

- Continue maintenance and promote enhanced fire safety measures at critical facilities, and encourage widespread use of fire safety devices;

- Continue to work towards compliance with the National Incident Management System;

- Continue/enhance coordination of emergency response plans among Federal, State, and local governmental units, businesses, and emergency management services; and

- Promote and expand training through the Southeastern Wisconsin COAD program and encourage citizen involvement in the various components of that program and its affiliated programs (CERT, Medical Reserve Corps, and Volunteers In Police Service).

Because most of these measures are intended to be ongoing efforts, the Steering Committee decided to retain them in the updated plan.

HAZARD RISK ANALYSIS AND PRIORITIZATION: 2011

The major natural and other hazards that have been identified to potentially affect the City of Milwaukee have been compared and ranked by risk for implementation of the mitigation measures set forth in Tables 37 and 38. Additional description of natural and other hazards as well as the vulnerability assessment of the City of Milwaukee to these hazards have been identified and summarized in Chapter III of this report. These priority rankings were based upon the number of incidents per year, number of mortalities, number of injuries, and

Table 37

PRIORITY RANKING OF NATURAL AND OTHER HAZARDS AFFECTING THE CITY OF MILWAUKEE BASED UPON MORTALITY AND INJURY

Order Based on Steering Committee Perception[a]	Natural and Other Hazards	Period of Record	Number of Incidents per Year (average)	Number of Mortalities per Year (average)	Number of Injuries per Year (average)	Sum of Average Mortality and Injury Incidents per Year	Priority Ranking Based on Analysis
7	Medical/health risks (infectious diseases and parasites)	1995-2008	- -	199.3	- -	199.3	1
8	Temperature extremes	1994-2009	2.9	7.6	10.1	17.7	2
5	Major fire and	2000-2009	889 fires	9.8 (fires)	- -	9.8	3
	Emergency incidents		51,894	- -	- -	- -	
3	Tornadoes	1958-2009	0.3	0.0	3.4	3.4	4
4	Thunderstorms, high wind, hail, and lightning	1993-2009	11	0.2	1.2	1.4	5
6	Hazardous materials incident	1971-2009	0.8[c]	0.0[c]	0.8[c]	0.8[c]	6
2	Winter storms	1987-2009	2.3	0.6	0.0	0.6	7
1	Flooding	1993-2009	2.5	0.1	0.1	0.2	8
10	Contamination or loss of water supply	1993-2009	<1	- -[d]	- -[d]	- -[d]	- -
9	Terrorism incident	2000-2009	0.1	- -[e]	- -[e]	- -[e]	- -
11	Coastal erosion	1975-1995	Less than one foot per year	0.0	0.0	0.0	- -
12	Earthquake	1899-2009	<1	0.0	0.0	0.0	- -

[a] *These numbers reflect the ranked order of the hazards assigned by the City of Milwaukee Hazard Mitigation Task Force. For more details see Hazard Identification section and Table 7 in Chapter III in this report.*

[b] *Ranking by Milwaukee County Emergency Management was based solely on natural hazard events.*

[c] *Refers to gas and liquid hazardous materials pipeline incidents within the City of Milwaukee 1971 to 2009.*

[d] *Information on mortalities and injuries is based on one event in 1993 related to a parasitic contamination of the water supply. According to the Wisconsin Division of Health, the estimated number of mortalities was about 69, and approximately 4,400 people were hospitalized. As the water treatment facilities have been upgraded to avoid such contamination, the number of mortalities and injuries are not being considered in the current ranking.*

[e] *Number of incidents is not known.*

Source: National Climatic Data Center; U.S. Department of Transportation, Office of Pipeline Safety; National Consortium for the Study of Terrorism; Wisconsin Department of Health Services; Milwaukee Fire Department; City of Milwaukee Hazard Mitigation Steering Committee; Milwaukee County Pre-Disaster Mitigation Plan; and SEWRPC.

property damage inventories and analyses set forth in Chapter III of this report. Specifically, this prioritization is based upon the protection of human life and health and protection from property damages throughout the City of Milwaukee. Therefore, the major indicators of hazard severity used to rank the natural and other hazards in the City of Milwaukee are based upon the deaths and injuries versus economic losses resulting from such.

As identified in the vulnerability assessment of natural and other hazards to the City of Milwaukee in Chapter III of this report, the magnitude and consequent risk of a particular hazard is dependent upon a number of factors that include, but are not limited to, time (e.g. time of year for thunderstorm, and time in terms of how long an event may last, such as winter storm events), size or scale, frequency of occurrence, population size potentially impacted, and amount of urban growth or development potentially impacted. This does not indicate that less densely populated areas are any more or less important than dense urban areas; however, it does indicate that the

Table 38

PRIORITY RANKING OF NATURAL AND OTHER HAZARDS AFFECTING THE CITY OF MILWAUKEE BASED UPON PROPERTY DAMAGE

Order Based on Steering Committee Perception[a]	Natural and Other Hazards	Period of Record	Number of Incidents per Year (average)	Total Property Damage per Year (average)[b]	Priority Ranking Based on Analysis
5	Major fire and emergency incidents	2000-2009	889 fires 51,894	$18,940,000 (fires) - -	1
1	Flooding	1993-2009	2.5	$15,631,176[d]	2
4	Thunderstorms, high wind, hail, and lightning	1993-2009	11.0	$ 2,724,488[d]	3
3	Tornadoes	1958-2009	0.3	$ 320,427[d]	4
6	Hazardous materials incident	1971-2009	0.8[e]	$ 106,259	5
2	Winter storms	1987-2009	2.3	$ 616[d]	6
11	Coastal erosion	1975-1995	Less than one foot per year	- -[f]	- -
8	Temperature extremes	1994-2009	2.9	- -[f]	- -
9	Terrorism incident	2000-2009	0.1	- -[f]	- -
12	Earthquake	1899-2009	<1.0	- -[f]	- -
10	Contamination or loss of water supply	1993-2009	<1.0	- -	- -
7	Medical/health risks	1995-2008	- -	- -	- -

[a] *These numbers reflect the ranked order of the hazards assigned by the City of Milwaukee Hazard Mitigation Task Force. For more details see Hazard Identification section and Table 7 in Chapter III in this report.*

[b] *Dollar values are adjusted to year 2010 by using the average annual Consumer Price Index (CPI) values from the U.S. Department of Labor, Bureau of Labor Statistics.*

[c] *Ranking by Milwaukee County Emergency Management was based solely on natural hazard events.*

[d] *Based on data from the National Climate Data Center accessed December 2009.*

[e] *Refers to gas and liquid hazardous materials pipeline incidents within the City of Milwaukee 1971 to 2009.*

[f] *Data are not known.*

Source: National Climatic Data Center; U.S. Department of Transportation, Office of Pipeline Safety; National Consortium for the Study of Terrorism; Wisconsin Department of Health Services; Milwaukee Fire Department; City of Milwaukee Hazard Mitigation Steering Committee; Milwaukee County Pre-Disaster Mitigation Plan; and SEWRPC.

more dense urbanized areas have a greater chance of loss in terms of human death, injury, and property damage per hazard event. It is also important to note, as identified in Chapter III of this report, that many disaster events are compounded in nature and not the result of a single event, such as increased flooding hazards and coastal erosion during a severe thunderstorm event. Nonetheless, since the causes of disasters of the past will likely be the best predictor of future disasters, an attempt was made to normalize all of the hazard incidences to an annual average in order to understand the relative potential level of risk each hazard poses to the City of Milwaukee on a yearly basis (see Tables 37 and 38).

Ranking Severity of Natural and Other Hazards

Death and Injury

Using the data from the various sources summarized in the vulnerability assessment of Chapter IV of this report, natural and other hazards of the City of Milwaukee were ranked first with respect to their severity in terms of the sum of the number of annual deaths and injuries they caused and then by frequency of occurrence of each type of hazard event as shown in Table 37.

The top eight from a combined total of 12 natural and other hazards based upon death and injury incidences, as shown in Table 37 in order of appearance, indicate that medical and health risks from infectious diseases, temperature extremes, major fire and emergency incidents, tornadoes, thunderstorms and their related events, hazardous materials incidents, winter storms, and flooding are the most severe hazards in the City of Milwaukee. The vulnerability and community impact assessment in Chapter IV of this report identified that all three of these hazards were related to public health concerns, and the individuals at greatest risk are the very young, the very old, and sick persons within the community.

Of the weather-related natural hazards, temperature extremes are the most costly in terms of the number of annual mortalities and injuries. Weather-related natural hazards comprise five of the top eight most costly hazards in terms of injuries and lost lives. These also include tornadoes, thunderstorms/high wind/hail/lightning, winter storms, and flooding, which pose a significant risk to public health and safety within the City of Milwaukee. The vulnerability and community impact assessment indicates that the entire County is at risk from these hazards which are highly unpredictable in terms of exactly where they may occur and how powerful they might be.

Hazardous material incidents ranked sixth in priority, as these incidents average less than one injury per year. Although one incident of water supply contamination occurred in 1993 in which the Wisconsin Division of Health reported an associated 69 mortalities and an estimated 4,400 hospitalizations, major efforts have been undertaken to upgrade water treatment facilities among other measures to ensure the safety of the water supply. Thus, this type of hazard is not likely to reoccur.

The remaining three hazards have not been recorded in recent history to be associated with human mortality or injury within the City of Milwaukee based upon known data; these include terrorism, coastal erosion, and earthquakes.

A comparison of Table 37 and Table 38 illustrates significant differences in ranking hazards between human life and injury versus property damage comparisons within the City of Milwaukee (see Property Damage section below). Also, due to the importance of human life and health of individuals within the City of Milwaukee, and the high potential for a mass casualty event associated with these hazards, and that such incidents have been recorded elsewhere in the State of Wisconsin (see vulnerability assessment in Chapter IV of this report), these hazards were incorporated into the final all-hazard mitigation plan and implementation strategies by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A of this report).

The priority rankings based upon death and injury in this update are similar to those presented in the initial City of Milwaukee All Hazards Mitigation Plan. While the rank order of most of the hazards in terms of mortality and injuries has changed, the ranks of all but one hazard are within one position of their ranking in the initial plan. In addition, the top five most costly hazards in terms of mortality and injuries in this update include all five of the hazards that were found got be among the most costly in the initial hazard mitigation plan.

Property Damage

Another way to assess the vulnerability of the City of Milwaukee to natural and other hazards is to examine the property damages they cause. Again, using the data from the various sources summarized in the vulnerability assessment of Chapter IV of this report, natural and other hazards were ranked with respect to their severity in terms of the annual sum of property damages caused, and then by frequency of occurrence of each type of hazard event as shown in Table 38.

The top six from a combined total of 12 natural and other hazards, as shown in Table 38 in order of appearance based upon total annual property damages, indicate that major fire/emergency incidents, flooding, thunderstorms/high wind/hail/lightning, tornadoes, hazardous materials incident, and winter storms are the most severe hazards to affect the City of Milwaukee. Among the top eight, major fire and emergency incidents was identified as the number one risk to property compared to any other hazards within the City of Milwaukee.

Flooding and thunderstorms/high wind/hail/lightning ranked as the second and third most costly hazards to cause property damage in the City of Milwaukee and, aside from major fires, these hazards inflict the greatest amount of property damage reported compared to the other severe weather-related damages. As summarized in the vulnerability and community impact assessment, flooding and their associated property damages are expected to decrease significantly in the future based on current steps being implemented to mitigate flood damages.

Four of the top six most costly hazards to property damage within the City of Milwaukee are natural hazards; flooding, thunderstorms/high wind/hail/lightning, tornadoes, and winter storms. Milwaukee County also determined that flooding, tornadoes, and winter storms pose a high risk to property.[24] The vulnerability and community impact assessment indicates that flooding hazard risks are associated with the major river systems within and adjacent to the City of Milwaukee; this includes the Kinnickinnic River, the Menomonee River, the Milwaukee River, and Oak Creek watersheds. The vulnerability and community impact assessment indicates that the entire County is at risk from thunderstorms/high wind/hail/lightning hazards which are highly unpredictable in terms of storm location and magnitude. Tornadoes and winter storms rank as the third and fourth most costly natural hazards in the City of Milwaukee. The vulnerability and community impact assessment indicates that the entire county is at risk from tornados and winter storms as locations and magnitudes of these events are unpredictable.

The remaining six hazards, as shown in Table 38, have not been recorded to be associated with property damage within the City of Milwaukee based upon known data. These hazards include coastal erosion, temperature extremes, earthquake, terrorism, contamination or loss of water supply, and medical/health risk incidents. It is important to note that, although these hazards have not been recorded to cause property damage, two of these hazards, emergency medical health risk incidents and temperature extremes, rank high among the top eight recorded to be associated with significant mortality and injury costs to the City of Milwaukee (see Table 37). For this reason, these hazards were incorporated into the final all-hazard mitigation plan and implementation strategies by the City of Milwaukee Hazard Mitigation Steering Committee (see Appendix A).

The priority rankings based upon property damage in this update are similar to those presented in the initial City of Milwaukee all hazard mitigation Plan. While the rank order in terms of property damage of some of the hazards has changed, the ranks of all hazards are within one position of their rankings in the initial plan. In addition, the top six most costly hazards in terms of property damage in this update include all six hazards that were found to be among the most costly in the initial hazard mitigation plan.

Ranking Summary

Hazard severity can be assessed and ranked in a variety of ways. The purpose of ranking hazards is to help set priorities and direct more resources to address those hazards of the greatest severity. However, the kinds of mitigation actions that will be needed and warranted in the City of Milwaukee all hazard mitigation plan depend on the type of vulnerability to be addressed. Some hazards, such as excessive heat and lightning, are unlikely to cause a disaster, but they can be fatal and therefore are serious hazards. Vulnerability to such hazards can best be addressed by preventive measures, such as public information to encourage hazard awareness and personal protection. Other hazards, such as flooding are pervasive and devastating, and may require a variety of tools—mapping, building codes, zoning laws, insurance, elevation or acquisition of floodprone structures and public awareness—to effectively reduce the risk of disaster. However, flooding might not result in more fatalities than a heat wave. In general, ranking hazards by the number of deaths and injuries they cause shifts the focus away from major and possibly avoidable disasters, such as floods. Weather hazards that have caused past Wisconsin disasters are probably the hazards that will cause future disasters. However, the types of natural hazards that result in fatalities remain a public health and safety concern, which is why these hazards were incorporated by the City of Milwaukee Hazard Mitigation Steering Committee into the final updated all-hazard mitigation plan and implementation strategies, as summarized in this section of this report.

[24] *Milwaukee County Sheriff's Department, Emergency Management Bureau,* op. cit.

SUMMARY

Based upon the foregoing evaluation for each of the natural and other hazards above, the priority mitigation measures identified to be included in the City of Milwaukee hazard mitigation plan are summarized in Table 39. Table 39 also includes a ranking evaluation of the mitigation measures identified in each hazard category based upon relative cost, direct benefits, and likely indirect benefits affected summarized below.

There are several potential issues inherent in the prioritization or ranking of the mitigation measures, which were considered in development of the recommended ranking of priority mitigation measures summarized below. First, the City of Milwaukee hazard vulnerabilities as shown in Tables 37 and 38 are different for loss of life and injury versus property damages, which may affect prioritization of costs to be incurred. For the purposes of this plan priority or emphasis was placed upon preventing loss of life and injury.

The costs of avoidance of a particular hazard may not be quantifiable, but the cost of occurrence of the hazard often is, for example, most hazards have been quantified by insurance underwriters in the issuance of property and life insurance policies. Conversely, the benefit of any particular mitigation measure may also not be quantifiable or realized. For example, continued coordination of emergency response and operation plans among governmental units and first responders will directly enhance preparedness and protection of the communities involved; however, this action may or may not ultimately result in reduced property damage, injuries or death if the hazard does not occur. Similarly in the case of flood mitigation, upstream actions may result in downstream benefit even if the immediate benefits at the location where the mitigation measure was applied may be less than optimal, i.e. monetary costs are higher than the estimated benefit from such action.

Another potential issue is whether the hazard ranking reflects public health concerns for which mitigation is possible. For example, the vulnerability to hazards, such as extreme heat and lightning are very much a matter of personal exposure. Mitigation in the traditional sense (strengthening a structure or moving a structure away from the hazard, such as in flood mitigation) is of little use for these hazards. Neither extreme heat nor lightning are emergency management issues in terms of operations. Reducing the risk of mortality from lightning or temperature extremes requires public health information and hazard awareness so that individuals take precautions to limit their exposure to the hazard. While hazard awareness and public safety information are important for any type of hazard, it is especially important for hazards, such as temperature extremes, lightning, tornadoes, and severe thunderstorms.

Ranking of Priority Mitigation Measures

The mitigation measures identified in each hazard category were further evaluated based upon relative cost, direct benefits, and likely indirect benefits and ranked accordingly as shown in Table 39. Consideration was given to the likelihood of occurrence of each type of hazard as set forth in the hazard prioritization analysis as shown in Tables 37 and 38, which is consistent with the project ranking and prioritization procedures in the Milwaukee County pre-disaster mitigation plan.[25] Greatest priority is recommended to be given to those mitigation measures that directly or indirectly resulted in minimized loss of life or injury.

Estimated Cost

Table 39 includes a summary of the estimated capital cost, average annual operation and maintenance cost, and estimated capitol benefits, where possible, for each mitigation measure. It is important to note that the annual benefits and costs used in the benefit-cost analysis include only the direct benefits derived from the abatement of monetary flood damages, and the direct costs attendant to implementation of the floodland management measures, including capital and operation and maintenance costs. Hence, environmental, recreational, or other intangible benefits and costs that cannot be readily quantified were not addressed or reflected in the final estimated capital costs or benefits as shown in Table 39 (see also Tables 31 to 36).

[25]Ibid.

Table 39

COST BENEFIT ANALYSIS SUMMARY OF MEASURES INCLUDED IN THE CITY OF MILWAUKEE ALL-HAZARDS MITIGATION PLAN

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Flooding[e] and Related Stormwater Drainage Problems	Floodland and Environmentally Sensitive Land Preservation Element										
	Floodplain zoning[f]	--[g]	X	--	--	--	X	X	X	X	5
	Environmentally sensitive area and open space area preservation	--[g]	X	--	--	--	X	X	--	--	4
	Floodland Management Plan Element										
	Kinnickinnic River Watershed[h]										
	Lyons Park Creek	$ 948	--	X	--	$ 1,361	X	X	--	--	3
	Villa Mann Creek	419	--	X	--	616	X	X	--	--	3
	Wilson Park Creek	33,000	--	--	X	77,650[i]	X	X	--	--	3,4
	Kinnickinnic River	49,900	--	--	X	48,000[j]	X	X	--	--	3,4
	Total	$84,267	--	--	X	$115,177	X	X	--	--	
	Menomonee River Watershed[k]										
	Menomonee River	$60,050	--	--	X	$15,909	X	X	X	X	3,4,5
	Grantosa Creek	--[l]	--	--	--	--[l]	X	X	--	--	3
	Little Menomonee River	--[l]	--	--	--	--[l]	X	X	X	X	--
	Total	$60,050	--	--	X	$15,909[m]	--	--	--	--	
	Milwaukee River Watershed[n]										
	Milwaukee River	$50	--	X	--	$50	--	X	--	--	2,3
	Lincoln Creek	--[l]	--	--	--	--[l]	X	X	--	--	3,4
	Southbranch Creek	--[l]	--	--	--	--[l]	X	X	--	--	3
	Oak Creek Watershed[o]										
	North Branch of Oak Creek subtotal	$ 697	--	X	--	$ 105	X	X	--	--	3
	Mitchell Field Drainage Ditch subtotal	1,350	--	--	X	575	X	X	--	--	5
	Total	$2,047	--	--	X	$ 680	--	--	--	--	
	Stormwater Management Plan Element										
	Stormwater management plans[f]	--[g]	--	--	--	--	X	X	--	--	3,5
	Stormwater-related regulations[f]	--[p]	--	--	--	--	X	X	--	--	3,5
	Public Information and Education Element	--[q]	X	--	--	--	X	X	X	X	

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Flooding[d] and Related Stormwater Drainage Problems (continued)	Secondary Plan Element										
	National Flood Insurance Program and Map Updating	--[g]	X	--	--	--	X	X	--	--	1,3
	Lending institution and real estate agent policies[f]	--[g]	X	--	--	--	X	X	--	--	3
	Stormwater management facilities maintenance	--[g]	X	--	--	--	X	X	--	--	3
	Community utility policies and emergency programs	--[g]	X	--	--	--	X	X	--	--	2,3,5
	Basement backup problem resolution	--[r]	--	--	--	--	--	X	--	--	5
	Stream channel maintenance	--[g]	X	--	--	--	X	X	--	--	3
Thunderstorm, High-Wind, Hail, and Lightning Hazards	Maintenance and potential expansion of early warning and communication systems, with emphasis on NOAA Weather Radio, EAS broadcasts, and expanded use of emergency technologies	--[r]	--	X	--	--	X	--	--	--	1,5
	Educational and informational programming, especially related to the early warning network, and to individual actions to protect citizens, property, and businesses	--[q]	X	--	--	--	X	--	--	--	1,5
	Ongoing review and enforcement of building code ordinance and requirements	--[g]	X	--	--	--	X	X	X	X	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1
	Continued coordination of emergency operation and response plans among governmental units and first responders	--[g]	X	--	--	--	X	--	--	--	5
Tornadoes	Maintenance and potential expansion of early warning and communication systems, with emphasis on NOAA Weather Radio, EAS broadcasts, and expanded use of emergency technologies	--[r]	--	X	--	--	X	--	--	--	1,5

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Tornadoes (continued)	Evaluate need to retrofit existing or install new structures to ensure adequate shelters from tornadoes for public buildings, major industrial sites and other large businesses or complexes such as shopping malls, fairgrounds, mobile home parks, and other vulnerable public areas	- -[s]	- -	X	- -	- -	X	X	X	X	5
	Educational and informational programming, especially related to the early warning network, and to individual actions to protect citizens, property, and businesses	- -[q]	X	- -	- -	- -	X	- -	- -	- -	1,5
	Ongoing review and enforcement of building code ordinance and requirements	- -[g]	X	- -	- -	- -	X	X	X	X	5
	Continue to work towards compliance with the National Incident Management System	- -[r]	X	- -	- -	- -	X	- -	- -	- -	1
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[g]	X	- -	- -	- -	X	- -	- -	- -	5
	Promote and expand Citizen Corps program and encourage citizen participation.	- -[r]	- -	X	- -	- -	X	X	X	X	1,2,3,5
Extreme Temperature Events	Organize neighborhood outreach groups who look after vulnerable groups and individuals	- -[r]	X	- -	- -	- -	X	- -	- -	- -	1,5
	Increase coverage and use of NOAA Weather Radio and EAD broadcasts	- -[r]	- -	X	- -	- -	X	- -	X	X	1,5
	Encourage the provision of special arrangements for payment of heating bills	- -[r]	X	- -	- -	- -	X	- -	- -	- -	5
	Identify and advertise a list of available heating and or cooling shelters in the immediate area	- -[q]	X	- -	- -	- -	X	- -	- -	- -	5
	Educational and informational programming	- -[q]	X	- -	- -	- -	X	- -	- -	- -	1,5
	Continue to work towards compliance with the National Incident Management System	- -[r]	X	- -	- -	- -	X	- -	- -	- -	1
	Promote and expand Citizen Corps program and encourage citizen participation.	- -[r]	- -	X	- -	- -	X	X	X	X	1,2,3,5

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Lake Michigan Coastal Hazards	Continued enforcement of City shoreland regulations and policies[f]	--[g]	X	--	--	--	X	X	X	X	5
	Continued construction and maintenance of shoreline protection structures	--[t]	--	X	--		X	X	--	--	3
	Public informational and educational programming	--[q]	X	--	--	--	X	--	--	--	5
Winter Storm Events	Organize neighborhood outreach groups who look after vulnerable groups and individuals	--[r]	X	--	--	--	X	--	--	--	5
	Provide special arrangements for payment of heating bills	--[r]	X	--	--	--	X	--	--	--	5
	Identify and advertise a list of available heated shelters in the immediate area	--[q]	X	--	--	--	X	--	--	--	5
	Increase coverage and use of NOAA Weather Radio and EAD broadcasts	--[r]	--	X	--	--	X	--	X	X	1,5
	Educational and informational programming	--[q]	X	--	--	--	X	--	--	--	1,5
	Ongoing review and enforcement of building code ordinance requirements	--[g]	X	--	--	--	X	X	X	X	5
	Work with agencies to establish a system for short-term sheltering	--[r]	X	--	--	--	X	--	--	--	5
	Continued coordination of emergency operation and response plans among governmental units and first responders	--[g]	X	--	--	--	X	--	--	--	5
	Work with utilities to assess and improve electrical service reliability	--[g]	X	--	--	--	X	--	--	--	5
	Continue and refine State, County, and local road maintenance programs	--[g]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Earthquake Events	Ongoing review and enforcement of building code ordinance requirements	--[g]	X	--	--	--	X	X	--	--	5
	Continued coordination of emergency operation and response plans among governmental units and first responders	--[g]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5
Contamination or Loss of Water Supply	Educational and informational programming related to water safety issues	--[q]	X	--	--	--	X	--	--	--	1,5
	Continued maintenance, operation, and upgrading of the state-of-the-art treatment facilities	--[r]	--	--	X	--	X	--	--	X	5
	Continued maintenance, operation, and upgrading of water supply facility security facilities programs and procedures	--[r]	--	--	X	--	X	--	--	X	5
	Continued coordination of emergency operation and response plans among governmental units and first responders	--[g]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5
Hazardous Material Events	Educational and informational programming related to hazardous material safety, and to individual actions to protect citizens, property, and businesses	--[q]	X	--	--	--	X	--	--	--	5
	Promote community and operator compliance with industry safety regulations and standards	--[g]	X	--	--	--	X	X	X	X	5
	Promotion of ongoing enforcement of Federal, State and County regulatory standards	--[q]	X	--	--	--	X	X	X	X	5
	Support existing household waste management control programs, which should include hazardous material disposal sites for public citizens	--[r]	X	--	--	--	X	--	--	--	5

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Hazardous Material Events (continued)	Continue support of training, equipment, planning, and preparedness of first responders	--[r]	X	--	--	--	X	--	--	--	5
	Continued coordination of emergency response plans among governmental units, businesses, and first responders	--[r]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1,3,5
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5
Medical/Health Risks	Educational and informational programming related to public health and safety issues. Increase information and educational activities for specific health issues, such as West Nile Virus	--[q]	X	--	--	--	X	--	--	--	5
	Strengthen public health infrastructure to support surveillance, response, reporting, and research, and to implement prevention and control programs	--[r]	--	X	--	--	X	--	--	--	5
	Provide the public health work force with the knowledge and tools needed for early detection and control of diseases and disease vectors	--[r]	--	X	--	--	X	--	--	--	5
	Implement specific health issue-related mitigation strategies, such as mosquito reduction measures for West Nile Virus	--[r]	X	--	--	--	X	--	X	X	5
	Ensure prompt implementation of prevention strategies and enhance communication of public health information about emerging diseases, their vectors, and control measures	--[r]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[q]	X	--	--	--	X	--	--	--	1,3,5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1,3,5
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Terrorism Incidents	Continue and expand educational and informational programming related to public health and safety issues due to terrorist incidents	--[q]	X	--	--	--	X	--	--	--	1,5
	Continue to participate in federal programs such as UASI or LETPP	--[t]	--	--	--	--	X	--	--	--	1
	Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential chemical and biological attacks	--[r]	--	X	--	--	X	--	--	--	5
	Continue support for training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments and other emergency management services	--[r]	--	X	--	--	X	--	--	--	5
	Continue coordination of emergency response plans among Federal, State, and local governmental units, businesses and emergency management services	--[r]	X	--	--	--	X	--	--	--	5
	Continue to work towards compliance with the National Incident Management System	--[r]	X	--	--	--	X	--	--	--	1,3,5
	Promote and expand Citizen Corps program and encourage citizen participation.	--[r]	--	X	--	--	X	X	X	X	1,2,3,5
Major Fire and Emergency Medical Events	Continue and expand educational and informational programming related to public health and safety issues due to fire and emergency medical incidents	--[q]	X	--	--	--	X	--	--	--	1,5
	Continue support for training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments and other emergency management services	--[r]	X	--	--	--	X	--	--	--	5
	Continue building safety inspection efforts	--[g]	--	--	X	--	X	X	X	X	1
	Raze condemned buildings	--[g]	--	--	X	--	--	X	X	X	1

Table 39 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a,b]				Benefits					
		Estimated Costs in Dollars (thousands)	Low	Medium	High	Estimated Benefits for a 1 Percent Annual Probability Flood Event[c]	Enhanced Preparedness/ Protection	Reduced Property Damage	Reduced Injuries	Reduced Mortalities	Indirect Benefits[d]
Major Fire and Emergency Medical Events (continued)	Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential fire and major medical emergencies	- -[r]	- -	X	- -	- -	X	X	X	X	1
	Continue maintenance and promote enhanced fire safety measures at critical facilities, and encourage widespread use of fire safety devices	- -[r]	- -	- -	X	- -	X	X	X	X	1
	Continue support of training, equipment, planning, and preparedness for local law enforcement, fire, and rescue departments, and other emergency management services	- -[g]	- -	--	X	- -	X	X	X	X	1
	Continue to work towards compliance with the National Incident Management System	- -[r]	X	- -	- -	- -	X	- -	- -	- -	1,3,5
	Continue/enhance coordination of emergency response plans among Federal, State, and local governmental units, businesses, and emergency management services	- -[g]	X	- -	- -	- -	X	- -	- -	- -	3,5
	Promote and expand Citizen Corps program and encourage citizen participation.	- -[r]	- -	X	- -	- -	X	X	X	X	1,2,3,5

[a] *All costs and benefits expressed in 2010 dollars.*

[b] *Cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000) and high (greater than $1,000,000) costs, which are generally defined as*

Low
- *Educational and informational programming*
- *Ongoing enforcement of ordinances*
- *Plan Development*
- *Continued coordination/mutual aid/interagency agreements*

Moderate
- *Addition of new staff*
- *Additional staff hours budgeted*
- *Additional equipment*
- *New ordinance development*
- *New programs/task force*

High
- *Major constraints*
- *New buildings (infrastructure)*
- *Capital programs*

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Table 39 (continued)

[c] *The estimated benefits are based upon the reduction in flood damages during a 1 percent probability flood event. The damage estimates were developed by the Commission staff based upon structure values, flood stage, and depth of flooding data as documented in Tables 31 through 36.*

[d] *Indirect benefits represent a continuum of potential benefits that may occur as a result of the implementation of specific management actions. For example, implementation of informational programming, while not directly saving lives, may ultimately result in people having the knowledge necessary to save lives and protect property. These intangible benefits cannot be readily quantified and range from increased awareness to reduces loss of life and property, and have been assessed using the following relative cumulative scale:*

1 = Increased awareness/preparedness
2 = Enhanced quality of life/social benefits
3 = Reduced property damage
4 = Increased environmental and recreational benefits/ecosystems services
5 = Reduced loss of life and injury with concomitant benefits for economic productivity

[e] *For further details on the benefit-cost analysis of floodland mitigation alternatives, refer to Tables 31 through 36.*

[f] *This mitigation measures is related but not essential to continued compliance with the requirements of the National Flood Insurance Program.*

[g] *Costs covered under ongoing activity.*

[h] *Mitigation measures in the Kinnickinnic River watershed related but not essential to continued compliance with the requirements of the National Flood Insurance Program are identified in Table 31.*

[i] *The estimated benefits are based on the prorated assessed value of the structures in the updated floodplain.*

[j] *The estimated benefits are based upon removal of 320 structures from the floodplain at a cost of $150,000 each.*

[k] *Mitigation measures in the Menomonee River watershed related but not essential to continued compliance with the requirements of the National Flood Insurance Program are identified in Tables 32 and 33.*

[l] *No cost or benefit given. This element has already been implemented.*

[m] *Benefits taken from MMSD Menomonee River Phase 1 system plan and reflects reduction of damages in both the Cities of Milwaukee and Wauwatosa.*

[n] *Mitigation measures in the Milwaukee River watershed related but not essential to continued compliance with the requirements of the National Flood Insurance Program are identified in Table 34.*

[o] *Mitigation measures in the Oak Creek watershed related but not essential to continued compliance with the requirements of the National Flood Insurance Program are identified in Table 36.*

[p] *Cost of ordinance development is covered under ongoing projects. Cost of implementation is not determined.*

[q] *Portion of costs included in ongoing program and construction project implementation programs.*

[r] *Costs to be determined. Partially covered under ongoing programs.*

[s] *Costs are site specific and survey is needed for citywide estimate.*

[t] *Costs to be determined.*

Source: SEWRPC.

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It is important to note that there were many mitigation measures, especially for hazards other than flooding and related stormwater drainage problems, where a direct monetary cost analysis was not possible to calculate. Therefore, mitigation measures were further prioritized based upon comparison of the relative cost of implementation, direct benefits and indirect benefits (see Direct and Indirect Benefits section below).

Cost of Implementation

An estimated cost of implementation was developed in order to categorize the relative cost of each of the priority mitigation measures as shown in Table 39. The cost of implementation is allocated among three categories of low (less than $100,000 dollars), moderate (greater than $100,000 and less than $1,000,000), and high (greater than $1,000,000) costs, which are generally defined as including:

Low

Educational and informational programming
Ongoing enforcement of ordinances
Plan Development
Continued coordination/mutual aid/interagency agreements

Moderate

Addition of new staff
Additional staff hours budgeted
Additional equipment
New ordinance development
New programs/task force

High

Major construction
New buildings (infrastructure)
Capital programs

This cost categorization allows the mitigation measures to be prioritized with particular regard to cost effectiveness by comparing the estimated low, moderate, and high cost to the number of both direct and indirect benefits identified (see Direct and Indirect Benefits section below).

Direct and Indirect Benefits

The benefits from implementation of a mitigation measure can be classified as direct, or measurable, and as indirect, or intangible. Direct benefits were defined in terms of enhanced preparedness/protection of individuals or communities, reduced property damage, reduced injuries and reduced mortalities. Although the exact numbers or amounts of such direct benefits are not known, these would be a direct result of implementation of a particular mitigation measure. In contrast, indirect benefits represent a continuum of potential benefits that may occur as a result of the implementation of specific management actions. For example, implementation of informational programming, while not directly saving lives, may ultimately result in people having the knowledge necessary to save lives and protect property. These intangible benefits cannot be readily quantified and range from increased awareness to reduced loss of life and property, and have been assessed using the following relative cumulative scale:

1 = Increased awareness/preparedness
2 = Enhanced quality of life/social benefits
3 = Reduced property damage
4 = Increased environmental and recreational benefits/ecosystems services
5 = Reduced loss of life and injury with concomitant benefits for economic productivity

Chapter VI

PLAN ADOPTION, IMPLEMENTATION, MAINTENANCE, AND REVISION

This updated hazard mitigation plan is designed to attain, to the maximum extent practicable, the goals and objectives set forth in Chapter III of this report. In a practical sense, however, the plan is not complete until the steps to implement it, that is, to convert the plan into action policies and programs, have been specified. This chapter presents the plan implementation strategies envisioned and includes provisions and information on plan adoption, maintenance, and revision.

PLAN REFINEMENT, REVIEW, AND ADOPTION

As described in Chapter I, the all-hazard mitigation planning program was initiated by the City of Milwaukee Department of Public Works in 2003 as part of its broader, ongoing program of flooding and other hazard mitigation conducted in cooperation with the Federal Emergency Management Agency (FEMA) and the Wisconsin Department of Military Affairs, Division of Emergency Management. The plan update set forth in this report was begun in 2010 and conducted pursuant to the mitigation planning requirements of 44 *Code of Federal Regulations*, Section 201.6 (d) (44 CFR 201.6(d)) which call for local hazard mitigation plans to be reviewed; updated to reflect changes in development, progress in local mitigation efforts, and changes in priorities; and reapproved every five years for local jurisdictions to be able to receive hazard mitigation funding. During 2002, FEMA published new rules for hazard mitigation planning and the hazard mitigation grant program in response to the Disaster Mitigation Act of 2000. These rules address State and local mitigation planning and are important for the City of Milwaukee hazard mitigation program in three ways:

- The State of Wisconsin Department of Military Affairs, Division of Emergency Management is directly involved in a partnership role for all hazard mitigation planning. That agency is responsible for preparing and periodically updating a State all hazard mitigation plan; provides technical assistance and guidance for local all-hazards planning; and administers the Pre-Disaster Mitigation Program for FEMA.

- The rules outline State and local mitigation planning guidelines for accessing Hazard Mitigation Program funds. According to the rules, for disasters declared after November 1, 2004, local government must have a FEMA-approved mitigation plan in order to receive grants from the Hazard Mitigation Grant Program (HMGP) and the Pre-Disaster Mitigation Program (PDM). This element is important because it requires local adoption of an all-hazards mitigation plan to remain eligible for certain future mitigation funds. This element can be taken care of if the community formally adopts the City plan.

- The rules and related guidance set forth more specificity and detail on the hazard mitigation plan content.

Because of the 2002 rules noted above, the initial City of Milwaukee hazard mitigation plan was structured to meet the new guidance. The work was also coordinated with a Wisconsin Emergency Management statewide task force on hazard mitigation planning.

The City of Milwaukee all-hazards mitigation plan was prepared under the guidance of the City of Milwaukee Hazard Mitigation Steering Committee comprised of representatives and interested parties throughout the City, as well as County agency representatives. The committee met four times during the plan preparation period for the initial plan to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review the draft report chapters with the report chapters then being refined to reflect the comments and recommendations of the Steering Committee. The Steering Committee was reconvened for this updating effort and met three times during the plan preparation period to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review the draft report chapters with the report chapters then being refined to reflect the comments and recommendations of the Steering Committee (see Appendix A).

Following completion of the initial plan in draft form, a public informational meeting was held on April 21, 2005, to review the plan. Following plan finalization, the plan was presented for consideration and adoption to the City of Milwaukee Common Council. Formal adoption of the plan occurred on May 2, 2005.

With some additions, similar local adoption procedures were followed for this updated plan. As draft chapters of the updated plan report were completed, copies were placed in downloadable format on the website of the Southeastern Wisconsin Regional Planning Commission (SEWRPC) and a webpage was available on the SEWRPC website where members of the public could ask questions and submit comment on the draft plan update. When the plan was completed in draft form, two public informational meetings were held to review the plan with local officials, business and industry, and citizens. Following finalization of the updated plan, the plan update was presented to the City of Milwaukee Common Council for consideration and adoption.

An important first step in implementation of the all-hazards mitigation plan for the City of Milwaukee is its formal adoption by the City. Upon its formal adoption, the plan becomes an important guide to the making of hazard mitigation and related management decisions for the City and County. Such adoption serves to signify agreement with and official support of the plan recommendations and enables government officials and staff to begin integrating the plan recommendations into the other ongoing municipal programs, such as land use control, and public works development planning and programming.

The City of Milwaukee Department of Public Works and the Office of Emergency Management and Homeland Security will provide the means to ensure that actions identified in the all-hazards mitigation plan are incorporated into relevant ongoing municipal programs. The City of Milwaukee Department of City Development Planning Department is responsible for administering land use plans, building codes, and other relevant planning activities within the City. After the City formally adopts the all hazards mitigation plan, the Department of Public Works will conduct periodic reviews of the City's policies in order to integrate the all hazards mitigation plan with such programs and policies.

PLAN IMPLEMENTATION STRATEGIES

The recommended hazard mitigation plan described in this report is designed to attain, to the maximum extent practicable, the goals and objectives set forth in Chapter III of this report. In a practical sense, however, the plan is not complete until the steps to implement it—that is, to convert the plan into action policies and programs—have been specified. Following formal adoption of the plan by the City of Milwaukee, realization of the plan will require a long-term commitment to the objectives of the plan and a high degree of coordination and cooperation

among City and County officials and staff and various City, County, and community departments and other bodies. Close cooperation with the Wisconsin Department of Military Affairs, Division of Emergency Management, and FEMA is also essential.

A summary of the plan elements and selected implementation strategy information, including costs, designated management agencies, and schedules is included in Table 40.

It is recommended that the City incorporate the analyses performed and mitigation strategies recommended into other local planning efforts, such as those related to stormwater management, stream and river protections, land and water conservation, and comprehensive planning, where appropriated.

HAZARD MITIGATION FUNDING SOURCES

Financing of the construction, operation, and maintenance of hazard mitigation measures may be accomplished through a number of means, including: the establishment of a stormwater utility; tax-incremental-financing (TIF) districts; local property taxes; reserve funds; general obligation bonds; private-developer contributions, including fees paid to be applied toward construction of regional stormwater management facilities in lieu of providing onsite facilities; State grants or loans; and certain Federal and State programs.

The identification of potential funding sources, including sources other than solely local-level sources, is an integral part of the implementation of a successful mitigation plan. The following description of funding sources includes those that appear to be potentially applicable for the City as of 2011. However, because funding programs and opportunities are constantly changing, the involved City and County government staffs have and will continue to become familiar with the potential funding sources and programs. Some of the programs described in this chapter may not be available under all envisioned conditions in the City or to its residents and/or property owners for a variety of reasons, including, for example, eligibility requirements or lack of funds at a given time in Federal and/or State budgets. Nonetheless, the list of sources and programs set forth in this chapter should provide a starting point for identifying possible funding sources for implementing the flood mitigation plan recommended in this report (see also Appendices F and G).

Federal Emergency Management Agency Programs

The Federal Emergency Management Agency (FEMA) funds several programs that in the State of Wisconsin are administered through the Wisconsin Department of Military Affairs, Division of Emergency Management. These programs are described below.

Hazard Mitigation Grant Program

The Hazard Mitigation Grant Program (HMGP) can provide up to 75 percent of the costs attendant to certain natural hazard mitigation programs. In the case of flood mitigation, projects can include the floodproofing or acquisition and relocation of floodprone properties, the elevation of structures in compliance with National Flood Insurance Program (NFIP) standards, and other flood control measures, including structural projects, where identified as cost-effective. To be eligible for mitigation activities with FEMA funding, structures must be insured under the NFIP. Under the HMGP, the balance of the costs is shared by the State of Wisconsin (12.5 percent) and the grantee (12.5 percent). Communities in Wisconsin can apply through the State for HMGP funds only after a Presidential disaster declaration is issued. HMGP funds must be applied for within 60 days of the declaration. The State, as HMGP grantee, is responsible for identifying and prioritizing projects. Eligible projects must be included as part of the grantee's all-hazard mitigation plan and must meet cost-benefit criteria established by FEMA. Although State and local units of government are eligible applicants, HMGP funds can be used on private property for eligible projects. The HMGP gives priority to properties identified by FEMA as repetitive-loss properties.

Table 40

CITY OF MILWAUKEE ALL-HAZARDS MITIGATION PLAN SUMMARY AND IMPLEMENTATION PLAN

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Flooding and Related Stormwater Drainage Problems	Floodland and Environmentally Sensitive Land Preservation Element						
	Floodplain zoning	- -[b]	- -	CMDCD	In place and ongoing	- -[c]	1, 2, 7, 20, 21, 49, 53, 55, 60
	Environmentally sensitive area and open space area preservation	- -[b]	- -	CMDCD, MC, CO, MMSD with involvement of WDNR	In place and ongoing	- -[d]	1, 2, 5, 6, 7, 21, 23, 24, 28, 40, 46, 49, 50, 51, 52, 53, 55, 60, 63, 64, 65
	Floodland Management Plan Element[e]						
	Kinnickinnic River Watershed	- -	- -	- -	- -	- -	1, 2, 3, 5, 6, 7, 16, 19, 21, 24, 31, 33, 46
	Lyons Park Creek	$ 948,400	$ 1,361,200	CMDPW, MMSD	2011-2015	Partially implemented	
	Villa Mann Creek	419,300	616,400	CMDPW, MMSD	Ongoing	Floodproofing completed by property owner and then possibly reimbursed by MMSD[f]	
	Wilson Park Creek	33,000,000	77,650,000	CMDPW, MMSD	2008-2024	Partially implemented	
	Kinnickinnic River	49,900,000	35,550,000	CMDPW, MMSD, CMDCD	2006-2024	Partially implemented	
	Total	$84,267,700	$115,177,700	- -	- -	- -	
	Menomonee River Watershed	- -	- -	- -	- -	- -	1, 2, 3, 5, 6, 7, 16, 21, 24, 31, 33, 46, 55
	Menomonee River	$60,050,000	$15,909,200	CMDPW, MC, MMSD, LU	2003-2014	Partially implemented	
	Grantosa Creek	- -[g]	- -	CMDPW, MC, MMSD	2000	Implemented	
	Little Menomonee River	- -[g]	- -	CMDPW, MC, MMSD	2006	Implemented	
	Total	$60,050,000	$15,909,200	- -	- -	- -	
	Milwaukee River Watershed	- -	- -	- -	- -	- -	1,2,5,6,19,46
	Milwaukee River	$50,000	$50,000	MMSD, CMDPW, CMDCD	Ongoing	Floodproofing completed by property owner and then possibly reimbursed by MMSD[f]	
	Lincoln Creek	- -[g]	- -	CMDPW, MC, MMSD	2002	Implemented	
	Southbranch Creek	- -[g]	- -	CMDPW, MC, MMSD, LU	2001	Implemented	
	Total	$50,000	$50,000	- -	- -	- -	

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Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Flooding and Related Stormwater Drainage Problems (continued)	Oak Creek Watershed	- -	- -	- -	- -	- -	1, 2, 3, 5, 6, 7, 16, 18, 19, 21, 24, 31, 33, 46
	North Branch of Oak Creek	$ 697,000	$ 105,600	CMDPW, CMDCD, MC, MMSD, LU	Ongoing	Floodproofing completed by property owner and then possibly reimbursed by MMSD[f]	
	Mitchell Field Drainage Ditch	1,350,100	575,300	CMDPW, MC, MMSD	Ongoing	SEWRPC currently updating the watercourse management plan	
	Total	$2,047,100	$ 680,900	- -	- -	- -	
	Stormwater Management Plan Element	- -	- -	- -	- -	Currently being implemented	1, 2, 3, 5, 6, 7, 16, 19, 21, 23, 24, 25, 33, 40, 46, 49, 50, 21, 52, 53, 55, 60
	Stormwater management plans	- -[b]	- -	CMDPW, CMDCD, MMSD	Ongoing	Partially implemented	
	Stormwater-related regulations	- -[h]	- -	CMDCD, MMSD	Ongoing	Implemented	
	Public Information and Education Element	- -[i]	- -	CMOES, MC, MMSD, UWEX	Ongoing	Partially implemented	7, 23, 42, 43, 44, 52, 53, 60
	Secondary Plan Element						
	National Flood Insurance Program and Map Updating	- -[b]	- -	CMPDW, MC, MMSD, WDNR, FEMA, SEWRPC	Ongoing	Implemented	1, 2, 3, 5, 6, 16, 17, 19, 21, 23, 24, 25, 46, 49, 50, 51, 52, 53, 55, 60
	Lending institution and real estate agent policies	- -[b]	- -	CMDCD,LI, RB	Ongoing	Partially implemented	
	Community utility policies and emergency programs	- -[b]	- -	CMEM, MC	Ongoing	Partially implemented	
	Stormwater management facilities maintenance	- -[b]	- -	CMDPW, MC	Ongoing	Partially implemented	
	Stream channel maintenance	- -[b]	- -	CMDPW, MMSD	Ongoing	Partially implemented	
	Basement backup problem resolution	- -[j]	- -	CMDPW, MMSD, VWM	Ongoing	Problem assessment underway	

Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Thunderstorm, High-Wind, Hail, and Lightning Hazards	Maintenance and potential expansion of early warning and communication systems, with emphasis on NOAA Weather Radio, EAS broadcasts, and expanded use of emergency technologies	- -[j]	- -	CMEM, MC	Ongoing	Partially implemented	1, 4, 29, 32, 35, 42, 57, 57, 59
	Educational and informational programming, especially related to the early warning network, and to individual actions to protect citizens, property, and businesses	- -[i]	- -	CMEM, MC, UWEX	Ongoing	Partially implemented	
	Ongoing review and enforcement of building code ordinance and requirements	- -[b]	- -	CMDCD, CMNS	Ongoing	Partially implemented	
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[b]	- -	CMEM, MC	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
Tornadoes	Maintenance and potential expansion of early warning and communication systems, with emphasis on NOAA Weather Radio, EAS broadcasts, and expanded use of emergency technologies	- -[j]	- -	CMEM, MC	Ongoing	Partially implemented	1, 4, 29, 32, 35, 42, 57, 57, 59
	Retrofit existing or install new structures to ensure adequate shelters from tornadoes for public buildings, major industrial sites and other large businesses or complexes such as shopping malls, fairgrounds, mobile home parks, and other vulnerable public areas	- -[k]	- -	CMEM, CMDPW, MC	Ongoing	Partially implemented	
	Educational and informational programming, especially related to the early warning network, and to individual actions to protect citizens, property, and businesses	- -[i]	- -	CMEM, MC, UWEX	Ongoing	Partially implemented	
	Ongoing review and enforcement of building code ordinance and requirements	- -[b]	- -	CMDCD, CMNS, MC, WDC	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[b]	- -	CMEM, MC	Ongoing	Partially implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Extreme Temperature Events	Organize neighborhood outreach groups who look after vulnerable groups and individuals	- -[j]	- -	CMEM, CMHD, MC	Ongoing	Partially implemented	1, 4, 29, 32, 35, 42, 57, 57, 59

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Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Extreme Temperature Events (continued)	Provide special arrangements for payment of heating bills	- -[j]	- -	MC, UC, WHEAP	Ongoing	Partially implemented	
	Identify and advertise a list of available heating and or cooling shelters in the immediate area	- -[i]	- -	CMEM, MC, UWEX	Ongoing	Partially implemented	
	Educational and informational programming	- -[i]	- -	CMEM, CMHD, MC	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Lake Michigan Coastal Hazards	Continued enforcement of City shoreland regulations and policies	- -[b]	- -	MC	Ongoing	Implemented	40, 61, 62
	Continued construction and maintenance of shoreline protection structures	- -[l]	- -	CMDPW, MC, WDNR, SEWRPC	Ongoing	Partially Implemented	
	Public informational and educational programming	- -[i]	- -	MMSD, CMEM, MC, UWEX	Ongoing	Partially implemented	
Winter Storm Events	Organize neighborhood outreach groups who look after vulnerable groups and individuals	- -[j]	- -	CMEM, CMHD, MC	Ongoing	Partially implemented	1, 4, 29, 32, 35, 42, 57, 57, 59
	Encourage the provision of special arrangements for payment of heating bills	- -[j]	- -	MC, UC, WHEAP	Ongoing	Partially implemented	
	Identify and advertise a list of available heated shelters in the immediate area	- -[j]	- -	CMEM, MC, UWEX	Ongoing	Partially implemented	
	Increase coverage and use of NOAA Weather Radio and EAD broadcasts	- -[j]	- -	CMEM, MC	Ongoing	Partially implemented	
	Educational and informational programming	- -[i]	- -	CMEM, CMHD, MC, UWEX	Ongoing	Partially implemented	
	Ongoing review and enforcement of building code ordinance requirements	- -[b]	- -	CMDCD, CMNS	Ongoing	Partially implemented	
	Work with agencies to establish a system for short-term sheltering	- -[j]	- -	CMEM, MC	Ongoing	Partially implemented	
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[b]	- -	CMEM, CMFD, CMPD, MC	Ongoing	Partially implemented	
	Continue and refine State, County, and local road maintenance programs	- -[b]	- -	CMDPW, MC, WDOT	Ongoing	Partially implemented	
	Work with utilities to assess and improve electrical service reliability	- -[b]	- -	CMEM, CMDPW, MC, PP, UC	Ongoing	Partially implemented	

Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Winter Storm Events (continued)	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Earthquake Events	Ongoing review and enforcement of building code ordinance requirements	- -[b]	- -	CMDCD, CMNS, MC, WDC	Ongoing	Partially implemented	4, 57
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[b]	- -	CMEM, CMFD, CMPD, MC	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Contamination or Loss of Water Supply	Educational and informational programming related to water safety issues	- -[i]	- -	CMWW, MC, WDNR, UWEX	Ongoing	Partially implemented	4, 26, 49, 50, 53, 54, 55, 57
	Continued maintenance, operation, and upgrading of the state-of-the-art treatment water facilities	- -[j]	- -	CMWW	Ongoing	Partially implemented	
	Continued maintenance, operation, and upgrading of water supply facility security measures, programs, and procedures	- -[j]	- -	CMWW	Ongoing	Partially implemented	
	Continued coordination of emergency operation and response plans among governmental units and first responders	- -[b]	- -	CMWW, CMEM, MC	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Hazardous Material Events	Educational and informational programming related to hazardous material safety, and to individual actions to protect citizens, property, and businesses	- -[i]	- -	CMEM, MC, WDNR, WEM	Ongoing	Partially implemented	1, 4, 8, 11, 12, 13, 14, 30, 36, 38, 54, 57, 58, 59
	Promote community and operator compliance with industry safety regulations and standards	- -[b]	- -	CMEM, MC, WEM, UWEX	Ongoing	Partially implemented	
	Promotion of ongoing enforcement of Federal, State and County regulatory standards	- -[i]	- -	CMDCD, MC, WEM	Ongoing	Partially implemented	
	Support existing household waste management control programs, which should include hazardous material disposal sites for public citizens	- -[j]	- -	CMDPW, CMHD, MC, MMSD, WDNR	Ongoing	Partially implemented	
	Continued support of training, equipment, planning, and preparedness of first responders	- -[j]	- -	CMEM, CMFD, CMPD, MC, WEM	Ongoing	Partially implemented	

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Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Hazardous Material Events (continued)	Continued coordination of emergency response plans among governmental units, businesses, and first responders	- -[j]	- -	CMEM, CMFD, CMPD, MC, WEM	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD. CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Medical/Health Risks	Educational and informational programming related to public health and safety issues. Increase information and educational activities for specific health issues, such as West Nile Virus	- -[i]	- -	CMHD, MC, WDPH	Ongoing	Partially implemented	33, 44, 45, 57
	Strengthen public health infrastructure to support surveillance, response, reporting, and research, and to implement prevention and control programs	- -[j]	- -	CMHD, MC, WDPH	Ongoing	Partially implemented	
	Provide the public health work force with the knowledge and tools needed for early detection and control of diseases and disease vectors	- -[j]	- -	CMHD, MC, WDPH, PP	Ongoing	Partially implemented	
	Implement specific health issue-related mitigation strategies, such as mosquito reduction measures for West Nile Virus	- -[j]	- -	CMHD, MC, WDPH	Ongoing	Partially implemented	
	Ensure prompt implementation of prevention strategies and enhance communication of public health information about emerging diseases, their vectors, and control measures	- -[j]	- -	CMHD, MC, WDPH, PP	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMHD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Terrorism Incidents	Continue and expand educational and informational programming related to public health and safety issues due to terrorist incidents	- -[i]	- -	CMEM, MC, WEM, UWEX	Ongoing	Partially implemented	4, 8, 9, 10, 11, 12, 13, 14, 15, 29, 34, 43, 44, 45, 48, 57
	Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential chemical and biological attacks	- -[j]	- -	CMHD, MC, WEM, WDPH	Ongoing	Partially implemented	

Table 40 (continued)

Hazard	Mitigation Measures	Cost of Implementation[a]	Estimated Benefits for a 1 Percent Annual Probability Flood Event	Managing Agency	Plan Implementation Schedule	Implementation Status Notes	Potential Funding Programs (see Appendix F)
Terrorism Incidents (continued)	Continue support for training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments and other emergency management services	- -[j]	- -	CMEM, CMFD, CMPD, MC, WEM,	Ongoing	Partially implemented	
	Continue coordination of emergency response plans among Federal, State, and local governmental units, businesses and emergency management services	- -[j]	- -	CMEM, MC, WEM, UWEX	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	
Major Fire and Emergency Medical Events	Continue and expand educational and informational programming related to public health and safety issues due to fire and emergency medical incidents	- -[i]	- -	CMFD, MC, UWEX	Ongoing	Partially implemented	4, 8, 9, 10, 11, 12, 13, 14, 29, 43, 44, 45, 48, 57
	Continue support for training, equipment, planning, and preparedness for local law enforcement, fire and rescue departments and other emergency management services	- -[j]	- -	CMFD, MC, WEM	Ongoing	Partially implemented	
	Continue building safety inspection efforts	- -[b]	- -	CMNS, CMFD	Ongoing	implemented	
	Raze condemned buildings	- -[b]	- -	CMNS	Ongoing	Implemented	
	Consider the need to strengthen public health infrastructure to support surveillance, response, reporting and research, and to implement prevention and control programs from potential fire and major medical emergencies	- -[j]	- -	CMHD	Ongoing	Partially implemented	
	Continue maintenance and promote enhanced fire safety measures at critical facilities, and encourage widespread use of fire safety devices	- -[b]	- -	CMFD	Ongoing	Partially implemented	
	Continue support of training, equipment, planning, and preparedness for local law enforcement, fire, and rescue departments, and other emergency management services	- -[b]	- -	CMFD, CMPD	Ongoing	Partially implemented	
	Continue/enhance coordination of emergency response plans among Federal, State, and local governmental units, businesses, and emergency management services	- -[b]	- -	CMEM, WEM	Ongoing	Partially implemented	
	Continue to work towards compliance with the National Incident Management System	- -[i]	- -	CMEM, CMFD, CMPD, MC	2007	Partially Implemented	
	Promote and expand Citizens Corps program and encourage citizen participation	- -[i]	- -	CMEM, MC, COAD	Ongoing	Partially Implemented	

Table 40 (continued)

NOTE: The following abbreviations are used for designated management agencies:

CMDCD	=	City of Milwaukee Department of City Development
CMDPW	=	City of Milwaukee Department of Public Works
CMEM	=	City of Milwaukee Office of Emergency Management and Homeland Security
CMFD	=	City of Milwaukee Fire Department
CMHD	=	City of Milwaukee Health Department
CMNS	=	City of Milwaukee Department of Neighborhood Services
CMOES	=	City of Milwaukee Office of Environmental Sustainability
CMPD	=	City of Milwaukee Police Department
CMWW	=	City of Milwaukee Water Works
CO	=	Conservation Organizations
COAD	=	Coalition of Organizations Active in Disasters
LI	=	Lending Institutions
LU	=	General Purpose Local Units of Government
MC	=	Milwaukee County
MMSD	=	Milwaukee Metropolitan Sewerage District
PP	=	Private Parties
RB	=	Real Estate Brokers
SEWRPC	=	Southeastern Regional Planning Commission
UC	=	Utility Company
UWEX	=	University of Wisconsin Extension
VWM	=	Veolia Water Milwaukee
WEM	=	Wisconsin Emergency Management
WDC	=	Wisconsin Department of Commerce
WDNR	=	Wisconsin Department of Natural Resources
WDOT	=	Wisconsin Department of Transportation
WDPH	=	Wisconsin Division of Public Health
WHEAP	=	Wisconsin Home Energy Assistance Program

[a]*All costs expressed in 2010 dollars.*

[b]*Costs covered under ongoing activity.*

[c]*Plan implementation is largely complete in City of Milwaukee. Additional actions are needed within watershed.*

[d]*Plan implementation largely complete. Environmentally sensitive lands are all under County ownership. Additional actions are underway within watershed by MMSD.*

[e]*For further details on the benefit-cost analysis of floodland mitigation alternatives, refer to Tables V-1 through V-5.*

[f]*MMSD reimbursement is dependent on property owner granting easements to enable MMSD to determine that floodproofing measures are adequately implemented and maintained.*

[g]*No cost or benefit given. This element has already been implemented.*

[h]*Cost of ordinance development is covered under ongoing projects. Cost of implementation is not determined.*

[i]*Portion of costs included in ongoing program and construction project implementation programs.*

[j]*Costs to be determined. Partially covered under ongoing programs.*

[k]*Costs are site specific and survey is needed for citywide estimate.*

[l]*Costs to be determined.*

Source: SEWRPC.

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Flood Mitigation Assistance Program
The Flood Mitigation Assistance (FMA) program can provide up to 75 percent of the costs attendant to the acquisition, relocation, elevation, and floodproofing of structures in compliance with NFIP standards. In addition to participating in the NFIP, eligible program applicants must meet cost-benefit criteria established by FEMA. Mitigation of repetitive-loss properties is given a high priority under this program. Increased cost of compliance (ICC) coverage under the NFIP may provide a funding source for bringing noncompliant structures into compliance after a flood loss.

Public Assistance Program
FEMA's Public Assistance Program can provide some limited assistance with respect to structure elevation and relocation. For example, if entire portions of a community were to be relocated outside of a floodplain, this program can assist in rebuilding the necessary infrastructure in the new location. Funding under this program is provided for repair of infrastructure damaged during a flood that results in a Presidential disaster declaration. In making repairs to the infrastructure, cost-effective mitigation activities may be included. If a community determines that a badly damaged facility is not to be repaired, the estimated damage amount may be used to fund an alternate project. The Public Assistance Program may pay for mitigation measures under Section 406 of the Stafford Act.

Pre-Disaster Mitigation Program
FEMA's Pre-Disaster Mitigation Program (PDM) can potentially provide up to 75 percent of the costs attendant to pre-disaster mitigation planning and the implementation of cost-effective mitigation projects prior to a disaster event. Funding these plans and projects reduces overall risks to the population and structures, while also reducing reliance on funding from actual disaster declarations. Examples of eligible projects include property acquisition, structure acquisition and demolition or relocation, structure elevation, safe room construction, dry floodproofing of nonresidential structures and historic residential structures, and minor localized flood reduction projects.

Repetitive Flood Claims Program
FEMA's Repetitive Flood Claims Program (RFC) provides funds on an annual basis to reduce the risk of flood damage to individual properties insured under the NFIP that have had one or more claim payments for flood damages. RFC provides up to 100 percent Federal funding for projects in communities that meet the reduced capacity requirements. Examples of eligible projects include property acquisition, structure removal or relocations, dry floodproofing of nonresidential structures and historic residential structures and minor localized flood reduction projects.

Severe Repetitive Loss Program
FEMA's Severe Repetitive Loss Program (SRI) provides funds on an annual basis to reduce the risk of flood damage to residential structures insured under the NFIP that are qualified as severe repetitive loss structures. SRL provides up to 90 percent Federal funding for eligible projects. Examples of eligible projects include property acquisition, structure removal or relocations, structure elevation, dry floodproofing of residential structures, mitigation reconstruction, and minor localized flood reduction projects.

National Training and Education Division
FEMA's National Training and Education Division provides over 100 training courses for state and local first responders.

U.S. Department of Housing and Urban Development Community Development Block Grant Program
Community Development Block Grant (CDBG) programs, funded by the U.S. Department of Housing and Urban Development, are administered by the Wisconsin Departments of Administration and Commerce.

The Community Development Block Grant Emergency Assistance Program is a special program that the Wisconsin Department of Commerce, Division of Housing and Community Development activates to assist local units of government that have recently experienced a natural or man-made disaster. The program provides funds to address housing needs that occur as a direct result of natural or man-made disasters, with preference given to those

households with incomes at or below 80 percent of the county median household income. A local unit of government that has recently experienced a natural or man-made disaster may apply for assistance in addressing the housing problems caused by the disaster. Generally, cities, towns, counties, and villages with populations less than 50,000 and all counties, except Milwaukee, Waukesha, and Dane, are eligible to apply. The program also makes funds available for the repair of public infrastructure affected by natural disaster. Eligible activities dependent upon the nature of the disaster may include: repair of damage to the dwelling unit; acquisition and demolition of dwellings unable to be repaired; costs for new housing units to replace those lost in the disaster; and repairs to publically-owned utility systems, streets, and sidewalks.

U.S. Small Business Administration Programs

The U.S. Small Business Administration (SBA) provides disaster loans to homeowners and businesses to repair or replace property damaged in a declared disaster. SBA loans are granted only for uninsured losses. Loans may be used to meet required building codes, such as the NFIP requirements. SBA may also provide loans for relocation out of special flood hazard areas when such locations are required by local officials. While SBA's enabling legislation generally prohibits the agency from making disaster loans for voluntary relocations, there are exceptions that can be made, including relocations of homeowners, renters, and business owners out of special flood hazard areas when the community is participating in a buyout program. These loans would be limited to the amount necessary to repair or replace the damage at the disaster site. SBA loans may also be used to refinance existing mortgages. Up to 20 percent of the disaster loan can be used for mitigation measures.

U.S. Army Corps of Engineers

The Corps of Engineers programs are potential sources of funding for implementing the floodland management recommendations of this plan. In order to be eligible for funding, the plan components must meet specific Corps economic feasibility and other criteria. The programs which may be applicable include the following:

- Section 22—Water resources planning assistance—50 percent Federal, 50 percent local cost share—Maximum $500,000 in funds available to any one state per project.

- Section 205—Small flood control projects—Maximum $7.0 million per project (65 percent Federal, 35 percent local cost share).

- Section 208—Clearing debris and sediment from channels for flood prevention—Maximum $500,000 per project (65 percent Federal, 35 percent local cost share).

- Section 14—Emergency streambank and shoreline protection—Maximum $1.5 million per project (65 percent Federal, 35 percent local cost share).

U.S. Fire Administration

The U.S. Fire Administration (USFA) was established by the Federal Fire Prevention and Control Act of 1974, which called for the establishment of a National Fire Academy to advance the professional development of the fire service personnel and of other persons engaged in fire prevention and control activities; a technology program of development, testing, and evaluation of equipment for use by the Nation's fire, rescue, and civil defense services; the operation of a National Fire Data Center for the selection, analysis, publication, and dissemination of information related to the prevention, occurrence, control and results of fires of all types; and to take all necessary steps to educate the public and to overcome public indifference as to fire and fire prevention. The USFA operates the National Fire Academy, which provides tuition-free training in firefighting, fire prevention, emergency medical services, and related areas to persons with substantial involvement in the fire control and prevention, emergency medical services, fire-related emergency management activities, and related professions. The academy also has a program to provide travel stipends to students attending National Fire Academy courses.

The USFA also administers several grant programs that are designed to assist local fire departments and other organizations in protecting citizens and firefighters against the effects of fire and fire-related incidents. These programs include the Assistance to Firefighters Grant program, the Fire Protection and Safety Grant program, the

Staffing for Adequate Fire and Emergency Response Grant program, and the Fire Management Assistance Grant program.

Assistance to Firefighters Grant Program
These grants provide direct assistance to fire departments for the purpose of protecting the health and safety of the public and firefighting personnel against fire and fire-related hazards. Funding is provided for programs that directly benefit fire department or provide equipment to enhance safety. Emergency medical services units are eligible for assistance provided the unit falls organizationally under the auspices of a fire department as defined above. However, special operations teams, like DIVE or HURT, are ineligible for assistance under this grant, and limits and restrictions are set for specific equipment. Examples of eligible projects include firefighting and EMT training, purchase of firefighting and EMS equipment, and firefighter personal protective equipment. Cost-share matching requirements for this program are dependent upon the size of the population served by the fire department.

Fire Prevention and Safety Grant Program
This program provides grants to assist State, regional, national or local organizations programs that address fire prevention and safety. The grant program is intended to support programs that reach high-risk groups, such as children, seniors and firefighters. Examples of eligible projects include public education programs, arson prevention programs, fire prevention-related training, fire prevention activities, and risk assessments. Cost-share matching requirements for this program are dependent upon the size of the population served by the fire department.

Staffing for Adequate Fire and Emergency Response (SAFER) Grant Program
The purpose of the SAFER program is to award grants directly to volunteer, combination, and career fire departments in order to assist the departments in increasing their cadre of firefighters. The program's goal is to enhance the grantees' ability to attain 24-hour staffing and assure that their communities have adequate protection from fire and fire-related hazards. The program provides funding to support the rehiring of laid off firefighters and for the hiring of new firefighters.

Fire Management Assistance Grant Program
The Fire Management Assistance Grant Program provides grants to States, Indian tribal governments, and local governments for the mitigation, management, and control of any fire burning on publicly (nonfederal) or privately owned forest or grassland that threatens such destruction as would constitute a major disaster.

Chemical Emergency Preparedness and Prevention (CEPP) Technical Assistance Grants Program
These grants are offered through the Office of Solid Waste and Emergency Response, Environmental Protection Agency to provide financial assistance to States, County and local agencies, and Indian Tribes for chemical accident prevention activities that relate to the Risk Management Program under the Clean Air Act Section 112(r). Innovative Technical Assistance Grants are offered to improve the ability of States, County, and local agencies to protect public health and safety and involve the development of technical assistance or similar materials that could be used directly or adapted by other States or Local Emergency Planning Committees (LEPCs). Projects which address implementing the Risk Management Program under the Clean Air Act Section 112(r) are especially encouraged.

NIEHS Hazardous Waste Worker Health and Safety Training
This program is sponsored by the National Institutes of Health, Department of Health and Human Services to provide assistance for Superfund Site worker training. This program assists organizations in the development of institutional competency to provide appropriate training and education to hazardous waste workers. It provides project grant support for the development and administration of model worker health and safety training programs consisting of classroom and practical health and safety training of workers and their supervisors, who are engaged in activities related to hazardous materials, hazardous waste generation, treatment, storage, disposal, removal, containment, transportation, or emergency response. Public or private-nonprofit entities are eligible for this program.

Department of Homeland Security, Office for Domestic Preparedness: Urban Area Security Initiative
The Urban Area Security Initiatives (UASI) program provides financial assistance to address planning, equipment, training, and exercise needs of large urban areas, and to assist them in building an enhanced and sustainable capacity to prevent, respond to, and recover from threats or acts of terrorism. It also provides funds to selected mass transit agencies to protect infrastructure and for emergency preparedness. Funds are awarded to and distributed through the State Administrative Agency designated by the Governor of each state. The State then distributes funds to urban areas or mass transit agencies based on need.

Wisconsin Emergency Management
Wisconsin Emergency Management (WEM) administers many of the federally derived funding sources, directing assistance to local and county agencies. This includes assistance from the Hazard Mitigation Grant Program (HMGP). WEM also administers the Pre-Disaster Mitigation Program (PDM) which provides funding to local and county agencies to implement cost-effective hazard mitigation activities.

Wisconsin Department of Natural Resources
The Wisconsin Department of Natural Resources (WDNR) operates programs that may serve as potential funding sources for the City's flood mitigation efforts (see also Appendices G and H). These programs are described below.

Urban Green Space Program
The WDNR's Urban Green Space (UGS) program provides 50 percent matching grants to cities, villages, towns, counties, public inland lake protection and rehabilitation districts, and qualified nonprofit conservation organizations for the acquisition of land. The intent of the program is to provide natural open space within or near urban areas and protect scenic or ecological features.

Urban Rivers Grants Program
The Wisconsin Department of Natural Resources Urban Rivers Grants Program (URGP) provides grants to municipalities or nature conservancy organizations through its land stewardship program. This program allocates 20 percent of the funds available in the Local Assistance Program for the acquisition of land or rights to land on or adjacent to rivers that flow through urban areas, in order to preserve or restore urban rivers or riverfronts for the purposes of economic revitalization and the encouragement of outdoor recreational activities.

Stormwater Management Program
The WDNR administers a Targeted Runoff Management (TRM) grant program provided for under Section 281.65(4c) of the *Wisconsin Statutes.* Local governmental units may be reimbursed up to 70 percent of eligible costs associated with installing Best Management Practices (BMPs) to limit of end nonpoint water pollution. Grant awards cannot exceed $150,000. Grants provided under this program may be used for projects to control nonpoint source pollution and may be available to partially support dual-purpose (quality and quantity) detention ponds, streambank protection projects, or other stormwater management facilities.

The WDNR also administers an Urban Nonpoint Source and Stormwater Grant Program provided for under Section 281.66 of the *Wisconsin Statutes*. Cities, towns, villages, and counties are eligible for grants under this program to improve urban water quality by limiting or ending sources of urban nonpoint source pollution. Funded projects are site-specific and targeted to address high priority problems in urban project areas. Two types of grants are available under this program: planning grants and construction grants. Construction grants are made for construction projects designed to control stormwater runoff rates, volumes, and discharge quality from nonpoint sources within existing urban development. Eligible project sponsors can be reimbursed up to 50 percent to construct BMPs. The maximum possible grant is $200,000 ($150,000 for construction activities and $50,000 for land acquisition or easements). A project must be located in an urban area to be eligible for BMP cost sharing. Eligible activities include construction of structural urban BMPs such as detention basins, wet basins, infiltration trenches, infiltration basins, or wetland basins; engineering design and construction services for BMP installation;

land acquisition and easement purchase; storm sewers; and streambank and shoreland stabilization projects. Projects are selected for funding based on a competitive process.

Municipal Flood Control Grants
Under Chapter NR 199, "Municipal Flood Control Grants,: of the *Wisconsin Administrative Code* municipalities including cities, towns, and villages, as well as metropolitan sewerage districts, are eligible for cost-sharing grants from the State for projects such as acquisition and removal of structures; floodproofing and elevation of structures; riparian restoration projects; acquisition of vacant land or purchase of easements to provide additional flood storage or to facilitate natural or more efficient flood flows; construction of facilities for the collection, detention, retention, storage, and transmission of stormwater and groundwater for flood control and riparian restoration projects; and preparation of flood mapping projects. Municipalities and metropolitan sewerage districts are eligible for up to 70 percent State cost-share funding for eligible projects, and would have to provide at least a 30 percent local match. Applications are due on July 15 of each calendar year.

Wisconsin Coastal Management Program
The Wisconsin Coastal Management Program administers an annual competitive grants program available for the 15 Wisconsin coastal counties. Under the category Coastal Resource and Community Planning, funds are available for projects that support natural hazard planning and development of ordinances.

Other Potential Funding Sources
A variety of other potential sources exist which may provide funds or technical assistance for implementation of elements of the recommended hazard mitigation plan. These are listed in Appendices G and H.

PLAN MONITORING AND REEVALUATION STRATEGIES

For a hazard mitigation plan to be successful it must not only be implemented, it must be monitored. Plan monitoring is best accomplished through a formal, periodic process designed to measure and assess progress in implementation, changing outside circumstances that may affect the plan and efforts to implement it, and the need for any changes to the plan and/or to how it is being implemented. The plan should also be reviewed following each hazard event occurrence to assess its continued viability and the need for revisions.

Plan Monitoring
Toward ensuring successful monitoring of the hazard mitigation plan for the City of Milwaukee, the City intends to annually formally review the plan and the status of its implementation, as well as develop and recommend any necessary revisions of the plan to the Department of Public Works and other governmental departments involved, for consideration and possible adoption by those bodies. As needed, the City will call a meeting of the Hazard Mitigation Plan Steering Committee. The revisions would be proposed, considered, and adopted in the form of formal amendment to the hazard mitigation plan. This review process will be coordinated and conducted by the Department of Public Works, and will typically be in April of each year.

The Department of Public Works, with advice from the Hazard Mitigation Plan Steering Committee, in its review process, will examine the plan and the efforts to implement it with respect to 1) whether any hazards affecting the City have changed, and, if so, how they have changed; 2) whether any hazard mitigation goals and objectives have changed, or need to be changed; 3) the degree and extent of progress made in implementing previously identified hazard mitigation actions; 4) whether the plan elements and their priorities should remain unchanged or need modification; 5) whether any new plan elements are needed; and 6) whether applicable funding programs and levels have changed.

The plan monitoring and refinement strategy will include a post-disaster component whereby the plan is reviewed and evaluated after any future major hazard event. Based upon this review, the hazard mitigation plan will be updated or revised as needed based upon the flood event experiences, circumstances, and consequences. In this regard, the post-disaster review effort will be coordinated with the emergency operations program administered by the County Office of Emergency Management in partnership with the local units of government. The

experiences of the emergency operations may indicate a need for refined mitigation actions which would then be incorporated into the plan. Any plan updating found to be needed will be incorporated into the annual plan update noted above.

The meetings of the Steering Committee will continue to be publicly noticed and salient decisions recorded in Public Works Department and City Emergency Management files and, where appropriate, on the City website and in press releases. Meetings of the Steering Committee are considered public meetings under Wisconsin Law and are open to all interested parties.

Reevaluation Strategy

The components of the City of Milwaukee Hazard Mitigation Plan will be reviewed within the context of all hazards planning and programs developed for Milwaukee County and communities adjacent to the City of Milwaukee at five-year intervals. That review will consider the degree to which the actions recommended under such efforts would impact the City of Milwaukee Plan and any changes in the available hazard mitigation strategy state-of-the-art management methods and procedures. The plan components will be revised as necessary to reflect changing conditions and needs in accord with the appropriate review-revision procedures. This updated plan will then be submitted to the State Hazard Mitigation Officer.

Reevaluation, updating, and revision of this updated plan should be initiated approximately 24 months prior to expiration of this updated plan. For each five-year update, one or more public meetings will be scheduled prior to plan submittal and the public will be given an opportunity to provide feedback about the plan and any changes that may occur. Copies of the plan will be made available to the public through the Department of Public Works. If no changes to the plan are required, the State Hazard Mitigation Officer will be given a justification for this determination. Comments and recommendations offered by committee members, the public and the State Hazard Mitigation Officer will then be incorporated into the updated plan.

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APPENDICES

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Appendix A

COMMITTEES AND OTHER RELEVANT MATERIALS USED IN THE CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN

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Figure A-1

CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

Elizabeth Corneliuson ..... Program Administrator, Region 7, Wisconsin Hospital Emergency Preparedness Program
Kurt Drezek ..... Law Enforcement Program Manager, Milwaukee Police Department
Steven Fronk..... Director, City of Milwaukee Office of Emergency Management and Homeland Security
Steven Jacquart..... Intergovernmental Coordinator, Milwaukee Metropolitan Sewerage District
Ghassan Korban ..... Coordination Manager, City of Milwaukee Department of Public Works
James H. Ley ..... Battalion Chief, City of Milwaukee Fire Department
Doreen Martinez..... Director, Disaster Services, American Red Cross in Southeastern Wisconsin
Matthew J. Mortwedt..... Security Operations Manager, City of Milwaukee Department of Public Works
Kate Pillman ..... Executive Director, Community Organizations Active in Disaster
Edward A. Richardson..... Principal Planner, City of Milwaukee Department City Development
Julie Schneider ..... Transit Security Planning Coordinator, Milwaukee County Transit System
Carl Stenbol..... Director, Milwaukee County Division of Emergency Management
Timothy Thur ..... Chief Sewer Design Manager, City of Milwaukee Department of Public Works

Figure A-2

ACTIVITIES OF THE CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

City of Milwaukee Department of Public Works
City of Milwaukee Office of Emergency Management and Homeland Security
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN STEERING COMMITTEE

DATE: March 30, 2011

TIME: 1:30 to 3:30 p.m.

PLACE: Frank P. Zeidler Municipal Building
Room 501
841 N. Broadway Street
Milwaukee, Wisconsin

AGENDA:

1. Welcome

2. Introductions

3. Overview of hazard mitigation plan updating process: Roxanne K. Gray, State Hazard Mitigation Officer, Wisconsin Division of Emergency Management

4. Background on the update to the City of Milwaukee All Hazards Mitigation Plan: Michael G. Hahn, SEWRPC Chief Environmental Engineer

    a. Initial 2004/2005 plan

    b. Main plan components to be reviewed and revised

    c. Schedule for the plan update (Attachment 1)

5. Review of preliminary draft Chapter I, "Introduction and Background," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner **[NOTE: Preliminary draft chapters can be viewed at:**

    http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

    Scroll down to the "Hazard Mitigation" section and select the chapter that you want to review. Chapters I and II will be posted on the web page on or before March 7. Meeting summary notes and meeting agendas can also be accessed from that web page.]

6. Review of preliminary draft Chapter II, "Basic Study Area Inventory," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner

7. Hazard and vulnerability assessment exercise (Attachment 2): Joseph Boxhorn

8. Other Business

9. Next meeting

10. Adjourn

Respectfully Submitted,

Michael G. Hahn
Secretary

Enclosures (#153986, #156202)

#156201 V1 - CAPR-282-2ED AGENDA 03/30/11 MTG
KRY/MGH/JEB/pk
03/04/11

Attachment 1

PROPOSED WORK SCHEDULE FOR UPDATING
THE CITY OF MILWAUKEE HAZARD MITIGATION PLAN

Task	Estimated Completion Date
Chapter I, Introduction and Background	March 2011
Chapter II, Basic Study Area Inventory	March 2011
Chapter III, Hazard Mitigation Goals and Objectives	April 2011
Chapter IV, Analysis of Hazard Conditions	April 2011
Chapter V, Hazard Mitigation Strategies	June 2011
Chapter VI, Plan Adoption, Implementation, Maintenance, and Revision	June 2011
Submit Draft Plan Update for Review by Wisconsin DEM (WDEM)	June 2011
Revise Plan Based on State Review	July 2011
Public Meeting	July 2011
Submit Final Plan Update for FEMA Approval	Mid-July 2011
FEMA Approval	August 14, 2011
Formal Adoption	To be determined by the City

#156215 V1 - CAPR-282-2ED NOTICE 03/30/11 MTG ATTACHMENT 1

Attachment 2

HAZARD AND VULNERABILITY ASSESSMENT TOOL
CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN UPDATE

EVENT	PROBABILITY	SEVERITY = (MAGNITUDE - MITIGATION)				RISK
		HUMAN IMPACT	PROPERTY IMPACT	BUSINESS IMPACT	PREPARED-NESS	
	Likelihood this will occur	*Possibility of death or injury*	*Physical losses and damages*	*Interuption of services*	*Preplanning*	*Relative threat**
SCORE	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = Low 2 = Moderate 3 = High*	*0 = N/A 1 = High 2 = Moderate 3 = Low or none*	*0 - 100%*
A1. Riverine flooding						0%
A2. Stormwater flooding						0%
A3. Tornado or high straight-line wind event						0%
A4. Earthquake						0%
A5. Lake Michigan coastal erosion (long-term lake level changes)						0%
A6. Snow storm						0%
A7. Blizzard or extreme snowfall						0%
A8. Ice storm						0%
A9. Extreme heat						0%
A10. Extreme cold						0%
A11. Lightning						0%
A12. Thunderstorm						0%
A13. Hail						0%
A14. Fog						0%
A15. Drought						0%
A16. Dust storm						0%
B1. Contamination or loss of water supply system						0%
B2. Loss of sewerage system						0%
B3. Loss of telecommunication						0%
B4. Electrical system outage						0%
B5. Computer system incident/cyber attack						0%
C1. Hazardous materials railroad incidents						0%
C2. Hazardous materials roadway incidents						0%
C3. Hazardous materials pipeline incidents						0%
C4. Hazardous materials fixed facility incidents (industries, bulk fuel storage sites, grain elevators, agricultural chemical storage, and explosives, including fireworks storage						0%
D1. Aircraft Transportation Accident						0%
D2. Roadway transportation accidents						0%
D3. Railway transportation accidents						0%
E1. Correctional center incident						0%
E2. Civil unrest						0%
E3. Terrorism incident (bomb threat, hostage situation, biological incident)						0%
E4. Biological contaminants (anthrax, smallpox, etc.)						0%
E5. Workplace violence						0%
E6. School violence						0%
F1. Communicable disease outbreak or epidemic						0%
G1. Major fire (structure(s) or other)						0%
G2. Explosion						0%
G3. Mass casualty incident						0%
G4. Building collapse or cave-in						0%
AVERAGE SCORE	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0%**

**Threat increases with percentage.*

RISK = PROBABILITY * SEVERITY		
0.00	0.00	0.00

Source: Kaiser Permanente and SEWRPC.

DOCS #156202
KRY/MGH/JEB/pk
3/4/2011

SUMMARY NOTES OF THE MARCH 30, 2011 MEETING OF THE CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

INTRODUCTION

The first meeting of the City of Milwaukee All Hazards Mitigation Steering Committee was convened at the Frank P. Zeidler Municipal Building, Room 501 at 1:35 p.m. The meeting was called to order by Steven Fronk, the City of Milwaukee Director of Emergency Management and Homeland Security. Attendance was taken by circulating a sign-in sheet.

In attendance at the meeting were the following individuals:

Steven Fronk, Co-Chairman	Director, City of Milwaukee Office of Emergency Management and Homeland Security
Ghassan Korban, Co-Chairman	Coordination Manager, City of Milwaukee Department of Public Works
Matthew H. Mortwedt, Co-Chairman	Security Operations Manager, City of Milwaukee Department of Public Works
Michael G. Hahn, Secretary	Chief Environmental Engineer, Southeastern Wisconsin Regional Planning Commission
Joseph E. Boxhorn	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Steven Buck	Disaster Co-Chair, American Red Cross of Southeastern Wisconsin
Roxanne K. Gray	State Hazard Mitigation Officer, Wisconsin Division of Emergency Management
Steven Jacquart	Intergovernmental Coordinator, Milwaukee Metropolitan Sewerage District
Lynsey Kawski	Response and Recovery Planner, Wisconsin Division of Emergency Management
James H. Ley	Battalion Chief, Milwaukee Fire Department and Office of Homeland Security
Barry Mitchell	Emergency Coordinator, Milwaukee County Sherriff's Office Emergency Management
Aaron W. Owens	Research Analyst, Southeastern Wisconsin Regional Planning Commission
Kate Pillman	Executive Director, Southeastern Wisconsin Citizens and Organizations Active in Disaster
Edward A. Richardson	Principal Planner, Milwaukee Department of City Development
Julie Schneider	Transit Security Planning Coordinator, Milwaukee County Transit
Timothy J. Thur	Chief Sewer Design Manager, City of Milwaukee Department of Public Works

Mr. Fronk welcomed all those in attendance and thanked them for their interest and participation on this committee. He explained that the City's hazard mitigation plan will expire this year, and that this planning process will update the existing plan. He then asked those in attendance to introduce themselves.

OVERVIEW OF HAZARD MITIGATION PLAN UPDATING PROCESS

Mr. Fronk introduced Roxanne Gray of the Wisconsin Division of Emergency Management (WEM). At Mr. Fronk's request, Ms. Gray presented an overview of the hazard mitigation plan updating process.

[Secretary's Note: Ms. Gray's presentation is attached hereto as Exhibit A.]

Ms. Gray noted that there are 211 repetitive loss properties in the City of Milwaukee. She explained that the confidentiality of these sites are protected by the Privacy Act and cannot be specifically identified in hazard mitigation planning. She noted that repetitive loss properties could be mapped or listed in a way that does not specifically identify the property or the property owner.

Ms. Gray explained that the City's hazard mitigation plan expires on June 16, 2011. After that date, the City will not be eligible to receive funding through the Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program or the Predisaster Mitigation Grant Program until FEMA approves an updated plan and the City adopts the plan. Lynsey Kawski of WEM added that FEMA will expedite the review of an updated plan, if there is a grant funding request awaiting approval. In the absence of such requests, FEMA will not expedite review of the updated plan.

Mr. Hahn noted that the Milwaukee Metropolitan Sewerage District (MMSD) has major involvement in the management of watercourses in the City, including management of floodlands. He asked whether the approval of the plan by the MMSD was essential to plan approval. Ms. Gray explained that while the MMSD's approval was not essential, she strongly recommends that the MMSD participate in planning process and formally indicate acceptance of the plan. She noted that the District did this for the City's initial hazard mitigation plan. She added that this would have the benefit of making District projects within the City eligible for funding under the hazard mitigation and predisaster mitigation grant programs.

[Secretary's Note: The membership of this Steering Committee includes a representative of the MMSD.]

Ms. Kawski emphasized that it is important for the City to take credit for hazard mitigation activities accomplished since the completion of the current plan. She explained that FEMA wants to see all mitigation efforts that have taken place. Ms. Kawski recommended looking to the City of Darlington's hazard mitigation plan as a good example of highlighting efforts in mitigation.

Mr. Fronk thanked Ms. Gray and Ms. Kawski, as well as the Southeastern Wisconsin Regional Planning Commission (SEWRPC) for their efforts and for reminding the City of the need to update the City's hazard mitigation plan.

BACKGROUND ON THE UPDATE TO THE CITY OF MILWAUKEE HAZARD MITIGATION PLAN

Mr. Fronk introduced Michael G. Hahn of the SEWRPC staff. At Mr. Fronk's request, Mr. Hahn presented background information on the initial hazard mitigation plan, the main plan components to be reviewed, and a schedule for the plan update.

Mr. Hahn stated that a flood mitigation plan was prepared for the City in 2001. The first all hazards mitigation plan for the City of Milwaukee was published in 2005. He explained that the current effort will update the 2005 plan. This will include updating the inventories, reviewing the hazards that plan will address, updating profiles of the hazards that the plan addresses, revising the risk and vulnerability analyses for these hazards, reviewing implementation of mitigation strategies presented in the initial plan, and revising the recommended mitigation strategies to reflect implementation efforts and changes in conditions.

Mr. Hahn indicated that as the update of the plan proceeds SEWRPC staff will present updated text to the Steering Committee and look for comments and additional information from the Committee. In addition, he continued, prior to the meetings, SEWRPC staff will post the chapters to be reviewed on the SEWRPC website where the Committee, as well as the public, will be able to review the material and submit questions and comments. He added that hard copies of the chapters will be provided at the Committee meetings. Mr. Hahn said

that he anticipated that the plan update process will require two or three more Steering Committee meetings. He also noted that there will be public informational meetings.

[Secretary's Note: The web address for the page on the SEWRPC website where the materials will be located is:

http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm]

Mr. Korban asked whether it is essential that all Committee members attend each meeting. Ms. Kawski indicated that as long as Committee members review and comment on the material, it is not vital that each member attend all the meetings. Mr. Boxhorn reminded the Committee the SEWRPC website includes a screen where questions and comments on the plan can be submitted at any time by Committee members. He added that members of the Committee may also email questions and comments directly to him. Mr. Fronk asked whether the materials relating to the update of the hazard mitigation plan and the comment screen on the SEWRPC website can also be accessed by the public for their review and comment. Mr. Boxhorn replied that the public can access the website and submit questions and comments via comment screen.

Mr. Hahn noted that City staff and SEWRPC staff would conduct the public meetings.

Ms. Kawski noted that there was a significant delay in receiving funding for this plan updating effort from the Federal government. She explained that the City applied for funding in December of 2009 and the funding was not awarded until after the Federal budget passed in October of 2010.

REVIEW OF PRELIMINARY DRAFT CHAPTER I, "INTRODUCTION AND BACKGROUND", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

Mr. Fronk introduced Joseph E. Boxhorn of the SEWRPC staff. At Mr. Fronk's request, Mr. Boxhorn reviewed the preliminary draft of Chapter I, "Introduction and Background."

[Secretary's Note: Mr. Boxhorn's presentation is attached hereto as Exhibit B.]

Mr. Boxhorn noted that the Commission staff used Chapter I from the initial report as a template for this draft of the updated chapter. He indicated that significant changes and additions to the text were highlighted in blue.

In his review of the mitigation planning requirements on page 2, Mr. Boxhorn noted that neighboring communities should be informed that this plan is being updated and given an opportunity to comment on the plan during plan development. Mr. Fronk asked whether SEWRPC would send out letters notifying surrounding communities of the current planning process. Mr. Boxhorn recommended that the letters be sent by the City. He said he could provide examples of letters sent out for planning efforts in other communities. Ms. Kawski noted that notification of surrounding communities is a requirement from FEMA.

Mr. Boxhorn drew the Committee's attention to the text highlighted in yellow on pages 2 and 8. He indicated that these highlighted areas were reserved for a brief discussion of the composition of the Steering Committee and that these would be completed now that the Committee has been reconstituted.

[Secretary's Note: The following paragraph was added in the reserved space after the first paragraph on page 2:

"In assembling the City of Milwaukee All Hazard Steering Committee, the City Department of Public Works and the City Office of Emergency Management and

Homeland Security sought representatives of law enforcement; the City's fire, public works, and community development departments; the County emergency management office and transit system; the Milwaukee Metropolitan Sewerage District; interested nongovernmental organizations; and the health care community."

The first full paragraph on page 8 was revised to read (The revised text and added text in this and all subsequent revisions in these summary notes is indicated in bold letters for clarification only. The report text will not be bold.):

"This hazard mitigation plan update was also prepared under the guidance of a City advisory Steering Committee comprised of local official representatives, including representatives **of City Departments**, such as **the** police**, fire, community development, and public works departments; County departments and agencies, including the County emergency management office and transit system;** the MMSD**; interested nongovernmental organizations; and the health care community.** The Steering Committee met three times during the plan preparation period to provide input on the types of hazards to be considered, the appropriate mitigation strategies, and to review the draft report **chapters**. Those chapters were then refined to reflect the comments and recommendations of the Steering Committee (see Appendix A)."]

After reviewing the section of the chapter regarding outreach and implementation activities, Mr. Boxhorn asked the Committee to provide information on any additional activities that were not discussed in the draft chapter. Mr. Hahn noted that there would be further discussion related to flood mitigation in later chapters. Mr. Jacquart suggested that the MMSD's private property inflow and infiltration reduction program, which aims to reduce basement backups, should be added to the discussion regarding implementation measures. Mr. Hahn agreed that discussion of this program should be added.

[Secretary's Note: The following paragraphs were added after the second full paragraph on page 7:

"Private Property Inflow and Infiltration Reduction Program

In 2010 and 2011, the MMSD drafted a policy to reduce I/I In an effort to further reduce sanitary sewer backups into basements and sanitary sewer overflows both caused primarily by infiltration and inflow (I/I) into the sanitary sewer system. Infiltration is stormwater and groundwater that may enter the sanitary sewer system through such sources as defective pipes, pipe joints, connections or leaking manholes. Clearwater inflow to the sanitary sewer is stormwater from foundation drains, connected downspouts, catch basins, and leaking manhole covers. With the assistance of the Technical Advisory Team comprised of public works, engineering, and/or administrative staff from the MMSD's 28 member communities, a program was developed to fund projects to reduce I/I from the privately owned components of sanitary sewerage systems. As of April 2011, it was proposed that the program provide $151 million over a period of ten years for design, inspection and activities to remove I/I from private sources. Funding of the program is based on the equalized value of the municipality. Each member community, including the City of Milwaukee, would control how the funds are used (within the eligible cost guidelines) and municipal staff could be responsible for managing the work. The program would fund activities such as foundation drain disconnection; sewer lateral repair or replacement; and design, planning, and investigation costs.

This program will assist the City in addressing the existing deficiencies in the private portion of the sewerage system. The City's sewerage system would benefit

from this program by reducing flows within the system. City residents would benefit from the improvement of their laterals and increased protection from basement backups. The City is responsible for maintaining or reducing its flows to the MMSD. This will assist the flow reduction effort by becoming part of the City's long-term maintenance program."]

Regarding discussion of a public informational meeting, Ms. Gray stated that there is a requirement of two public informational meetings. She explained that one meeting needs to be held before the plan goes to WEM for review. Ms. Kawski added that an option was to publicly notice the next two Steering Committee meetings. She suggested that the potential amount of public interest in flooding may mean that this is not a feasible option. Mr. Mitchell suggested that neighboring communities could give their input in conjunction with the public meeting. Mr. Korban asked if it would be acceptable to have two sessions at different locations on the same day. Ms. Kawski indicated that would be satisfactory.

Mr. Boxhorn told the Committee that meeting minutes, agendas, and any public comments would be included in the plan as Appendix A.

REVIEW OF PRELIMINARY DRAFT CHAPTER II, "BASIC STUDY AREA INVENTORY", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

At Mr. Korban's request, Mr. Boxhorn reviewed the preliminary draft Chapter II, "Basic Study Area Inventory."

Mr. Boxhorn noted that the section regarding population and households will be updated to reflect the preliminary 2010 census data that was recently released.

[Secretary's Note: Population data from the 2010 census were added to Table II-1 and Figure II-1 and household data from the 2010 census were added to Table II-2. These are attached as Exhibit C. The last paragraph on page 1, continuing onto page 2, was revised to read as follows:

"The area that is now the City of Milwaukee was first included in the Federal census in 1850. Historical population levels in the City of Milwaukee are provided in Table II-1. Population growth in the City of Milwaukee from 1850 to **2010** is graphically summarized in Figure II-1. In 1850, the City of Milwaukee had a resident population of about 20,000. The City's population rose from 1850 through 1880, and then began to increase at a greater rate until 1930, when population growth rate slowed. The population growth continued to climb until 1960 when it reached a peak of just over 740,000. From that time, it has slowly declined. The City of Milwaukee is the most populous community in Milwaukee County, with **594,833** residents, or about 63 percent of the County's population, in **2010**. The population distribution **by census block in the year 2000, the most recent year for which this data are available,** ranges up to more than 2,300 persons per census block, while most of the City of Milwaukee is dominated by densities of 50 to 300 persons, as shown on Map II-2."

The first full paragraph on page 2 was revised to read as follows:

"Trends in the number of households in the City of Milwaukee are shown in Table II-2. The City experienced an increase in the number of new households between 1970 and 1980, with a slight decline from 1980 through **2010**. **For most of**

that period, the rate of decrease in the number of households has been less than the rate of population decrease. Between 1980 and 2000, the number of households decreased by 4.0 percent, compared to a population decrease of 6.2 percent. **Between 2000 and 2010, the number of households in the City decreased by about 0.8 percent, which represents a slightly faster rate of decrease than the 0.4 percent decrease in the population. The differences between these rates suggest that** the number of persons per household decreased **between 1980 and 2000 and increased slightly between 2000 and 2010**."

The following sentence referring to Table II-3, "Number of Jobs in Milwaukee County: 1970-2000," was added after the first sentence in the second full paragraph on page 2:

"The data in the table are presented through the year 2000, which is the most recent year for which data are available."]

Mr. Boxhorn indicated that Map II-2, "Population Distribution by Census Block for the City of Milwaukee: 2000," will continue to be based on year 2000 data because 2010 census data is not yet available at the census block level. He also noted that SEWRPC staff is in the process of updating its land use inventories to reflect 2010 land use, but indicated that the updated data will not be completed in time to be included in this plan update. Ms. Kawski suggested adding a sentence in the land use section stating that the 2010 land use will be available for the next update of the plan.

[Secretary's Note: The following sentences were added to the end of the fourth full paragraph on page 2:

"SEWRPC staff is currently updating the land use inventories in the Region to reflect 2010 land uses. This process will not be finished in time for 2010 data to be included in this plan update. Updated 2010 land use will be available for the next update of the plan."

Ms. Schneider indicated that the contractors for the Milwaukee County Transit System's paratransit service change regularly based on annual awarding of contracts. Mr. Boxhorn indicated a footnote would be added to that reflect that.

[Secretary's Note: The following footnote was added after the last sentence of the third full paragraph on page 5:

"The contractors providing paratransit service change regularly based on annual awarding of contracts."]

Mr. Boxhorn stated that the critical community facilities are shown on Table II-8 and inventoried in Tables B-1 through B-4. He explained that Appendix B also contains tables of schools and historical sites.

Mr. Fronk suggested adding the Milwaukee County Transit facilities and the Intermodal Station to the critical facilities listed in Table B-1 and shown on Map II-8. Ms. Schneider added that a Milwaukee County Transit garage received stormwater damage during the July 2010 floods. Ms. Schneider indicated that she would provide addresses of these sites. Mr. Boxhorn confirmed that these sites will be added to Map II-8.

[Secretary's Note: The Milwaukee Intermodal Station as well as five MCTS Facilities were added to Map II-8 and Table B-1. The updated map and table are attached herein as Exhibit D.]

Mr. Buck asked whether pipelines should be mapped in addition to the critical facilities. Mr. Hahn stated that due to terrorism concerns, there may be some restrictions on mapping these. Ms. Gray indicated that it would be prudent to discuss pipelines in the text, but discouraged mapping them.

[Secretary's Note: The following paragraph was added after the fourth full paragraph on page 7:

"Several natural gas transmission pipelines run near or along the City's boundaries, in northwestern, southeastern, southwestern, and west-central portions of the City. In addition, natural gas transmission pipelines run through northwestern and southeastern sections of the City. Petroleum pipelines run near or along the City's boundaries in northwestern and southeastern portions of the City."]

Ms. Schneider suggested adding major attractions such as Miller Park, the Bradley Center, and the art museum to the list of critical facilities. She asked whether the updated plan will include planning for acts of terrorism on such attractions. Ms. Gray explained that the requirement for this sort of plan is to address all natural hazards. She noted that the plan may address technological and human-induced hazards at the discretion of the City. After considerable discussion, the Committee came to consensus that these sites would be more appropriately included in an emergency response plan than in a hazard mitigation plan. The Committee decided that these sites will not be included as critical facilities.

Ms. Pillman asked Mr. Buck whether there are any mass care facilities in the City that may be considered in this plan. Mr. Buck indicated that he did not believe it to be necessary to include these since the sites can always be moved. It was agreed by consensus not to include these among the critical facilities.

Mr. Jacquart questioned the accuracy of telephone phone numbers listed for some of the critical facilities in Table B-1. Ms. Gray explained that telephone numbers and fax numbers are not necessary for the plan. The Committee agreed that telephone and fax numbers should be removed from the tables in Appendix B.

[Secretary's Note: Telephone numbers, fax numbers, and website addresses were removed from Tables B-1, B-3, B-4, and B-5.]

Concerning the discussion on floodplain zoning ordinances, stormwater management regulations, and other related regulations and programs, Mr. Boxhorn asked the Committee to review and advise of any necessary additions. He again mentioned comments could be submitted at any time either via the comments page on the SEWRPC website or by emailing him directly.

Ms. Schneider suggested the plan discuss the Local Emergency Planning Committee in regards to hazardous materials storage. Mr. Boxhorn indicated this would be discussed in a subsequent chapter

REVIEW OF HAZARD AND VULNERABILITY ASSESSMENT EXERCISE

Mr. Boxhorn passed out the Hazard and Vulnerability Assessment Tool. He explained that the results from this tool would be used, along with recent hazard data, to reassess the hazard identification for the plan update. He noted that this form contained the list of hazards considered in the development of previous hazard mitigation plans. Mr. Boxhorn explained to the Committee how to complete the Hazard and Vulnerability Assessment Tool and asked them to complete the tool. He indicated that the results from the assessment tool would be distributed with the summary notes for this meeting.

[Secretary's Note: A summary of the results from the Hazard and Vulnerability Assessment Tool is attached hereto as Exhibit E.]

OTHER BUSINESS

Mr. Boxhorn noted that in the initial hazard mitigation plan, Chapter III discussed hazard mitigation goals and objectives, while Chapter IV discussed the analysis of hazard conditions. He suggested that the order of the two chapters be switched. Chapter III would become "Analysis of Hazard Conditions" and Chapter IV would become "Hazard Mitigation Goals and Objectives." He explained that this would more closely follow the plan development logic recommended by FEMA. The Committee agreed, and the order will be switched.

COMMENTS ON CHAPTERS I AND II, "OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION, AS PROVIDED BY MR. STEVEN JACQUART, MILWAUKEE METROPOLITAN SEWERAGE DISTRICT FOLLOWING THE COMMITTEE MEETING

Following the meeting, Mr. Jacquart provided SEWRPC staff with corrections and comments from MMSD staff.

Mr. Jacquart indicated that four road bridges are to be replaced between 6th Street and 27th Street as part of the floodland management measures in the Kinnickinnic River Watershed.

[Secretary's Note: The third sentence in the fourth paragraph on page 6 of Chapter I was revised to read as follows:

"This project involves removal of 12,000 linear feet of concrete channel; replacement of **four** road bridges and four pedestrian bridges; widening and lowering of the floodplain overbank; restoration of the channel; and acquisition and deconstruction of 82 residences and one commercial building that are currently within the floodplain."]

Mr. Jacquart indicated that the MMSD is currently verifying their estimate of 320 structures being in the floodplain in the project area for their Kinnickinnic River concrete removal project.

[Secretary's Note: The following sentence was added after the third sentence in the fourth paragraph on page 6:

"MMSD is currently verifying their estimate that approximately 320 structures are located within the one-percent-probability floodplain in this project reach."]

Mr. Jacquart indicated that the MMSD has developed an emergency action plan under the State dam safety program for the Milwaukee County Grounds Floodwater Management Facility.

[Secretary's Note: The following paragraph was added after the last paragraph on page 14 of Chapter II:

"The MMSD has prepared an emergency action plan for the Milwaukee County Grounds Floodwater Management Facility, which is located near Underwood Creek in the Menomonee River watershed.. This plan describes notifications to be made and actions to be taken in the event an unexpected failure of the facility's embankment during an extreme flooding event when the Facility is full and structures along the Menomonee River are already experiencing flooding."]

COMMENTS ON CHAPTER II, "OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION, AS PROVIDED BY MR. JAMES H. LEY, CITY OF MILWAUKEE FIRE DEPARTMENT FOLLOWING THE COMMITTEE MEETING

Following the meeting, Mr. Ley provided SEWRPC staff with several corrections and suggested edits to the subsection on fire suppression and rescue services.

[Secretary's Note: The second paragraph on page 8 was revised to read as follows:

"The City of Milwaukee maintains 36 fire houses which are divided geographically into five battalions. Within the fire houses are 36 engine companies, **15** ladder companies, and 12 emergency medical services paramedic units. The Milwaukee Fire Department Special Teams exercise expertise in **three** major disciplines: **Marine Operations** (DIVE **and Fireboat**), Hazardous Materials (HAZMAT), **and** Heavy Urban Rescue Team (HURT). HURT members are trained in specialized rescue procedures **in the disciplines of confined space rescue, collapse rescue, and trench rescue.**"

The fourth paragraph on page 8 was broken into three paragraphs and revised to read as follows:

"**Since 1991, t**he Milwaukee Fire Department has a service contract with the Village of West Milwaukee to provide full fire and **emergency medical** service **within the Village**.

Since 2006, the Milwaukee Fire Department has participated in **the** Mutual Aid Box Alarm System (MABAS). **MABAS was originally formed in Illinois in the late 1960s and adopted for use in Wisconsin, MABAS** enables each **member** department to render assistance to, and receive assistance from, other **member fire** departments **without charge when incidents overwhelm local resources**. This agreement enables individual departments to significantly supplement their own personnel, apparatus, and equipment **when needed**. Importantly, the agreement allows individual departments to access equipment, such as **water tenders**, aerial trucks, and **specialized** equipment, which they themselves do not possess and which they may only need infrequently.

The Milwaukee Fire Department also participates in Milwaukee County's Emergency Medical System (EMS). Milwaukee County provides training and medical oversight. The system allows paramedics from any participating fire department within the County to respond to medical emergencies in neighboring municipalities when needed. For example, MFD Med No. 15 routinely responds to emergencies in St. Francis as their paramedic unit and Wauwatosa's Med 81 responds to emergencies in the "finger" area on the west side of the City of Milwaukee."]

TIME AND DATE OF NEXT MEETING

Mr. Hahn proposed that the second meeting of the Steering Committee be held towards the end of April. He indicated that a notice, agenda, materials to review, and minutes would be sent out about a week ahead of the meeting. After discussion the Committee agreed to meet on April 26, 2011 at 1:30 p.m. in Room 501 of the Frank P. Zeidler Municipal Building.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 3:36 p.m.

Respectfully Submitted,

Michael G. Hahn
Secretary

Attachments

#156669 V1 - CAPR-282-2ED SUMMARY NOTES 03/30/11
330-3027
MGH/JEB/AWO/pk
04/19/11

ALL HAZARDS MITIGATION PLANNING

Roxanne Gray
Wisconsin Emergency Management
608-242-3211
Roxanne.gray@wisconsin.gov

What is Mitigation?

- Mitigation is any action taken to eliminate or reduce the long-term risk to human life and property from natural and technological hazards

Break the Cycle

- Mitigation is one of the phases of emergency management (preparedness, response and recovery)
- Can occur in any phase
- Only phase that breaks the cycle
  - Damage, repair, damage

Mitigation Examples

- Structural (dams, retention ponds, levees)
- Land-use planning
- Stronger building codes
- Removing persons out of harms way

More Examples

- Raise appliances and utilities
- Install back-flow valves
- Proper landscaping
- Retrofit for wind resistance
- Construct a safe room
- Community Storm Shelter
- Mobile Home Tie-Downs
- NOAA Weather Radios
- Education and Public Awareness
- INSURANCE (flood and sewer)

Why Mitigation?

- $140 Billion in the last 25 years in responding to disasters
- $6 Billion per year in flood damages
- Costs continue to rise
- People continue to build and live in high-risk areas

Here in Wisconsin

- $3 billion in Disaster-related damages last 3 decades
- 12 Federal Disaster Declarations in the 90's compared to 6 in the 80's
- 2000, 2001,two in 2002, 2004, 2007, 2008 plus 2 snow emergencies
- Two in 2010 and one pending in 2011

2008 Floods

- 31 counties declared
- $763,618,860 + in damages
- Over 40,000 applied for Individual Assistance with over $56 million disbursed
- Nearly 2,000 SBA low-interest disaster loans for over $48 million

2010 July Flood

- 2 counties declared
- Over 33,000 applied for Individual Assistance with over $53 million disbursed
- 679 SBA low-interest disaster loans for nearly $12 million

Public Assistance

2008 Flood

- Estimated $78 million in eligible damages to public infrastructure and emergency response costs
- 844 applicants (local and state governments and PNPs) for assistance

2010 July Flood

- Estimated $37 million in damages to public infrastructure and emergency response costs
- 87 applicants (local and state governments and PNPs)

Hazard Mitigation

- 2008 Flood:
  - $30.9 million
  - Acquisition and demolition of 218 properties
  - Hazard Mitigation Plans
- 2010 July Flood
  - $21.3 million

For every dollar spent on mitigation, $4 is saved in future damages.
(Per the National Institute of Building Sciences -2005)

MITIGATION - WEM

- **$90 million** in last 21 years through HMGP/FMA/PDM
- 360 properties acquired (200 + in process)
- 59 properties floodproofed (2 in process)
- 2 structures relocated
- Wind Retrofit
- Storm Shelters
- Education
- Structural (detention ponds, stormwater management, etc.)
- All Hazard Mitigation Plans

Hazard Mitigation Assistance City of Milwaukee

- Hazard Mitigation Grant Program (HMGP)
  - 1997: $1,545412 (acquisition of 19 structures and floodproofing 35 structures)
  - 1998: $91,630 (acquisition of 2 structures)
- Flood Mitigation Assistance Program (FMA)
  - 1999: $5,000 (Flood Mitigation Plan)
- Pre-Disaster Mitigation Program (PDM)
  - 2002: $23,000 (All Hazard Mitigation Plan)
  - 2010: $40,000 (Update of All Hazard Mitigation Plan)

Repetitive Loss Properties

- NFIP insured property
- 2 or more losses of $1,000 each within a 10-year period
- 211 RLP properties identified in the City of Milwaukee
- 8 RLP mitigated

Reasons to Plan

- Disasters cost too much
- State/Federal aid insufficient
- Can prevent damages
- Less impact and speed response and recovery process
- Mitigation happens at the local level

"You are aware, of course, of the urgency of this meeting."

DMA2K

- Disaster Mitigation Act of 2000
- PL 106-390 signed into law 10/30/00
- Establish a national disaster hazard mitigation program
  - Section 203 – Pre-Disaster Mitigation Program
  - Section 322 – Mitigation Planning Requirement

Vision

- To reduce disaster losses thru pre-disaster mitigation planning by pre-identifying, cost-effective mitigation.
- Mitigation planning would then streamline and speed up the recovery process

State Hazard Mitigation Goals

- To minimize human, economic and environmental disruption from natural hazards;
- To enhance public education about disaster preparedness and resistance, and expand public awareness of natural hazards;
- To encourage hazard mitigation planning;

- Support intergovernmental coordination and cooperation among federal, state and local authorities regarding hazard mitigation activities; and
- Improve the disaster resistance of buildings, structures, and infrastructure whether new construction, expansion or renovation.

Local Mitigation Plan Criteria

- Local Planning – 44 CFR Part 201.6
- Components
  - Planning Process
  - Risk Assessment
  - Mitigation Strategy
  - Plan Maintenance Process
  - Plan Adoption
  - Plan Review

Planning Deadlines

- Must have an approved All Hazards Mitigation Plan to receive certain FEMA assistance
- Local Plans have to be reviewed, updated, and re-approved every 5 years
- Milwaukee's plan will expire June 16th

5-Year Plan Update Requirements

- Review recommended revisions from the review of the approved plan
- Follow Plan Maintenance Section of the approved plan; if different document the new process
- Evaluate, review, analyze and update each section of the plan

- Follow federal and state guidance
- Address any data deficiencies identified in the first plan
- Formally adopted by participating jurisdictions
- Approved by the State and FEMA

Things to Consider

- Goals and objectives still current
- Update data in the risk assessment
- Are there new floodplain maps?
- Include data on disasters that may have occurred since the initial plan
- Have hazards change? Any new hazards
- Have conditions changed
- Have priorities changed

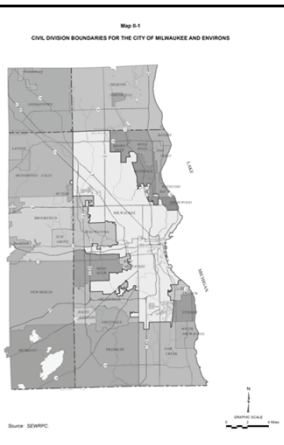
- Have data deficiencies been addressed or do they still exist
- Do mitigation recommendations need to be revised or new ones added based on changed conditions
- Document progress on mitigation actions taken since last update
- Are there changes in levels of funding
- Implementation problems

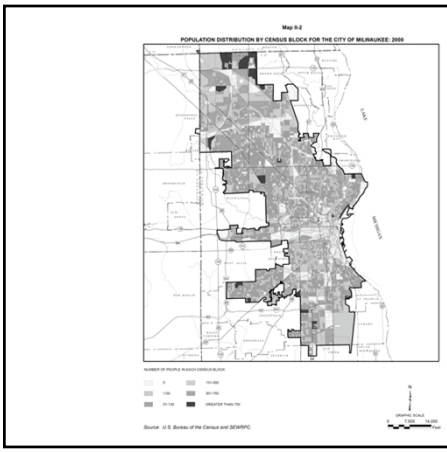
CITY OF MILWAUKEE ALL HAZARD
MITIGATION TASK FORCE

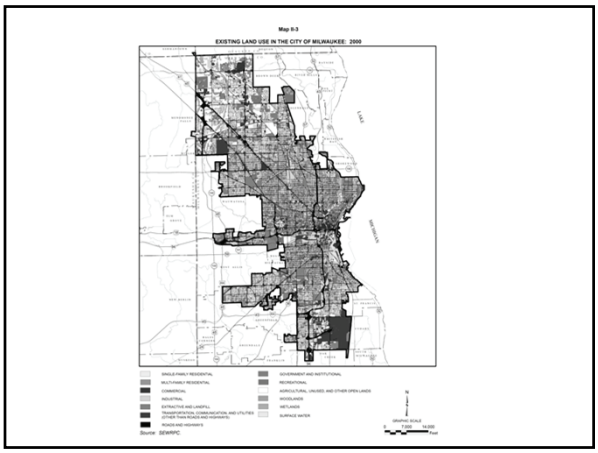
MARCH 30, 2011

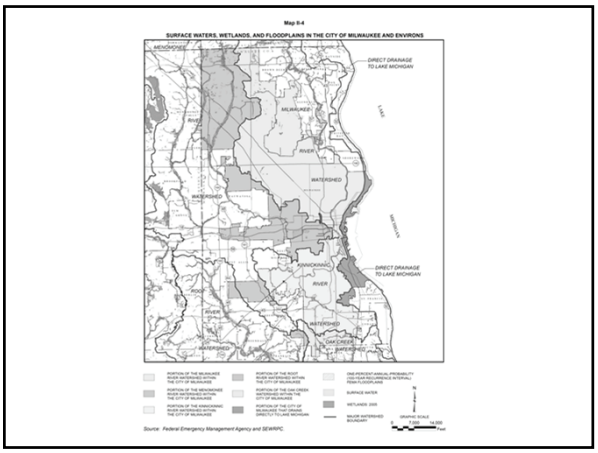
CHAPTER 1:
INTRODUCTION AND BACKGROUND

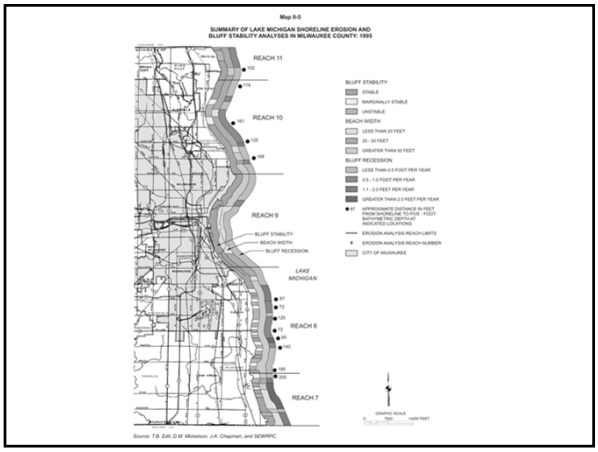
CHAPTER 2:
BASIC STUDY AREA INVENTORY

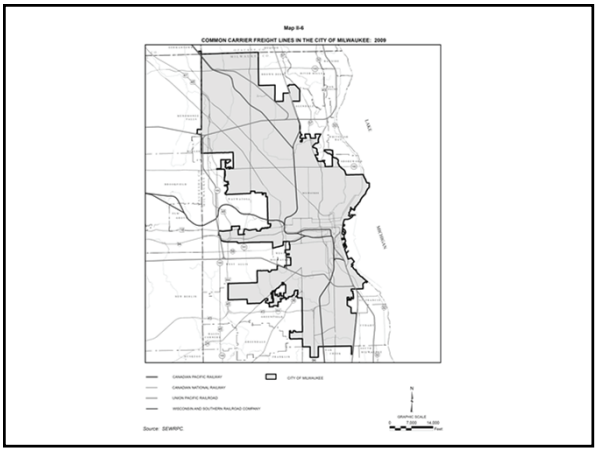


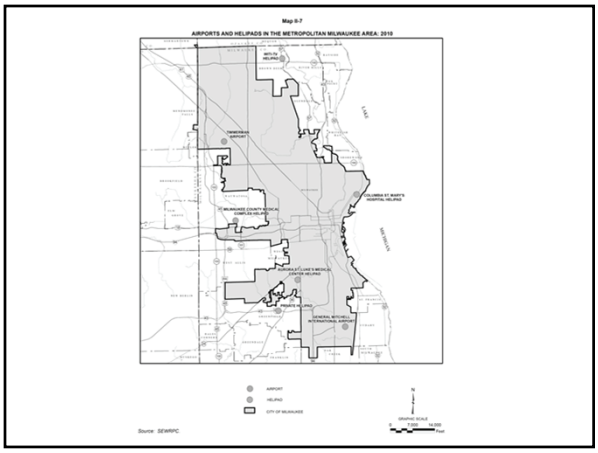


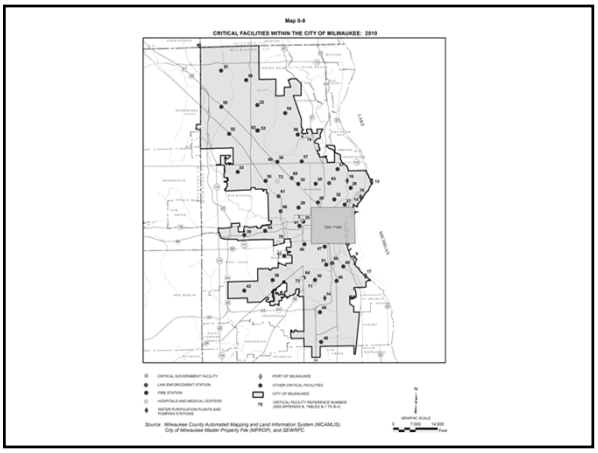

Map II-3
EXISTING LAND USE IN THE CITY OF MILWAUKEE: 2000
LAKE MICHIGAN
SINGLE-FAMILY RESIDENTIAL
MULTI-FAMILY RESIDENTIAL
COMMERCIAL
INDUSTRIAL
EXTRACTIVE AND LANDFILL
TRANSPORTATION, COMMUNICATION, AND UTILITIES (OTHER THAN ROADS AND HIGHWAYS)
ROADS AND HIGHWAYS
GOVERNMENT AND INSTITUTIONAL
RECREATIONAL
AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS
WOODLANDS
WETLANDS
SURFACE WATER
GRAPHIC SCALE
Source: SEWRPC

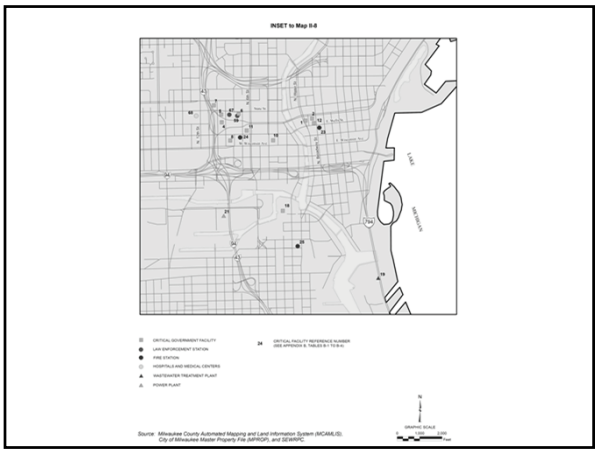

Map II-4
SURFACE WATERS, WETLANDS, AND FLOODPLAINS IN THE CITY OF MILWAUKEE AND ENVIRONS
MENOMONEE RIVER WATERSHED
DIRECT DRAINAGE TO LAKE MICHIGAN
MILWAUKEE RIVER WATERSHED
KINNICKINNIC RIVER WATERSHED
OAK CREEK WATERSHED
LAKE MICHIGAN
PORTION OF THE MILWAUKEE RIVER WATERSHED WITHIN THE CITY OF MILWAUKEE
PORTION OF THE MENOMONEE RIVER WATERSHED WITHIN THE CITY OF MILWAUKEE
PORTION OF THE KINNICKINNIC RIVER WATERSHED WITHIN THE CITY OF MILWAUKEE
PORTION OF THE ROOT RIVER WATERSHED WITHIN THE CITY OF MILWAUKEE
PORTION OF THE OAK CREEK WATERSHED WITHIN THE CITY OF MILWAUKEE
PORTION OF THE CITY OF MILWAUKEE THAT DRAINS DIRECTLY TO LAKE MICHIGAN
ONE-PERCENT-ANNUAL-PROBABILITY FLOODPLAIN (FORMERLY KNOWN AS NATURAL FRESH FLOODPLAIN)
SURFACE WATER
WETLANDS: 2005
MAJOR WATERSHED BOUNDARY
GRAPHIC SCALE
Source: Federal Emergency Management Agency and SEWRPC


Map II-5
SUMMARY OF LAKE MICHIGAN SHORELINE EROSION AND BLUFF STABILITY ANALYSES IN MILWAUKEE COUNTY: 1995
REACH 11
REACH 10
REACH 9
REACH 8
REACH 7
BLUFF STABILITY
BEACH WIDTH
BLUFF RECESSION
LAKE MICHIGAN
STABLE
MARGINALLY STABLE
UNSTABLE
LESS THAN 20 FEET
20 - 50 FEET
GREATER THAN 50 FEET
LESS THAN 0.5 FOOT PER YEAR
0.5 - 1.0 FOOT PER YEAR
1.1 - 2.0 FEET PER YEAR
GREATER THAN 2.0 FEET PER YEAR
APPROXIMATE DISTANCE IN FEET FROM SHORELINE TO 20-FOOT BATHYMETRIC DEPTH AT INDICATED LOCATIONS
EROSION ANALYSIS REACH LIMITS
EROSION ANALYSIS REACH NUMBER
CITY OF MILWAUKEE
GRAPHIC SCALE
Source: T.B. Edil, D.M. Mickelson, J.A. Chapman, and SEWRPC


Map II-6
COMMON CARRIER FREIGHT LINES IN THE CITY OF MILWAUKEE: 2009
LAKE MICHIGAN
CANADIAN PACIFIC RAILWAY
CANADIAN NATIONAL RAILWAY
UNION PACIFIC RAILROAD
WISCONSIN AND SOUTHERN RAILROAD COMPANY
CITY OF MILWAUKEE
GRAPHIC SCALE
Source: SEWRPC


Map II-7
AIRPORTS AND HELIPADS IN THE METROPOLITAN MILWAUKEE AREA: 2010
MITCHELL HELIPAD
TIMMERMAN AIRPORT
COLUMBIA ST. MARY'S HOSPITAL HELIPAD
MILWAUKEE COUNTY MEDICAL COMPLEX HELIPAD
AURORA ST. LUKE'S MEDICAL CENTER HELIPAD
FRANKLIN HELIPAD
GENERAL MITCHELL INTERNATIONAL AIRPORT
LAKE MICHIGAN
AIRPORT
HELIPAD
CITY OF MILWAUKEE
GRAPHIC SCALE
Source: SEWRPC


Map II-8
CRITICAL FACILITIES WITHIN THE CITY OF MILWAUKEE: 2010
LAKE MICHIGAN
CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
WATER PURIFICATION PLANTS AND PUMPING STATIONS
PORT OF MILWAUKEE
OTHER CRITICAL FACILITIES
CITY OF MILWAUKEE
CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
GRAPHIC SCALE
Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC



SUBMITTING COMMENTS OR
DATA ON THE PLAN CHAPTERS:

SEWRPC website:
http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

or

Email: jboxhorn@sewrpc.org

Exhibit C

Table II-1

HISTORICAL RESIDENT POPULATION LEVELS IN THE CITY OF MILWAUKEE: 1850-2000

Year	Population	Change from Preceding Census	
		Absolute	Percent
1850	20,061	- -	- -
1860	45,246	25,185	55.66
1870	71,440	26,194	36.67
1880	115,587	44,147	38.19
1890	204,468	88,881	43.47
1900	285,315	80,847	28.34
1910	373,857	88,542	23.68
1920	457,147	83,290	18.22
1930	578,249	121,102	20.94
1940	587,472	9,223	1.57
1950	637,392	49,920	7.83
1960	741,324	103,932	14.02
1970	717,099	-24,225	-3.38
1980	636,212	-80,887	-12.71
1990	628,088	-8,124	-1.29
2000	596,974	-31,114	-5.21
2010	594,833	-2,141	-0.36

Source: U.S. Bureau of the Census and SEWRPC.

Table II-2

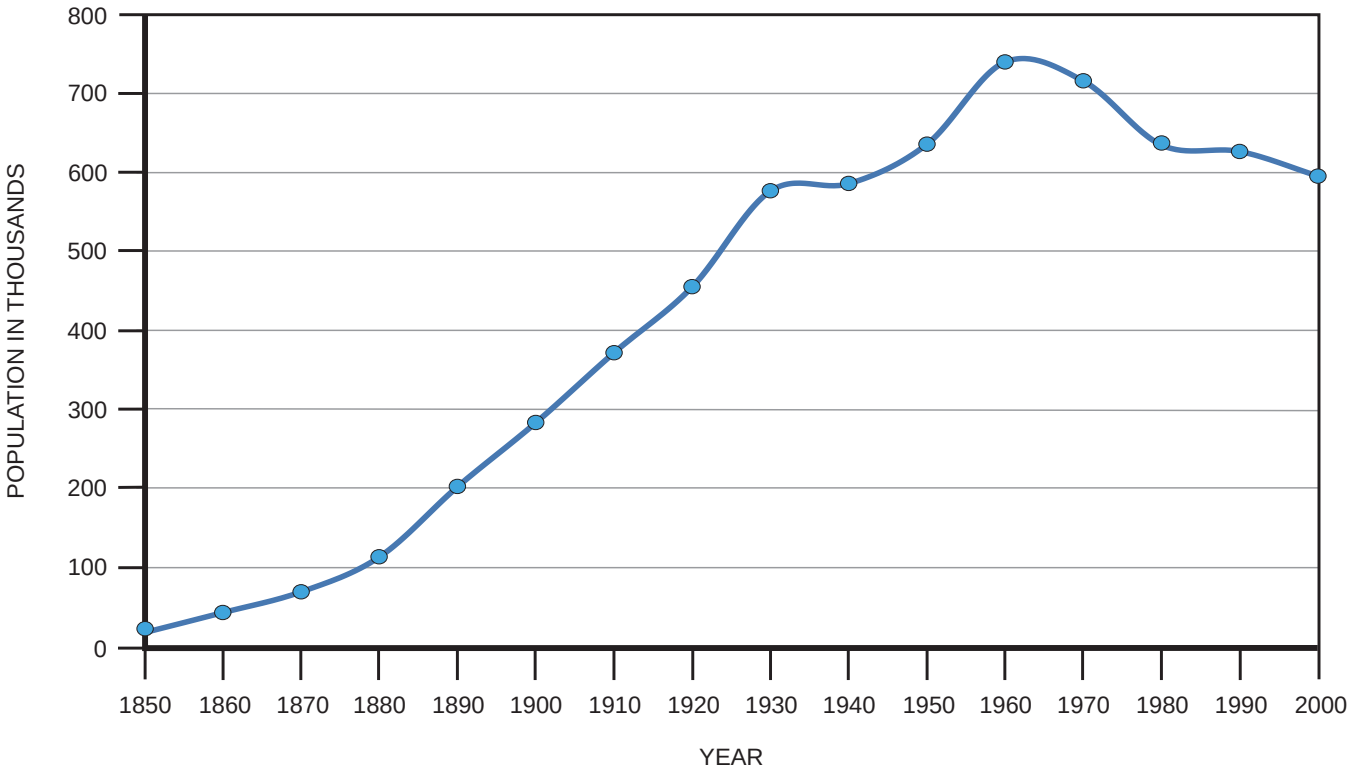
NUMBER OF HOUSEHOLDS IN THE CITY OF MILWAUKEE: 1970-2000

Year	Number of Households in the City of Milwaukee	Change from Preceding Census	
		Number	Percent
1970	236,981	- -	- -
1980	241,818	4,837	2.0
1990	240,540	-1,278	-0.5
2000	232,188	-8,352	-3.6
2010	230,221	-1,967	-0.8

Source: U.S. Bureau of the Census and SEWRPC.

Figure II-1

HISTORIC POPULATION LEVELS IN THE CITY OF MILWAUKEE: 1850-2000



Source: U.S. Bureau of the Census and SEWRPC.

Exhibit D

Table B-1

CRITICAL COMMUNITY FACILITIES FOR THE CITY OF MILWAUKEE: 2010

Number on Map II-8	Facility Name	Address	Municipality	2010 Assessed Value[a]
1	City Hall and the Office of the Mayor	200 E. Wells Street	Milwaukee	$ 9,424,200
2	City Department of Public Works Municipal Building	841 N. Broadway Street Room 501	Milwaukee	22,647,600
2	City of Milwaukee Health Department City Municipal Building	841 North Broadway Street 3rd Floor	Milwaukee	22,647,600
3	Milwaukee County Department of Transportation and Public Works	2711 W. Wells Street 3rd Floor	Milwaukee	592,100
4	Milwaukee County Courthouse Office of the County Executive	901 N. 9th Street	Milwaukee	33,500,000
5	Milwaukee County Jail	949 N. 9th Street	Milwaukee	33,500,000
6	City of Milwaukee Municipal Court	951 N. James Lovell Street	Milwaukee	33,500,000
7	Milwaukee Secure Detention Facility-Wisconsin Department of Corrections	1015 N. 10th Street	Milwaukee	- -
- -	Milwaukee County Juvenile Detention Center	10201 Watertown Plank Road	Wauwatosa	- -
8	Milwaukee Public Library-Central	814 W. Wisconsin Avenue	Milwaukee	10,840,000
9	Port of Milwaukee	2323 S. Lincoln Memorial Drive	Milwaukee	38,500,000
10	Henry S. Reuss Federal Plaza	310 W. Wisconsin Avenue	Milwaukee	24,877,800
11	Wisconsin State Office Building	819 N. 6th Street	Milwaukee	8,960,000
12	Milwaukee Water Works City Municipal Building	809 N. Broadway Room 406	Milwaukee	7,921,800
13	Linwood Avenue Station Water Purification Plant	3000 N. Lincoln Memorial Drive	Milwaukee	20,000,000
14	Howard Avenue Water Purification Plant	725 W. Howard Avenue	Milwaukee	31,519,000
15	North Point Pumping Station	2275 N. Lincoln Memorial Drive	Milwaukee	3,733,000
16	Riverside Pumping Station	1311 E. Chambers Street	Milwaukee	3,440,000
17	Texas Pumping Station	2900 E. Texas Avenue	Milwaukee	- -
18	Milwaukee Metropolitan Sewerage District	260 W. Seeboth Street	Milwaukee	200,000
19	Jones Island Water Reclamation Facility-Veolia Water North America	700 E. Jones Street	Milwaukee	5,250,400
- -	South Shore Wastewater Treatment Plant	8500 S. 5th Street	Oak Creek	- -
20	American Red Cross	2600 W Wisconsin Avenue	Milwaukee	994,200
- -	Milwaukee County Power Plant (We Energies)	9250 W. Watertown Plank Road	Wauwatosa	- -
- -	Oak Creek Power Plant (We Energies)	4801 E. Elm Road	Oak Creek	- -
21	Valley Power Plant (We Energies)	1035 W. Canal Street	Milwaukee	32,732,000
- -	Falk Landfill	13th Avenue North of Rawson	South Milwaukee	- -
- -	Veolia ES Emerald Park Landfill	W124 S10629 124th Street	Muskego	- -
- -	Waste Management-Metro Recycling & Disposal	10712 S. 124th Street	Franklin	- -
- -	Waste Management-Orchard Ridge Recycling & Disposal	W124 N9355 Boundary Road	Menomonee Falls	- -
22	Waste Management Transfer Station	6710 N. Industrial Road	Milwaukee	- -
75	Milwaukee Intermodal Station	433 W. Saint Paul Avenue	Milwaukee	
76	MCTS Hillside Administration Facility	1942 N. 17th Street	Milwaukee	
77	MCTS Hillside Fleet Maintenance Facility	1525 W. Vine Street	Milwaukee	
78	MCTS Fond du Lac Bus Garage	3343 W. Fond du Lac Avenue	Milwaukee	
79	MCTS Fiebrantz Bus Garage	1900 W. Fiebrantz Avenue	Milwaukee	
80	MCTS Kinnickinnic Bus Garage	1710 S. Kinnickinnic Avenue	Milwaukee	
81	MCTS Downtown Transit Center	909 E. Michigan Avenue	Milwaukee	

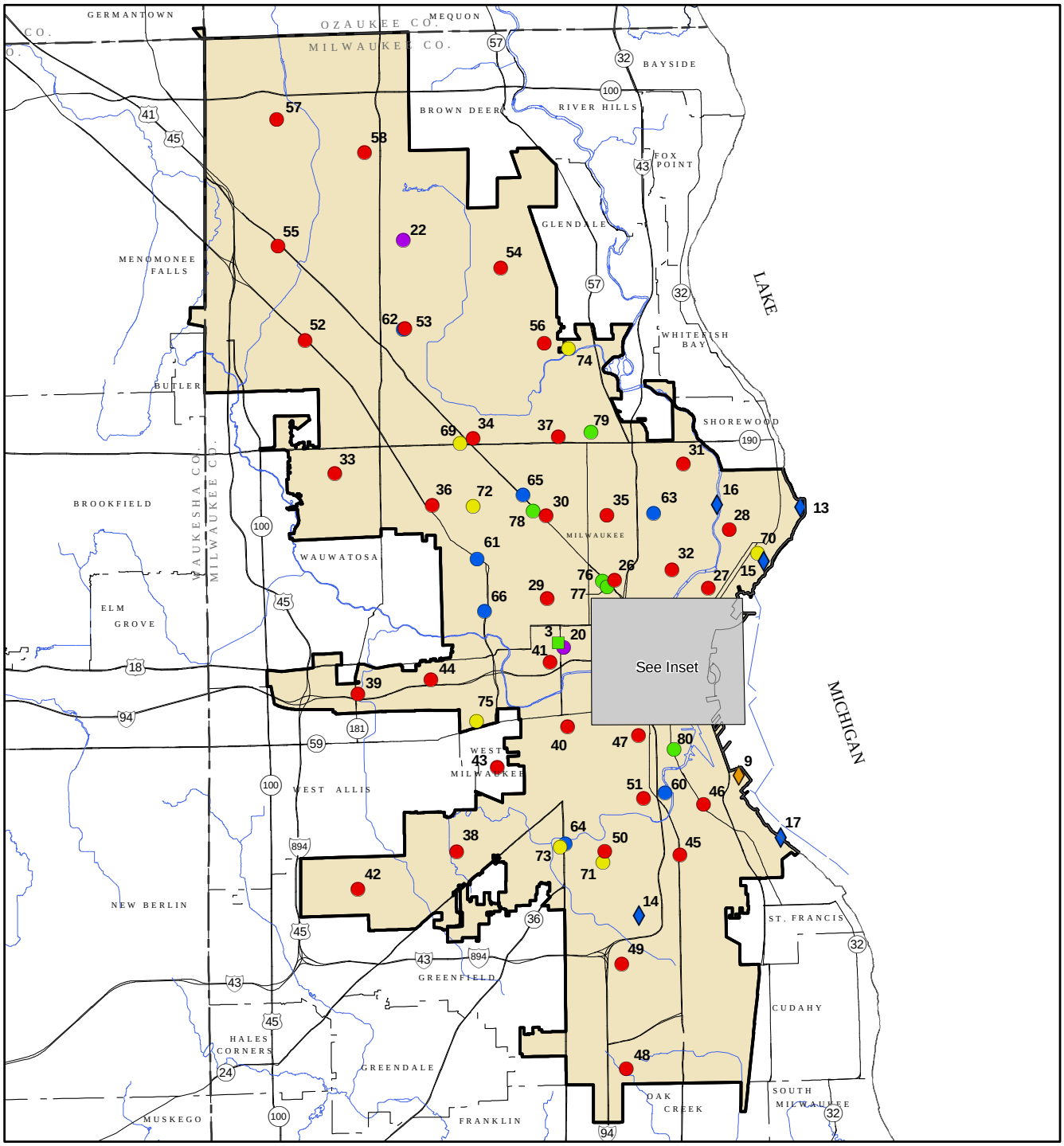
[a]*Current assessment value of improvements based on 2010 Milwaukee Properties Master file (MPROP).*

[b]*Unknown Web addresses.*

Source: City of Milwaukee, Milwaukee County, Milwaukee Green Map, and SEWRPC.

Map II-8

CRITICAL FACILITIES WITHIN THE CITY OF MILWAUKEE: 2010



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WATER PURIFICATION PLANTS AND PUMPING STATIONS
- PORT OF MILWAUKEE
- OTHER CRITICAL FACILITIES
- CITY OF MILWAUKEE
- 75 — CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

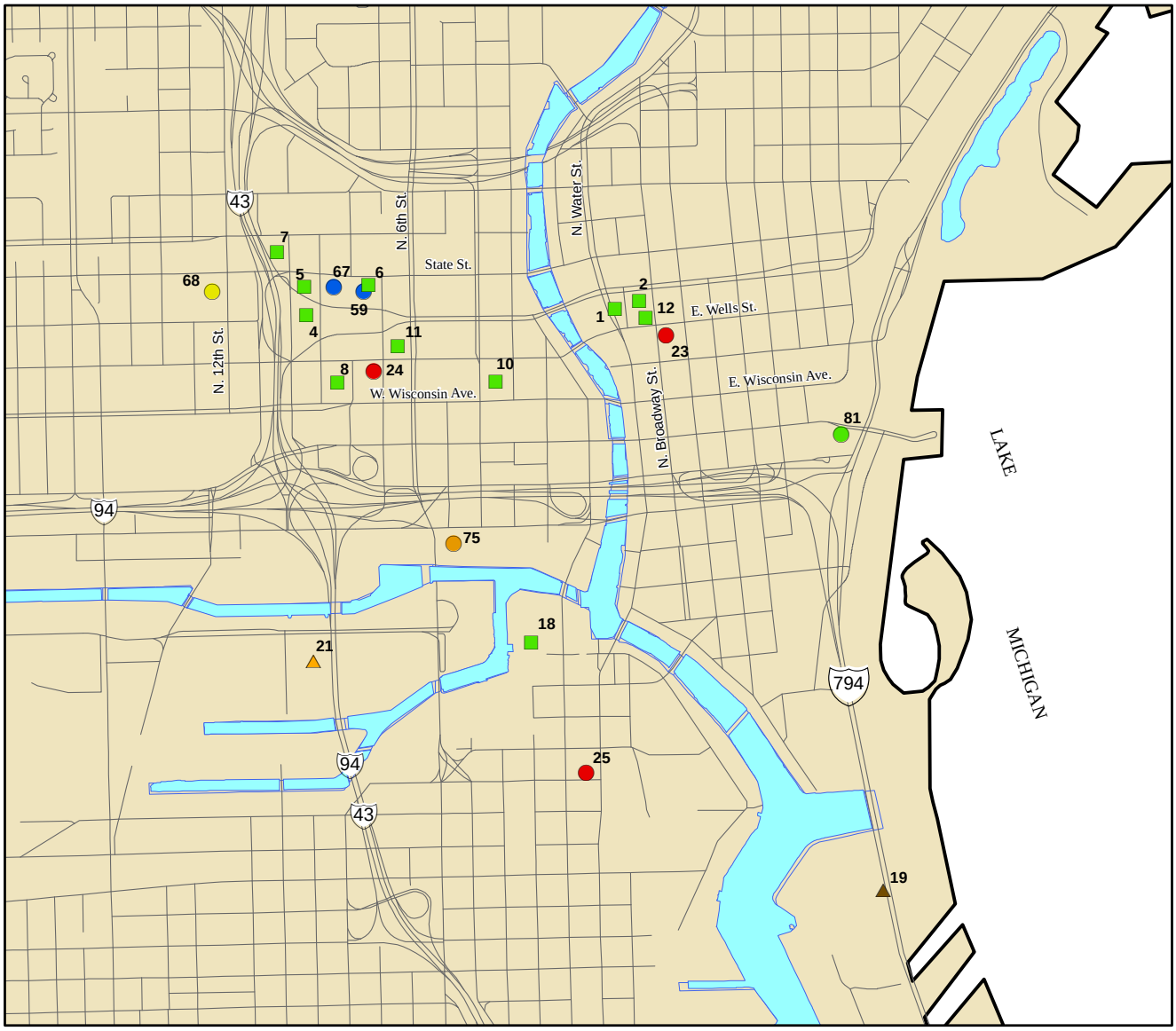
N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

INSET to Map II-8



- CRITICAL GOVERNMENT FACILITY
- LAW ENFORCEMENT STATION
- FIRE STATION
- HOSPITALS AND MEDICAL CENTERS
- MILWAUKEE INTERMODAL STATION
- MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
- WASTEWATER TREATMENT PLANT
- POWER PLANT

24 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

N

GRAPHIC SCALE

0 1,000 2,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

Exhibit E

Summary of Hazard and Vulnerability Assessment Tool Results

Methods

The assessment tools were completed at the March 30, 2011 meeting of the City of Milwaukee Hazard Mitigation Steering Committee, with 11 surveys being returned and analyzed. For each hazard in each survey, a risk was computed using the formula:

Risk(in %) = [(Probability/3) x (Human impact + Property impact + Business impact + Preparedness)/(4*3)]* 100

Where Probability (likelihood that an event would occur), Human impact (possibility of death or injury), Property impact (physical losses and damages), Business impact (interruption of services), and Preparedness (preplanning) were each assigned a number from 0 to 3, with 0 indicating "not applicable", 1 indicating low, 2 indicating moderate, and 3 indicating high.

The interpretation of the result returned by this formula is that the perceived threat increases with increasing percentage risk.

For each hazard, an average risk was calculated using the results of all the returned surveys. The hazards were then ranked by average risk, with a rank of 1 indicating the highest perceived risk. For each hazard, minimum and maximum risks were calculated. The results from the assessment tool were analyzed for 39 hazards.

In order to assess the degree of agreement among Steering Committee members in the assessment of average risk, the interquartile range was calculated for each hazard. This quantity indicates the range of the half of the responses that are in middle. A smaller interquartile range indicates greater agreement among Task Force members as to the level of risk, while a larger interquartile range indicates less agreement.

Results

The results from the assessment tool are summarized in Table 1. The average level of risk for hazards ranged from 12.1 percent for the lowest ranked hazard (earthquake) to 67.2 percent for the highest ranked hazard (stormwater flooding). The seven highest average risks belonged to natural hazards related to meteorological causes, mostly causes associated with either winter weather or severe storms. The remaining three of the 10 highest average risks belong to technological or human-induced hazards. The interquartile ranges for the 10 hazards with the highest average risks tended to be relatively large, indicating a diversity of opinion among Steering Committee members as to the level of risk posed by each of these hazards. In some instances, such as the hazards posed by stormwater flooding, riverine flooding, and ice storms there was general agreement among Steering Committee members that the risk was relatively high, but disagreement as to just how high.

The 10 lowest average risks belonged to hazards related to a variety of causes, including technological or human-induced hazards related to land use, natural hazards related to geological events, natural hazards related to meteorological events, and hazards related to human behavior. The interquartile ranges for the 10 hazards with the lowest average risks tended to be low, indicating strong agreement among Steering Committee members as to the level of risk posed by each of these hazards.

#156746 V1 - VULNERABILITY TOOL WRITE UP
330-3027
MGH/JEB/pk
04/19/11

Table 1

PERCEIVED RISKS OF HAZARDS AS DETERMINED BY HAZARD AND VULNERABILITY ASSESSMENT TOOL: 2011

Event	Minimum (percent)[a]	Maximum (percent)[a]	Average (percent)[a]	Interquartile Range (percent)[b]	Rank
A1. Riverine flooding	13.9	75.0	42.9	35.4	6.5
A2. Stormwater flooding	33.3	91.7	67.2	14.3	1
A3. Tornado or high straight-line wind event	25.0	91.7	45.5	26.4	4
A4. Earthquake	0.0	33.3	12.1	20.8	39
A5. Lake Michigan coastal erosion	8.3	50.0	21.7	16.7	34.5
A6. Snow storm	33.3	58.3	42.9	16.7	6.5
A7. Blizzard or extreme snowfall	33.3	75.0	47.7	27.8	2
A8. Ice storm	33.3	83.3	46.2	19.5	3
A9. Extreme heat	11.1	50.0	28.0	25.0	23
A10. Extreme cold	13.9	34.6	23.6	21.5	28
A11. Lightning	13.9	83.3	34.9	22.9	14
A12. Thunderstorm	27.8	83.3	43.4	15.6	5
A13. Hail	5.6	44.4	31.6	21.5	19
A14. Fog	0.0	50.0	33.1	28.5	16
A15. Drought	0.0	50.0	21.7	23.6	34.5
A16. Dust storm	0.0	41.7	14.7	18.8	38
B1. Contamination or loss of water supply	13.9	44.4	23.5	4.9	29
B2. Loss of sewerage system	0.0	44.4	20.7	5.6	36
B3. Loss of telecommunication	13.9	44.4	27.8	22.2	24.5
B4. Electrical system outage	13.9	66.7	38.1	40.2	11
B5. Computer system incident/cyber attack	0.0	66.7	30.3	33.3	20
C1. Hazardous materials railroad incident	13.9	61.1	30.1	23.6	21
C2. Hazardous materials roadway incident	13.9	91.7	36.6	25.0	13
C3. Hazardous materials pipeline incident	0.0	61.1	22.2	7.6	32
C4. Hazardous materials fixed facility incident	16.7	55.6	32.1	27.1	18
D1. Aircraft transportation accidents	16.7	50.0	27.8	10.4	24.5
D2. Roadway transportation accidents	13.9	66.7	38.8	12.2	10
D3. Railway transportation accidents	11.1	66.7	28.3	19.4	22
E1. Correctional center incident	0.0	33.3	18.2	10.4	37
E2. Civil unrest	0.0	30.6	23.0	5.6	30
E3. Terrorism incident	19.4	50.0	27.5	4.9	26
E4. Biological contaminants (anthrax, smallpox, etc.)	13.9	25.0	22.0	4.9	33
E5. Workplace violence	13.9	75.0	28.9	37.5	9
E6. School violence	13.9	66.7	36.9	22.2	12
F1. Communicable disease outbreak or epidemic	13.9	75.0	32.3	25.7	17
G1. Major fire	16.7	66.7	41.2	31.9	8
G2. Explosion	11.1	50.0	34.6	26.4	15
G3. Mass casualty incident	13.9	50.0	24.2	7.6	27
G4. Building collapse or cave-in	11.1	44.4	22.5	14.6	31

[a] *Perceived threat increases with percentage.*

[b] *Interquartile range acts as a measure of agreement upon the perceived level of threat with a smaller interquartile range indicating stronger agreement and a larger interquartile range indicating weaker agreement.*

Source: SEWRPC.

City of Milwaukee Department of Public Works
City of Milwaukee Office of Emergency Management and Homeland Security
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN STEERING COMMITTEE

DATE: April 26, 2011

TIME: 1:30 to 3:30 p.m.

PLACE: Frank P. Zeidler Municipal Building
Room 501
841 N. Broadway Street
Milwaukee, Wisconsin

AGENDA:

1. Welcome

2. Introductions

3. Review of Summary Notes of March 30, 2011 Task Force Meeting.

4. Review of preliminary draft Chapter III, "Analysis of Hazard Conditions," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner, and Laura L. Kletti, SEWRPC Principal Engineer **[NOTE: Preliminary draft chapters can be viewed at:**

   http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

   Scroll down to the "Hazard Mitigation" section and select the chapter that you want to review. Chapters III and IV will be posted on the web page on or before April 20. Meeting summary notes and meeting agendas can also be accessed from that web page.]

5. Review of preliminary draft Chapter IV, "Hazard Mitigation Goals and Objectives," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner.

6. Other Business

7. Next Meeting

8. Adjourn

Respectfully Submitted,

Michael G. Hahn
Secretary

#156870 V1 - CAPR-282-2ED AGENDA 04/26/11 MTG
MGH/JEB/pk
04/19/11

SUMMARY NOTES OF THE APRIL 26, 2011 MEETING OF THE CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

INTRODUCTION

The second meeting of the City of Milwaukee All Hazards Mitigation Steering Committee was convened at the Frank P. Zeidler Municipal Building, Room 501 at 1:35 p.m. The meeting was called to order by Ghassan Korban, Coordination Manager, City of Milwaukee Department of Public Works and Co-Chairman of the Committee. Attendance was taken by circulating a sign-in sheet.

In attendance at the meeting were the following individuals:

Steven Fronk, Co-Chairman	Director, City of Milwaukee Office of Emergency Management and Homeland Security
Ghassan Korban, Co-Chairman	Coordination Manager, City of Milwaukee Department of Public Works
Matthew H. Mortwedt, Co-Chairman	Security Operations Manager, City of Milwaukee Department of Public Works
Joseph E. Boxhorn, Secretary	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Steven Jacquart	Intergovernmental Coordinator, Milwaukee Metropolitan Sewerage District
Laura L. Kletti	Principal Engineer, Southeastern Wisconsin Regional Planning Commission
James H. Ley	Battalion Chief, Milwaukee Fire Department and Office of Homeland Security
Doreen Martinez	Director, American Red Cross of Southeastern Wisconsin
Aaron W. Owens	Research Analyst, Southeastern Wisconsin Regional Planning Commission
Kate Pillman	Executive Director, Southeastern Wisconsin Citizens and Organizations Active in Disaster
Edward A. Richardson	Principal Planner, Milwaukee Department of City Development
Timothy J. Thur	Chief Sewer Design Manager, City of Milwaukee Department of Public Works

Mr. Korban noted that there were several people in attendance who were not at the last meeting and asked everyone to introduce themselves.

REVIEW OF SUMMARY NOTES OF THE MARCH 30, 2011, STEERING COMMITTEE MEETING

At the request of Mr. Korban, Mr. Boxhorn reviewed the Summary Notes from the March 30, 2011, meeting of the Steering Committee. Mr. Boxhorn asked if there were any additional comments, corrections or additions to the summary notes.

Mr. Thur noted that the text added in the summary notes describing the Milwaukee Metropolitan Sewerage District's (MMSD) private property inflow and infiltration (I/I) reduction program indicates that it is proposed that the program provide $151 million over a period of 10 years. He stated that his understanding was that the amount of funding for the program had been reduced. Mr. Jacquart responded that the funding level for this program had not yet been decided. He explained that if the proposed State budget is passed, it is expected that the amount of funding proposed for the program will be reduced from $151 million to about $57 million. Mr. Boxhorn noted that the language to be added to Chapter I describing the program indicates that the funding is

proposed as of April 2011. The consensus of the Committee was to leave the text regarding funding of the MMSD private property I/I reduction program as written and revise it if official changes to the funding level of the program are made before this plan is finalized.

Mr. Korban asked whether the Committee will have the opportunity to review the entire plan report a final time before the report is published. Mr. Boxhorn replied that the corrections and additions that are discussed at Steering Committee meetings will be made to the plan chapters and that revised versions of the chapters will be posted on the SEWRPC website for review by the Committee. He added that Committee members may provide additional comments via the comments page on the SEWRPC website.

Mr. Fronk asked when the City should notify neighboring communities of this planning project, as is required by Federal Emergency Management Agency (FEMA). Mr. Boxhorn suggested that the City should notify these communities now. Mr. Fronk asked whether the communities should be directed to the SEWRPC website if they had any questions or comments on the plan. Mr. Boxhorn indicated that should be the process.

Mr. Boxhorn asked whether there were any additional comments, corrections, or additions to the Summary Notes. None were offered. The Committee approved the March 30, 2011 Summary Notes by consensus.

REVIEW OF PRELIMINARY DRAFT CHAPTER III, "ANALYSIS OF HAZARD CONDITIONS", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

At Mr. Mortwedt's request, Mr. Boxhorn reviewed the preliminary draft of Chapter III, "Analysis of Hazard Conditions."

[Secretary's Note: Mr. Boxhorn's presentation is attached hereto as Exhibit A.]

Mr. Boxhorn noted that the order of Chapters III and IV has been changed to better follow FEMA logic as discussed at the previous Steering Committee meeting.

Mr. Boxhorn reviewed the results of the vulnerability assessment completed by the Steering Committee at the last meeting. He noted that the results of the vulnerability assessment were very similar to the hazards identified by the Steering Committee for the 2005 plan. He drew the Steering Committee's attention to Table III-6, which lists the hazards that the plan will address. He noted that this list is identical to the one in the initial plan. He asked the Committee if they were comfortable maintaining the current list of hazards. Mr. Richardson asked whether there were any guidelines for choosing hazards to be assessed that are provided by FEMA. Mr. Boxhorn responded that FEMA requires that the plan address natural hazards. He added that technological or human-induced hazards may be included, at the discretion of the Steering Committee. Mr. Fronk questioned whether coastal erosion should be included in the hazard analysis. He asked whether there have been any major movements of bluffs in the City. Mr. Boxhorn replied that the bluffs have been relatively stable but there is no guarantee they will stay that way. Mr. Jacquart added that some North Shore communities have experienced problems with bluff stability related to stormwater outfalls and suggested that should be considered before removing this hazard. Mr. Mortwedt asked whether there was a risk associated in removing a hazard from the plan. Mr. Boxhorn indicated there may be risk of losing funding opportunities if an event related to such a hazard occurred. Mr. Korban proposed addressing the hazards that were addressed in the initial plan. The Steering Committee concurred with this.

Mr. Boxhorn introduced Laura Kletti of the SEWRPC staff. At Mr. Boxhorn's request, Ms. Kletti reviewed the sections of the chapter related to flooding and associated stormwater drainage problems. She explained that much of the information in the chapter pertaining to flooding will be retained from the initial plan. She indicated additional information added to the chapter is highlighted in blue and relates to flooding events or flood

mitigation efforts that have occurred since the previous planning effort. She asked the Committee to notify her of any possible inconsistencies in the information she presented.

Ms. Kletti noted that a paragraph was added on page 11 describing the flood control and stream rehabilitation project on Lincoln Creek that was completed in 2001. She explained that, as a result of the project, 1,600 homes and businesses are no longer within the one-percent-annual probability floodplain.

Ms. Kletti said the number of commercial buildings currently located within the flood hazard area in the Oak Creek watershed was reduced by one building to a total of three. Mr. Thur noted that SEWRPC is currently conducting a study of the Oak Creek watershed and asked if this study will alter this plan. Ms. Kletti explained that the current recommendation is to floodproof those three buildings, although she added that this recommendation has not been finalized.

Mr. Fronk noted that there is no discussion of the Milwaukee County Grounds stormwater detention project. He acknowledged that the project is actually in the City of Wauwatosa, but indicated it had a large downstream impact. Mr. Thur indicated there was a paragraph in the Summary Notes related to an emergency action plan for this project that will be added to Chapter II. Mr. Fronk indicated that the addition of this paragraph would be sufficient.

Ms. Kletti stated that the number of structures within the floodplain in the City as indicated on page 15 (485 structures) was largely based on updated floodplain mapping undertaken by SEWRPC, the Milwaukee County Automated Mapping and Land Information System (MCAMLIS) Steering Committee, and MMSD. She further explained that the structure counts do not include garages or other out buildings.

She explained that the 218 structures found in the SEWRPC/MCAMLIS/MMSD mapping is slightly greater than the Wisconsin Office of Emergency Management's (WEM) figure of 211 WEM repetitive-loss structures. She noted that she had discussed this difference with WEM and that they were comfortable with the revised number of structures.

Ms. Kletti said that the inventory of sanitary sewer backwater problems presented in Table III-7 had been updated through 2009. She explained that the numbers in the table are derived from newspaper reports. Mr. Thur indicated he thought the numbers for 2008 and 2009 looked accurate and that he would provide data for backwater events in 2010. He noted that the number of events from 2010 would be much higher. Mr. Fronk added that duplicate calls reporting backwater problems were eliminated from final counts for accuracy. Mr. Jacquart suggested that it would be more accurate to refer to backwater issues as "basement backwater problems" rather than "sanitary sewer backwater problem." Ms. Kletti indicated that she would make this change to the text.

[Secretary's Note: The third sentence in the third paragraph on page 16 was changed to read (The revised text and added text in this and all subsequent revisions in these summary notes is indicated in bold letters for clarification only. The report text will not be bold.):

*"From 1999 to 2009, there were a total of 2,419 reported **basement** backwater problems within the City of Milwaukee ranging up to 1,000 in one year as shown in Table III-7."*

The title of Table III-7 was revised to read:

"Reported Basement Backwater Problems[a] and Annual Precipitation Summaries within the City of Milwaukee: 1999-2009"

Footnote "a" in Table III-7 was revised to read:

*"[a]These are meant to illustrate rain-related **basement** backwater **problems** reported and does not include any backups that occurred due to clogged sewers or a problem in the building sewer."*]

Ms. Kletti pointed out that page 17 includes a recommendation that the City complete its stormwater master planning. She explained that this is especially important given the intense storm events that the City has experienced in the last few years. Mr. Fronk asked whether the City has already done this. Mr. Thur indicated that a master plan has not been done for the entire City. He added that the City has conducted stormwater planning on a neighborhood basis for some areas. He stated that he would review the language in the plan regarding a City wide master plan and may propose some different language.

[Secretary's Note: Mr. Thur has not yet provided alternative language. If this is provided, changes in the text of the report will be documented in future summary notes.]

Ms. Kletti noted that a paragraph was added at the bottom of page 17 related to increasing frequency of intense rain storms due to global climate change. Mr. Jacquart felt this was a very important point to emphasize. He suggested adding data to show the increase in the frequency of intense rain storms that has occurred. He noted that the intensity of some recent storms overwhelmed the stormwater systems. Mr. Thur recalled that Michael Hahn of the SEWRPC staff had presented data related to the timing of the top 10 rainfalls of the past 30 years. He suggested that this would be valuable to include. Ms. Kletti indicated she would talk with Mr. Hahn and would try to include the information in the chapter.

[Secretary's Note: The following text was added after the second sentence in the last paragraph on page 17:

"Discharge records at streamflow gauges show evidence that the frequency of large floods is increasing. For example, over the 34-year record for the USGS gauge along the Kinnickinnic River, eight of the 10 largest flows occurred during the 15-year period 1996-2010. Similarly, over the 49-year record for the USGS gauge along the Menomonee River, six of the 10 largest flows occurred during the same 15-year period."]

There being no further discussion regarding flooding and associated stormwater drainage problems, Mr. Boxhorn reviewed the remainder of Chapter III.

Mr. Fronk noted that Table III-8 shows multiple entries for thunderstorm, high-wind, hail, and lightning events reported in Milwaukee County for some dates. He asked why this was. Mr. Boxhorn explained that the data came from the National Climatic Data Center (NCDC) database and is derived from sources such as police accounts, newspaper reports, and reports to the National Weather Service (NWS). He explained that these multiple entries could represent either multiple events occurring on the same date or the same event being reported more than once as it moved through the County. Mr. Boxhorn pointed out that the property damage estimates represent underestimates due to damages that are not reported to law enforcement or noted by the media.

Mr. Boxhorn stated that NWS has changed the way it measures the intensity of tornadoes. He noted that the new methodology is reflected in the Enhanced Fujita Scale. He explained the Enhanced Fujita Scale examines damages to a wider variety of structures than were examined in the old Fujita Scale. He indicated that the NWS has not reclassified tornadoes that occurred prior to the introduction of the new scale. He noted that because of this, tornadoes that occurred prior to the scale change are still reported with the original Fujita Scale. He indicated that no tornado events have been reported in Milwaukee County since the introduction of the Enhanced Fujita Scale.

Mr. Korban asked whether discussion of coastal hazards was intended to be specific to Lake Michigan or if it includes local rivers. Mr. Boxhorn indicated that coastal hazards were specific to Lake Michigan.

Mr. Boxhorn noted that he was waiting for data from Milwaukee County related to the number of facilities in the City reporting inventories of hazardous materials under the requirements of the Emergency Planning and Community Right-to-Know Act (EPCRA). He indicated that data will be added on page 40.

[Secretary's Note: The Commission staff is still attempting to obtain the data. Any changes to the text of the report will be documented in future summary notes.]

Mr. Boxhorn explained that the text in the chapter regarding fire and medical emergencies has not yet been updated with the most current data provided by Mr. Ley of the Milwaukee Fire Department. He indicated that the most recent data will be added to the section and posted on the SEWRPC website. He commented that the decreasing number of fires in the City caused by ignition related to smoking materials, matches, and lighters shown in Figure III-3 highlights the success of the educational programs that the Milwaukee Fire Department has conducted for over two decades.

Mr. Boxhorn asked whether there were any additional comments or corrections to Chapter III. None were offered. Mr. Boxhorn indicated that the updated and revised version of Chapter III, "Analysis of Hazard Conditions" will be posted on the SEWRPC website.

REVIEW OF PRELIMINARY DRAFT CHAPTER IV, "HAZARD MITIGATION GOALS AND OBJECTIVES", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

At Mr. Fronk's request, Mr. Boxhorn reviewed the preliminary draft of Chapter IV, "Hazard Mitigation Goals and Objectives." He indicated that four changes had been made to the chapter. He noted that the first objective has been reworded to make it read more clearly. He indicated that references to recurrence intervals in the supporting standards to the objectives had been changed to annual probabilities of occurrence, in order to make the standards consistent with current practice. He indicated that Standard 9 supporting Objective 4 had been revised to make it consistent with MMSD's 2020 facilities plan. He indicated that text has been added to the Chapter discussing the relationship of the goals to the City's comprehensive plan. He added that this set of goals can be amended or added to; however, it would be helpful if any changes were suggested soon.

Mr. Richardson asked who receives reports of hazardous material spills. Mr. Boxhorn responded that spills are normally reported to the Wisconsin Department of Natural Resources. Mr. Fronk added that under EPCRA, inventories of hazardous materials are reported to the County.

Following the meeting, Mr. Thur indicated to SEWRPC staff that he will review Objective No. 4 and the associated standards listed in Table IV-1 for consistency with the City's stormwater design criteria.

[Secretary's Note: Any changes to the text of the report as a result of Mr. Thur's review will be documented in future summary notes.]

There was no further discussion regarding Chapter IV.

OTHER BUSINESS

Mr. Boxhorn reminded the Steering Committee that additional questions or comments on the draft chapters can be submitted through the comments page on the SEWRPC website or by emailing him directly.

TIME AND DATE OF NEXT MEETING

Mr. Boxhorn proposed that the third meeting of the Steering Committee be held on May 31, 2011. He indicated that a notice, agenda, materials to review, and summary notes would be available on the SEWRPC website about a week ahead of the meeting. After discussion the Committee agreed to meet on May 31, 2011 at 1:30 p.m. in Room 501 of the Frank P. Zeidler Municipal Building.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 2:55 p.m.

REVISIONS MADE BY SEWRPC STAFF TO CHAPTER II OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION FOLLOWING THE MEETING

After the April 26, 2011 meeting of the Steering Committee, population data at the census block level from the 2010 census became available. Map II-2, "Population Distribution by Census Block for the City of Milwaukee: 2000" has been updated to reflect 2010 data.

[Secretary's Note: The updated Map II-2, "Population Distribution by Census Block for the City of Milwaukee: 2010" is attached herein as Exhibit B

The last sentence in the last paragraph on page 1, continuing onto page 2, was revised to read as follows:

"The population distribution by census block in the year **2010** ranges up to more than 2,300 persons per census block, while most of the City of Milwaukee is dominated by densities of 50 to 300 persons, as shown on Map II-2."]

REVISIONS MADE BY SEWRPC STAFF TO CHAPTER IV OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION FOLLOWING THE MEETING

After the April 26, 2011 meeting of the Steering Committee, Commission staff determined that the final paragraph on page 4 of Chapter IV should be revised.

[Secretary's Note: The final paragraph on page 4 was revised to read as follows:

"Complementing each of these objectives is a set of standards which can be used to define more-specific actions or strategies to achieve the **objective. These standards** are set forth in Table IV-1 **and** incorporate the goals and objectives **of the** related City planning programs **having** the most direct relationship to hazard mitigation planning."]

Respectfully Submitted,

Joseph E. Boxhorn
Secretary

#157035 V1 - CAPR-282-2ED SUMMARY NOTES 04/26/11
330-3027
KRY/MGH/LLK/JEB/AWO/pk
05/19/11

CITY OF MILWAUKEE ALL HAZARD
MITIGATION STEERING COMMITTEE

APRIL 26, 2011

DOCS #156915

CHAPTER 3:
ANALYSIS OF HAZARD CONDITIONS

Hazards to be Profiled

Natural

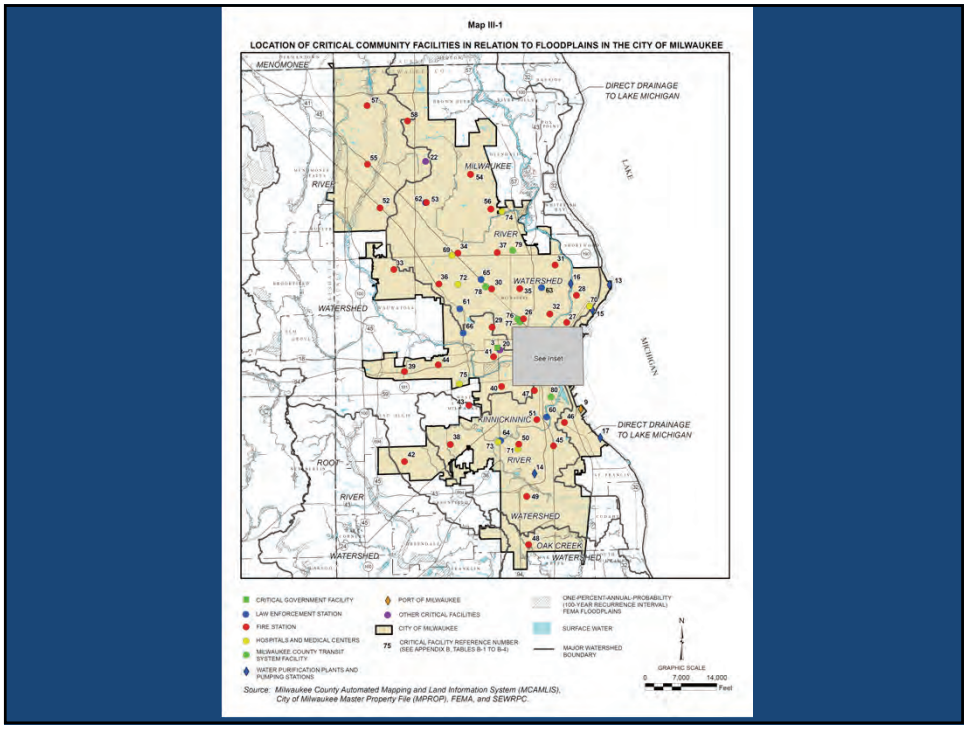
- Flooding
- Thunderstorm, high wind, hail, and lightning
- Winter storms
- Tornadoes
- Temperature Extremes
- Coastal Erosion
- Earthquakes

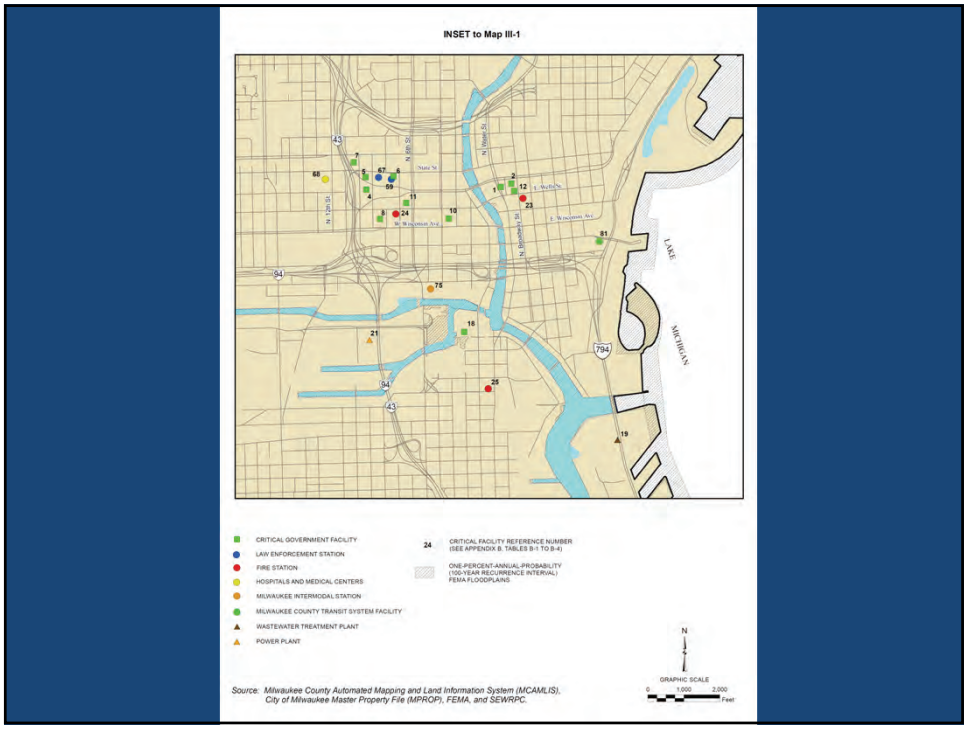
Human-induced

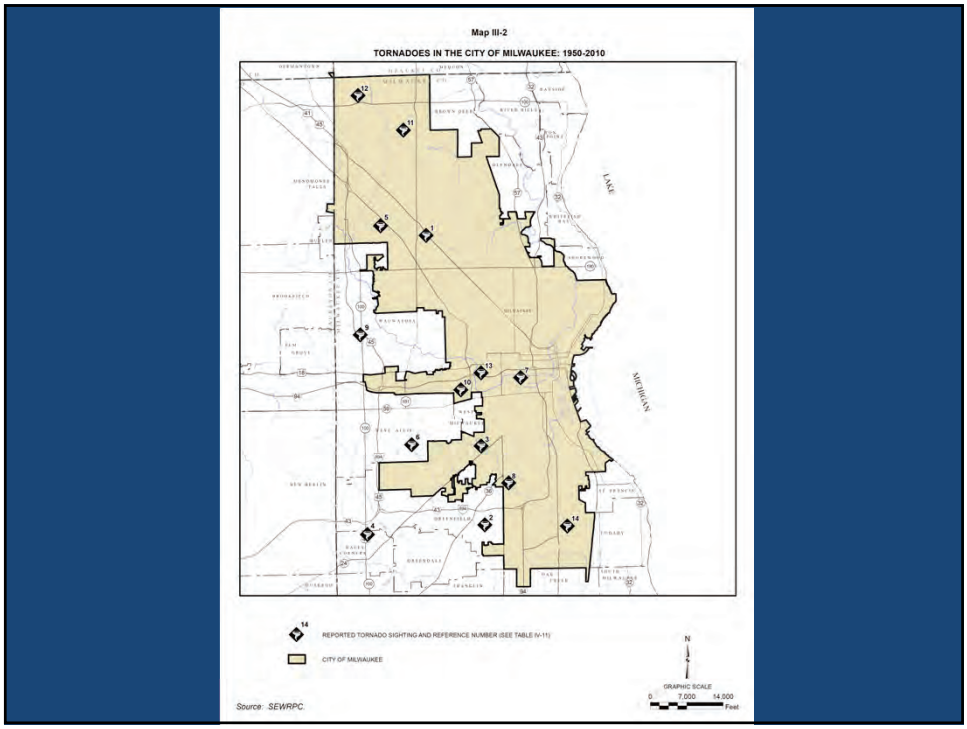
- Contamination or loss of water supply
- Hazardous materials incident
- Medical/health risk
- Terrorism incident
- Major fire and emergency incident

Vulnerability Assessment Format

- Description of Hazard
- Historical Experience with the Hazard
- Recent Hazard Events
- Vulnerability and Community Impacts Assessment
- Potential Future Changes


Map III-1
LOCATION OF CRITICAL COMMUNITY FACILITIES IN RELATION TO FLOODPLAINS IN THE CITY OF MILWAUKEE
MENOMONEE
DIRECT DRAINAGE TO LAKE MICHIGAN
MILWAUKEE
RIVER
LAKE
MICHIGAN
WATERSHED
See inset
KINNICKINNIC
ROOT
OAK CREEK
CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
WATER PURIFICATION PLANTS AND PUMPING STATIONS
PORT OF MILWAUKEE
OTHER CRITICAL FACILITIES
CITY OF MILWAUKEE
CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS
SURFACE WATER
MAJOR WATERSHED BOUNDARY
GRAPHIC SCALE
0 7,000 14,000 Feet
Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.


INSET to Map III-1
LAKE
MICHIGAN
CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
MILWAUKEE INTERMODAL STATION
MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
WASTEWATER TREATMENT PLANT
POWER PLANT
CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS
GRAPHIC SCALE
0 1,000 2,000 Feet
Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.


Map III-2
TORNADOES IN THE CITY OF MILWAUKEE: 1950-2010
LAKE
MICHIGAN
REPORTED TORNADO SIGHTING AND REFERENCE NUMBER (SEE TABLE IV-11)
CITY OF MILWAUKEE
N
GRAPHIC SCALE
0 7,000 14,000
Feet
Source: SEWRPC.

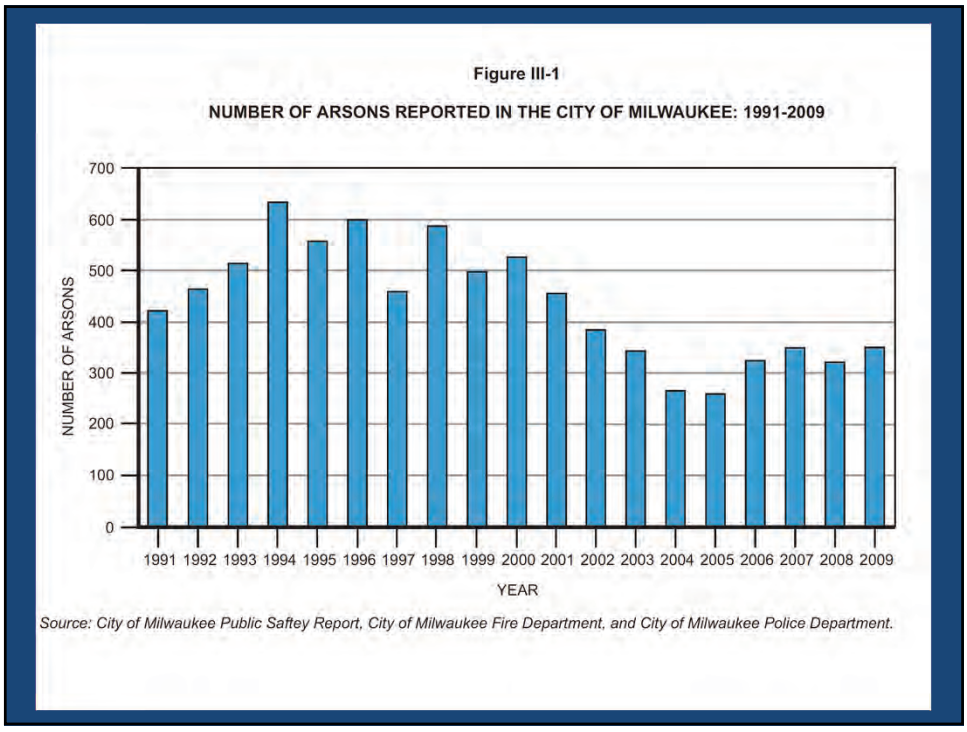
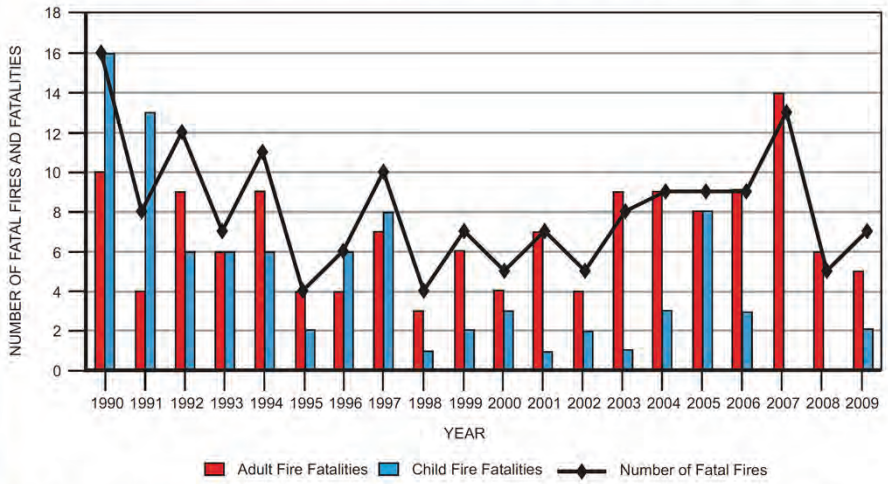


Figure III-1
NUMBER OF ARSONS REPORTED IN THE CITY OF MILWAUKEE: 1991-2009
NUMBER OF ARSONS
0
100
200
300
400
500
600
700
1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009
YEAR
Source: City of Milwaukee Public Saftey Report, City of Milwaukee Fire Department, and City of Milwaukee Police Department.

Figure III-2

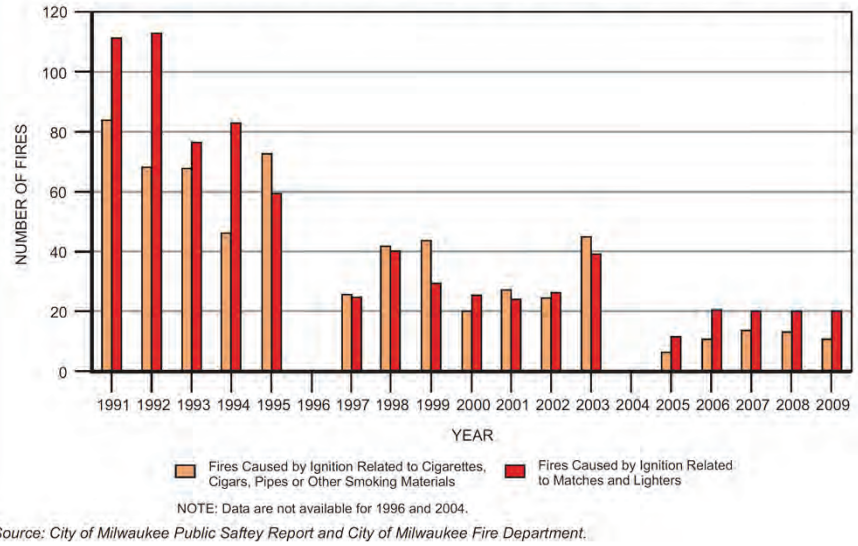
NUMBER OF FATAL FIRES AND FIRE FATALITIES IN THE CITY OF MILWAUKEE: 1990-2009



Source: City of Milwaukee Public Saftey Report, City of Milwaukee Fire Department, and City of Milwaukee Police Department.

Figure III-3

NUMBER OF FIRES IN THE CITY OF MILWAUKEE CAUSED BY IGNITION RELATED TO SMOKING MATERIALS OR MATCHES AND LIGHTERS: 1991-2009



NOTE: Data are not available for 1996 and 2004.

Source: City of Milwaukee Public Saftey Report and City of Milwaukee Fire Department.

CHAPTER 4:
HAZARD MITIGATION GOALS AND OBJECTIVES

Change in Objective No. 1 (pp. 4, 7)

- Old: A spatial distribution of the various land uses which minimizes hazards and dangers to health, welfare, and safety and which will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety, and public facility systems and which minimizes hazards and dangers to health, welfare, and safety, as well as further enhancing the economic base of the City.

- New: A spatial distribution of the various land uses that minimizes hazards and dangers to health, welfare, and safety as well as further enhancing the economic base of the City, and which will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety, and public facility systems.

Changes in Standards Supporting Objective No. 4 (pp. 8-9)

- Recurrence intervals for flooding and storm events were changed to annual probability of occurrence.

Changes in Standards Supporting Objective No. 4 (p. 9)

- Old Standard 9: In order to prevent property losses and health and safety hazards, the sanitary sewerage system and related stormwater and floodland management systems should be designed to prevent basement backups under the most extreme sewage flow event expected with a safety factor.

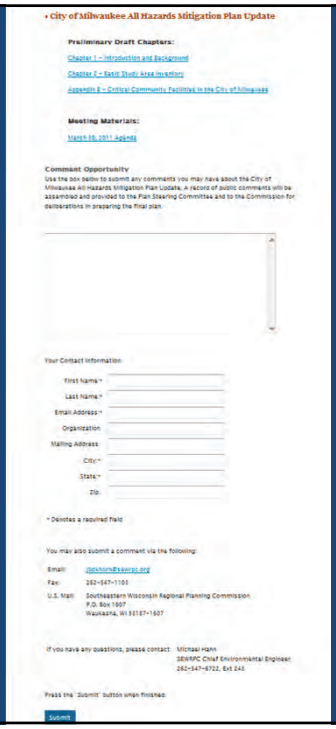
- New Standard 9: In order to prevent property losses and health and safety hazards, the sanitary sewerage system and related stormwater and floodland management systems should be designed to minimize basement backups through a) implementing the recommendations of the Milwaukee Metropolitan Sewerage District 2020 facilities plan and b) reducing problem sources of infiltration and inflow to the sanitary sewerage system.

SUBMITTING COMMENTS OR DATA ON THE PLAN CHAPTERS:

SEWRPC website:
http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

or

Email: jboxhorn@sewrpc.org



City of Milwaukee All Hazards Mitigation Plan Update

Preliminary Draft Chapters:

Chapter 1 – Introduction and Background

Chapter 2 – Basic Study Area Inventory

Appendix E – Critical Community Facilities in the City of Milwaukee

Meeting Materials:

March 30, 2011 Agenda

Comment Opportunity

Use the box below to submit any comments you may have about the City of Milwaukee All Hazards Mitigation Plan Update. A record of public comments will be assembled and provided to the Plan Steering Committee and to the Commission for deliberations in preparing the final plan.

Your Contact Information

First Name *
Last Name *
Email Address *
Organization
Mailing Address
City *
State *
Zip

* Denotes a required field

You may also submit a comment via the following:

Email: jboxhorn@sewrpc.org
Fax: 262-547-1103
U.S. Mail: Southeastern Wisconsin Regional Planning Commission
P.O. Box 1607
Waukesha, WI 53187-1607

If you have any questions, please contact: Michael Hahn
SEWRPC Chief Environmental Engineer
262-547-6722, Ext 243

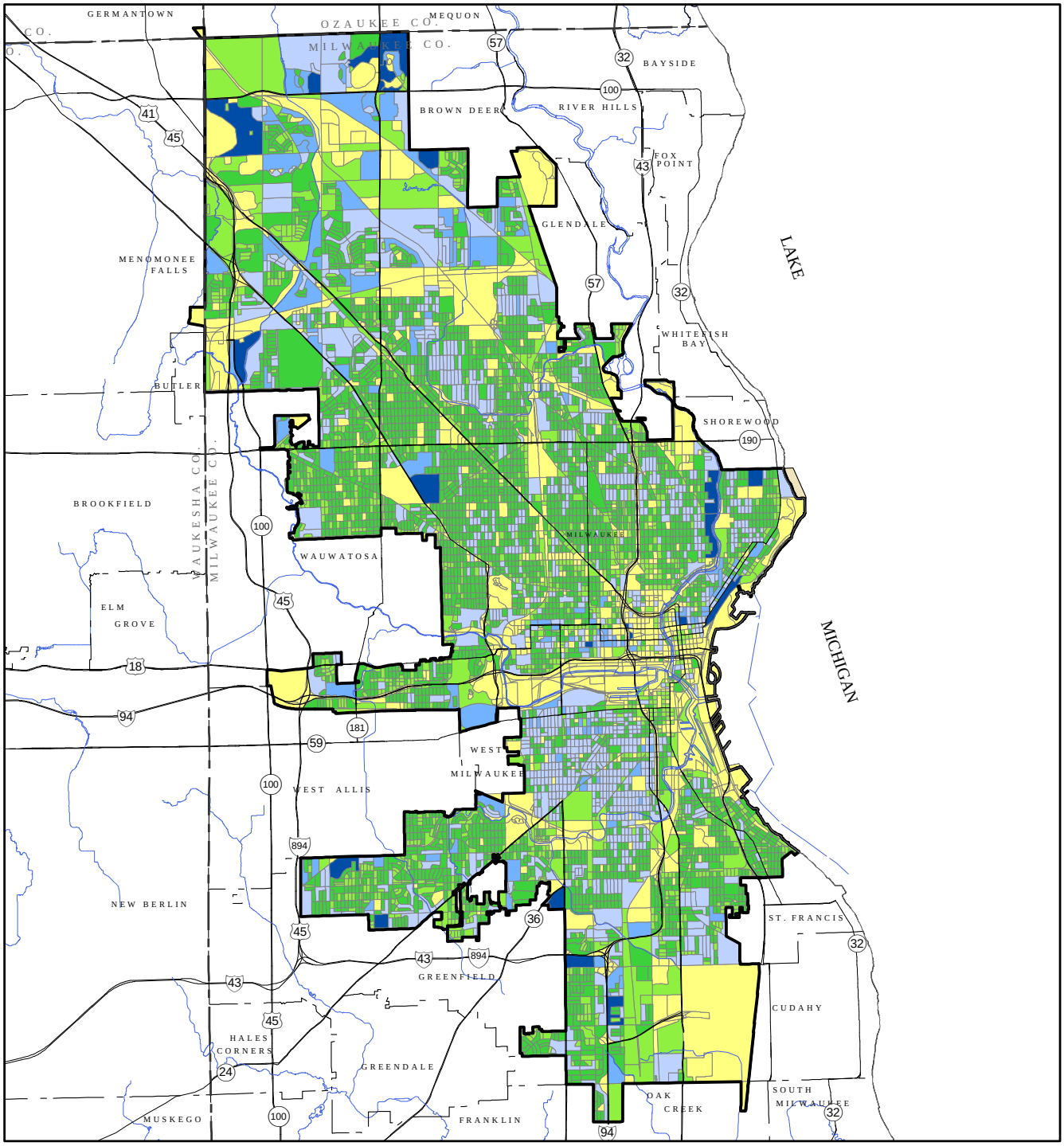
Press the "Submit" button when finished.

Submit

Exhibit B

Map II-2

POPULATION DISTRIBUTION BY CENSUS BLOCK FOR THE CITY OF MILWAUKEE: 2010



NUMBER OF PEOPLE IN EACH CENSUS BLOCK

	0		131-300
	1-50		301-750
	51-130		GREATER THAN 750

N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: U.S. Bureau of the Census and SEWRPC.

City of Milwaukee Department of Public Works
City of Milwaukee Office of Emergency Management and Homeland Security
Southeastern Wisconsin Regional Planning Commission

Notice of Meeting and Agenda

CITY OF MILWAUKEE ALL HAZARD MITIGATION PLAN STEERING COMMITTEE

DATE: May 31, 2011

TIME: 1:30 to 3:30 p.m.

PLACE: Frank P. Zeidler Municipal Building
Room 501
841 N. Broadway Street
Milwaukee, Wisconsin

AGENDA:

1. Welcome

2. Introductions

3. Review of Summary Notes of April 26, 2011 Task Force Meeting.

4. Review of preliminary draft Chapter V, "Hazard Mitigation Strategies," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner, and Laura L. Kletti, SEWRPC Principal Engineer **[NOTE: Preliminary draft chapters can be viewed at:**

   http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

   Scroll down to the "Hazard Mitigation" section and select the chapter that you want to review. Chapters V and VI will be posted on the web page on or before May 23. Meeting summary notes and meeting agendas can also be accessed from that web page.]

5. Review of preliminary draft Chapter VI, "Plan Adoption, Implementation, Maintenance, and Revision," of SEWRPC Community Assistance Planning Report No. 282 (CAPR No. 282), 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update: 2011-2015:* Joseph E. Boxhorn, SEWRPC Senior Planner.

6. Discussion regarding notification of adjacent communities

7. Discussion of arrangements for public meetings

8. Review of plan approval and adoption process

Respectfully Submitted,

Joseph E. Boxhorn
Secretary

#157328 V1 - CAPR-282-2ED AGENDA 05/31/11 MTG
330-3027
MGH/JEB/pk
05/19/11

SUMMARY NOTES OF THE MAY 31, 2011 MEETING OF THE CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN STEERING COMMITTEE

INTRODUCTION

The third meeting of the City of Milwaukee All Hazards Mitigation Steering Committee was convened at the Frank P. Zeidler Municipal Building, Room 501 at 1:35 p.m. The meeting was called to order by Steven Fronk, Director, City of Milwaukee Office of Emergency Management and Homeland Security and Co-Chairman of the Committee. Attendance was taken by circulating a sign-in sheet.

In attendance at the meeting were the following individuals:

Steven Fronk, Co-Chairman	Director, City of Milwaukee Office of Emergency Management and Homeland Security
Matthew H. Mortwedt, Co-Chairman	Security Operations Manager, City of Milwaukee Department of Public Works
Joseph E. Boxhorn, Secretary	Senior Planner, Southeastern Wisconsin Regional Planning Commission
Steven P. Adams	Public Involvement and Outreach Coordinator, Southeastern Wisconsin Regional Planning Commission
Steven Jacquart	Intergovernmental Coordinator, Milwaukee Metropolitan Sewerage District
Arlyn R. Johnson	Assistant Village Manager and Director of Public Works, Village of Menomonee Falls
Laura L. Kletti	Principal Engineer, Southeastern Wisconsin Regional Planning Commission
James H. Ley	Battalion Chief, Milwaukee Fire Department and Office of Homeland Security
Doreen Martinez	Director, American Red Cross of Southeastern Wisconsin
Aaron W. Owens	Research Analyst, Southeastern Wisconsin Regional Planning Commission
Edward A. Richardson	Principal Planner, Milwaukee Department of City Development
Julie Schneider	Transit Security Planning Coordinator, Milwaukee County Transit System
Matt Schuenke	Assistant Village Manager, Village of Whitefish Bay
Timothy J. Thur	Chief Sewer Design Manager, City of Milwaukee Department of Public Works

Mr. Fronk noted that there were several people in attendance who were not at the last meeting and asked everyone to introduce themselves.

REVIEW OF SUMMARY NOTES OF THE APRIL 26, 2011, STEERING COMMITTEE MEETING

At the request of Mr. Fronk, Mr. Boxhorn reviewed the Summary Notes from the April 26, 2011 meeting of the Steering Committee. Mr. Boxhorn stated that after the April 26 meeting, the Commission staff received several pieces of information from Mr. Thur. He explained that these were received after the Summary Notes for the meeting were completed. He indicated that Mr. Thur's comments would be documented and addressed in the Summary Notes for the May 31, 2011 meeting. Mr. Boxhorn asked if there were any comments, corrections or additions to the summary notes. None were offered. The Steering Committee approved the April 26, 2011 Summary Notes by consensus.

REVIEW OF PRELIMINARY DRAFT CHAPTER V, "HAZARD MITIGATION STRATEGIES", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

At Mr. Mortwedt's request, Mr. Boxhorn reviewed the preliminary draft of Chapter V, "Hazard Mitigation Strategies."

[Secretary's Note: Mr. Boxhorn's presentation is attached hereto as Exhibit A.]

Mr. Boxhorn introduced Laura Kletti of the SEWRPC staff. At Mr. Boxhorn's request, Ms. Kletti reviewed the sections of the chapter related to plan components addressing flooding and associated stormwater drainage problems. She stated that the projects to mitigate flood-related damage have been updated in the chapter. She explained that this includes indicating projects that have been completed and updating the estimated costs of remaining projects to reflect 2010 amounts. She noted that the maps in the chapter have been redrawn and updated.

Ms. Kletti drew the Committee's attention to the Kinnickinnic River concrete removal project described on page 4 of the draft chapter. She indicated that some of the structures that were purchased and demolished as part of the project were not located in the floodplain. She explained that these structures were purchased for construction purposes. Mr. Jacquart noted that this may shift the total number of structures that should be indicated by one or two. Ms. Kletti indicated that the text would be updated to reflect this.

[Secretary's Note: The text in parentheses in the fifth sentence of the third paragraph on page 4 was deleted.]

Ms. Kletti stated that Commission staff has been seeking information on the Kinnickinnic River streambank stabilization project described on page 5. Mr. Thur stated that the project has been completed. Ms Kletti indicated that the text would be updated.

[Secretary's Note: The bracketed and bolded text at the end of the third paragraph on page 5 was deleted and the last sentence in the third full paragraph on page 5 was revised to read:

"**T**his project **was completed in 2008.**"]

In reference to the subsection on the floodland management plan for the Menomonee River watershed described on pages 5 and 6, Ms. Kletti noted that she had confirmed that eight structures were acquired and demolished as part of the Valley Park project. She indicated that the text would be updated.

[Secretary's Note: The bracketed and bolded text under item 1) in the sixth paragraph on page 5 was deleted. The yellow highlighted text in Table V-3 was also changed to blue highlighting.]

Continuing in the subsection on the floodland management plan for the Menomonee River watershed discussed on pages 5 and 6, Ms. Kletti stated that she had received additional detail on the Western Milwaukee project from MMSD via electronic mail. The text was updated as noted below.

[Secretary's Note: The text under item 4) in the sixth full paragraph on page 5 was revised to read:

"4) **acquisition of approximately 40 acres of riparian land, acquisition and demolition of nine structures, floodplain lowering in two areas,** and construction of **4,100 linear feet of berms or** floodwalls in **western** Milwaukee;"

The description of Plan Component No. 2 in Table V-2 was revised to read:

"2. **Acquisition and demolition of nine structures**, floodplain lowering, and construction of **4,100** feet of berms or floodwalls in the western Milwaukee area"]

Ms. Kletti said that she had received comments from Mr. Thur on the subsection related to the stormwater management element of the plan. She stated that the text would be updated to reflect his comments.

[Secretary's Note: The last sentence in the seventh paragraph on page 7 was revised to read:

"The City **of Milwaukee should identify specific locations where the major stormwater management system is inadequate to handle the runoff from storms with annual probabilities of occurrence of one percent or greater and prepare stormwater management plans to address those deficiencies.**"]

Ms. Kletti stated that the discussion of basement backwater problems on pages 11 and 12 reflected the situation in 2004 and should be updated. She and Mr. Thur agreed to discuss this issue. She indicated that the text would be updated based upon this discussion.

[Secretary's Note: The bracketed sentence in the second full paragraph on page 11 was deleted. The last three sentences were also deleted. The sentence below was added at the end of this paragraph:

"In order to address ongoing inflow and infiltration (I/I) entering sanitary sewers and resulting in basement backups, the City of Milwaukee conducted one pilot project in 2011 and is initiating another pilot project to be conducted in 2011 and 2012. Both projects examine I/I originating from private property sources."

The last partial paragraph on page 11, extending into page 12 was deleted and replaced with the following paragraphs:

"The first pilot project was conducted in early 2011 and involved rehabilitating the plumbing in five city-owned homes in an area near W. Capitol Drive between N. 39th Street and N. 42nd Street. A major goal of this project was to identify the costs and challenges associated with lining sanitary sewer building laterals, disconnecting foundation drains from the sanitary sewer, installing sump pumps, and installing backflow preventers. The average per home cost to disconnect the existing foundation drain and rehabilitate the sanitary sewer lateral was approximately $14,200. In addition, the project demonstrated several challenges that are expected to be encountered in conducting large-scale projects of this type. These challenges include the potential need for an electrical service upgrade to provide dedicated service for a sump pump, locating areas in basements where a sump pump can be installed, and handling the sump discharge within the property.

The second pilot project will apply the lessons learned in the first project to the rehabilitation of laterals in an area that has had basement backups in the past and has been identified by the MMSD as being located in a poorly performing sewershed due to high levels of I/I. The area selected consists of 564 properties and is located approximately between W. Center Street, W. Burleigh Street, N. 85th Street, and N. 92nd Street. In 2010, the City completed the rehabilitation of all public sewer mains in this area. The City currently is obtaining permission from the property owners in the project area to inspect their sanitary sewer laterals. Once these inspections are

completed, the City will award a contract to have needed sanitary laterals rehabilitated, disconnect the foundation drains from the sanitary sewer, and install sump pumps. It is anticipated that this project will be completed in 2012.

Flow monitoring is also being conducted as part of the second pilot project to determine how much reduction in I/I was achieved by rehabilitation of the public sewer mains only and to quantify the reduction following the addition of the private property improvements."]

Mr. Fronk commented that he had heard news reports that the City's Flooding Study Task Force would be announcing its conclusions today (May 31, 2011). Mr. Thur responded that he felt that this was unlikely. He explained that his understanding was that the Task Force may vote on the contents of their report at their June 10, 2011 meeting.

Ms. Kletti indicated that this completed the review of the sections of the chapter related to plan components addressing flooding and associated stormwater drainage problems. Mr. Boxhorn thanked Ms. Kletti.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing thunderstorms, high-wind, hail and lightning. The Committee had no questions or comments on this section.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing tornadoes. Mr. Adams asked whether the recommendations relative to storms address the public's understanding of what to do in severe storm situations. Mr. Fronk replied that there is always a need for conducting additional outreach. He noted that City staff has been working with the Community Organizations Active in Disaster (COAD) and the faith-based community to further define their roles in this sort of outreach. Ms. Martinez added that the Red Cross has also been conducting outreach. Mr. Fronk acknowledged the need to make more outreach materials available. He noted that the City in collaboration with the Milwaukee Metropolitan Sewerage District (MMSD) is currently developing a video on post-flood mitigation procedures for residents. He explained that this will be available for distribution through a variety of channels including the City's website. Mr. Boxhorn asked Mr. Fronk whether he could provide a short description of this for inclusion in the report. Mr. Fronk replied that he would provide such a description.

[Secretary's Note: The following paragraph was added after the third paragraph on page 9:

"The City of Milwaukee Office of Emergency Management, in collaboration with the MMSD and Nechama, a nationally recognized flood response team, is currently in the process of producing a "self-help" video for individuals and business owners who may be affected by future flooding. This video will outline actions to be taken before a flood to reduce the impact of possible flooding. In addition, the video will demonstrate how a homeowner or business owner can conduct mold-remediation efforts in order to reduce long-term property damage and additional financial loss on a structure that has been flooded. The video will be made available for download via the Office of Emergency Management's website and distributed without charge through community groups and business and faith based organizations."]

Ms. Schneider asked whether it would be useful to develop a list of safe areas and shelters for buses on the streets to go to during tornado events. Mr. Boxhorn replied that a recommendation to develop such a list could be added to the plan, at the option of the Steering Committee. Ms. Martinez expressed concern that such a recommendation could create exposure to liability, if the sites included on such a list were not adequate as shelters. Messrs. Fronk and Mortwedt commented that they were hesitant to add such a recommendation. After further discussion, the consensus of the Steering Committee was to not add such a recommendation.

There was no further discussion on the section of the chapter related to plan components addressing tornadoes.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing extreme temperatures. Mr. Ley noted that the Milwaukee Heat Task Force remains active and last met during the week of May 23, 2011. Mr. Boxhorn asked whether the Heat Task Force had issued a 2011 update of its plan of excessive heat conditions. Mr. Ley replied that the 2010 plan remains the current version.

Mr. Boxhorn indicated that the reference to the Heat Steering Committee on page 24 would be changed to Heat Task Force.

[Secretary's Note: The second bullet point on page 24 was revised to read:

"Continue support of the Milwaukee Heat **Task Force**;"]

Ms. Martinez noted that the name of the Citizen Corps of Milwaukee has changed to Southeastern Wisconsin Community Organizations Active in Disaster (COAD). She asked that this be changed in the report. Mr. Boxhorn responded that this would be updated throughout the report.

[Secretary's Note: The last sentence in the first full bullet point on page 17 was revised to read:

"**Community Organizations Active in Disaster (COAD)** may be able to provide assistance in these educational efforts."

All references in the Chapter to "Citizen Corps of Milwaukee" were changed to "Southeastern Wisconsin COAD.

All references to "Citizen Corps" in the chapter were changed to "COAD."]

There was no further discussion on the section of the chapter related to plan components addressing extreme temperatures.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing Lake Michigan coastal hazards. With reference to the new paragraph on page 25, Ms. Kletti explained that FEMA would eventually like to map coastal wave run-up along all of the Lake Michigan shoreline. They are moving slowly on this in order to conduct pilot studies to determine the likely costs that would be associated with this mapping effort.

There was no further discussion on the section of the chapter related to plan components addressing Lake Michigan coastal hazards.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing winter storms. Mr. Richardson questioned whether this and other plan components should include review of building code requirements as a priority mitigation measure. He explained that the State now requires that local building codes conform to the International Building Code (IBC). He noted that this change occurred since the initial hazard mitigation plan was adopted. Mr. Thur indicated that this is an issue that was discussed at meetings of the City's Flooding Study Task Force. He stated that it is likely to be difficult to get variances from the State code, even to make local code requirements more stringent. He added that it would not hurt to retain the recommendation to review the City's building code as a priority mitigation measure as long as it is understood that such review would not be likely to result in changes. Mr. Boxhorn suggested retaining the recommendation with a footnote explaining the requirement that local building codes in Wisconsin conform to the IBC. He stated that he would seek further explanation of this from the State Department of Commerce and draft such a footnote.

[Secretary's Note: The following footnote was added at the end of the second bullet point at the top of page 17, at the end of the first bullet point on the top of page 21, and at the end of the sixth bullet point on page 30:

"*The State Uniform Dwelling Code (UDC) is a Statewide regulation that sets standards for fire safety, structural strength, energy conservation, erosion control, heating, plumbing, and electrical systems, and general health and safety in dwellings constructed or altered after 1980. The UDC applies uniformly throughout the State, and local governments may not adopt a more or less stringent code. Consequently, should review of local ordinances reveal that a change in the building code would be a viable mitigation measure, the City would need to pursue a change in the UDC at the State level.*"

The following footnote was added at the end of the first bullet point on page 32:

"Ibid."]

There was no further discussion on the section of the chapter related to plan components addressing winter storms.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing earthquakes. The Committee had no questions or comments on this section.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing contamination or loss of water supply. Mr. Jacquart stated that it was his understanding that the City had a group that meets periodically on water supply issues. Mr. Boxhorn replied that he had asked the Milwaukee Water Works about this and was told that this group was no longer active.

There was no further discussion on the section of the chapter related to plan components addressing contamination or loss of water supply.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing hazardous material incidents. The Committee had no questions or comments on this section.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing public health emergencies. The Committee had no questions or comments on this section.

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing terrorism. Ms. Schneider suggested adding discussion of the Fusion Center to the section on local programs. Mr. Fronk stated that he would provide text for this.

[Secretary's Note: The following paragraph was added after the fifth full paragraph on page 46:

"The Milwaukee Police Department's Intelligence Fusion Center (IFC) was created in 2009 by combining several units from the Milwaukee Police Department, including the Crime Analysis Section and the Southeastern Wisconsin Threat Analysis Center (STAC). State and major urban area fusion centers serve as focal points within the state and local environment for the receipt, analysis, gathering, and sharing of threat-related information between the Federal government and state, local, and private sector partners. Located in states and major urban areas throughout the country, fusion centers are situated to empower front-line law enforcement, public safety, fire service, emergency response, public health, critical infrastructure

and key resources protection, and private sector security personnel to understand local implications of national intelligence, enabling local officials to better protect their communities. Fusion centers provide interdisciplinary expertise and situational awareness to inform decision-making at all levels of government. They conduct analysis and facilitate information sharing while assisting law enforcements and homeland security agencies in preventing, protecting against, and responding to terrorism."

Mr. Boxhorn reviewed the section of the chapter related to plan components addressing major fire and medical emergency incidents. The Committee had no questions or comments on this section.

Mr. Boxhorn reviewed the section of the chapter related to the hazard risk analysis and prioritization. He explained that two parallel prioritizations had been conducted: One is based on the numbers of fatalities and injuries resulting from each hazard, while the other is based on the amount of property damage caused by each hazard.

Mr. Boxhorn stated that the plan components are summarized in Table V-8, which characterizes costs and benefits for each plan component.

Mr. Boxhorn asked whether there were any additional comments or corrections to Chapter V. None were offered. Mr. Boxhorn indicated that the updated and revised version of Chapter V, "Hazard Mitigation Strategies" will be posted on the SEWRPC website.

REVIEW OF PRELIMINARY DRAFT CHAPTER VI, "PLAN ADOPTION, IMPLEMENTATION, MAINTENANCE, AND REVISION", OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282 (CAPR NO. 282), 2ND EDITION, *CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE: 2011-2015*

At Mr. Fronk's request, Mr. Boxhorn reviewed the preliminary draft of Chapter VI, "Plan Adoption, Implementation, Maintenance, and Revision." Mr. Boxhorn referred the Steering Committee to Table VI-1. He explained that for each priority mitigation measure, this table contains a summary of the costs and benefits that were identified in Chapter V, an estimated schedule for implementation, and identification of departments and agencies responsible for leading implementation. Ms. Kletti added that the implementation schedule for those strategies that are related to flooding was taken mostly from the MMSD's fiscal plan.

Mr. Boxhorn asked the Steering Committee to review the assignments of departments and agencies responsible for leading implementation in the table and to indicate whether the assignments were appropriate relative to the City's policies and practices. Mr. Richardson commented that it would more closely reflect the City's practices if responsibility for razing condemned buildings was assigned to the City's Department of Neighborhood Services, rather than the Department of Public Works.

[Secretary's Note: The managing agency in the eighth row on Page 19 was changed from "CMDPW" to "CMNS."]

Mr. Boxhorn noted that Table VI-1 also identifies potential sources of funding for various plan elements. He indicated that the numbers identifying funding sources refer to sources described in Appendix G. Mr. Fronk asked whether the sources were for fiscal year 2011. Mr. Boxhorn replied that, because funding sources are in constant flux, the table identifies recent programs. He explained that the appendix is intended as a starting point for researching potential funding sources. Mr. Adams commented on the importance of stressing the need for continuity of funding to elected officials.

There was no further discussion regarding Chapter VI.

DISCUSSION REGARDING NOTIFICATION OF ADJACENT COMMUNITIES

Mr. Fronk reported that a letter was sent to representatives of municipalities adjacent to the City of Milwaukee notifying them that the City was updating its hazard mitigation plan and inviting them to participate in the process. He noted that representatives of the Villages of Menomonee Falls and Whitefish Bay were present at this meeting.

[Secretary's Note: A copy of the letter and cover email is included herein as Exhibit B.]

DISCUSSION OF ARRANGEMENTS FOR PUBLIC MEETINGS

Mr. Mortwedt reported that two public information meetings have been scheduled to review the draft updated hazard mitigation plan. He said that the first meeting would be held June 7, 2011, from 1:00 to 3:00 p.m., at the Andersen Lake Tower, 4001 S. 6th Street, Milwaukee, and the second would be held June 7, 2011, from 4:00 to 6:00 p.m., at the Department of Public Works Field Headquarters, 3850 N. 35th Street, Milwaukee. He noted that he had consulted the City Clerk's office regarding notice for the meeting and, as per the instructions from the Clerk's office, copies of the notice were posted in public areas of three City facilities. He added that the notice was also issued as a press release to local news organizations. Mr. Boxhorn commented that he would consult Wisconsin Emergency Management (WEM) to confirm that this notice procedure is sufficient to meet the Federal Emergency Management Agency's (FEMA) requirements.

[Secretary's Note: A copy of the meeting notice is attached herein as Exhibit D. Commission staff consulted WEM and confirmed that this notice will meet FEMA requirements.]

Mr. Fronk indicated that he would forward this notice to the municipalities adjacent to the City of Milwaukee.

[Secretary's Note: Commission staff confirmed that the notice was sent by email to the adjacent municipalities on May 31, 2011.]

Mr. Boxhorn and Mr. Mortwedt reviewed the agenda for the public meetings.

REVIEW OF PLAN APPROVAL AND ADOPTION PROCESS

At Mr. Fronk's request, Mr. Boxhorn reviewed the plan approval and adoption process. Mr. Boxhorn noted that the Steering Committee may ask additional questions and submit additional comments on the draft plan through the comment page on the SEWRPC website or by emailing him directly.

Mr. Boxhorn stated that following the public meetings, the draft plan will be revised to incorporate the revisions requested by the Steering Committee and to address any comments that are submitted during or following the public meetings. This revised version of the plan will be posted on the SEWRPC website for review by the Steering Committee. Following this, he continued, Commission staff will submit the plan on the City's behalf to WEM for review. Following this review, he noted, Commission staff will then make any revisions requested by WEM. After these revisions are made, he stated, Commission staff will resubmit the plan to WEM who will submit it on the City's behalf to FEMA for review and approval. Following this review, he noted, Commission staff will make any revisions requested by FEMA. After this, he concluded, the Common Council will need to formally adopt the plan by resolution.

Mr. Fronk asked what the time frame was for this process. Mr. Boxhorn replied that it is hard to predict how long review will take. He indicated that his intent is to submit the plan to WEM by the end of June 2011. He noted that staff at WEM had indicated to him that they would attempt to expedite their review; however, he did not know

how long it would take FEMA to conduct their review. Mr. Thur commented that after the initial plan expires, any application to FEMA for grant funds would be put on hold until the updated plan was approved.

ADJOURNMENT

There being no further business, the meeting was adjourned by unanimous consent at 3:10 p.m.

REVISIONS MADE BY SEWRPC STAFF TO CHAPTER II OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION FOLLOWING THE MEETING

After the April 26, 2011 meeting of the Steering Committee, population data for the City of Milwaukee at the census block level from the 2010 census became available. Map II-2, "Population Distribution by Census Block for the City of Milwaukee: 2000" has been updated to reflect 2010 data.

[Secretary's Note: The updated Map II-2, "Population Distribution by Census Block for the City of Milwaukee: 2010" is attached herein as Exhibit C

The last sentence in the last paragraph on page 1, continuing onto page 2, was revised to read as follows:

"The population distribution by census block in the year **2010** ranges up to more than 2,300 persons per census block, while most of the City of Milwaukee is dominated by densities of 50 to 300 persons, as shown on Map II-2."]

REVISIONS MADE BY SEWRPC STAFF TO CHAPTER III OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION FOLLOWING THE MEETING

After the May 31, 2011 meeting of the Steering Committee, the Commission staff received data from WEM related to the number of facilities in the City reporting inventories of hazardous materials under the requirements of the Emergency Planning and Community Right-to-Know Act.

[Secretary's Note: The last sentence of the first paragraph on page 40 was revised to read as follows:

"**As of May 2011, t**here are **369** facilities in the City of Milwaukee that report their **inventories** of hazardous materials **and 100 facilities that** provide notification that they have an extremely hazardous substance under the requirements of EPCRA."

The footnote at the end of this sentence was retained.]

REVISIONS MADE TO CHAPTERS III AND IV OF SEWRPC COMMUNITY ASSISTANCE PLANNING REPORT NO. 282, 2ND EDITION IN RESPONSE TO CORRESPONDENCE FROM MR. TIMOTHY THUR, CITY OF MILWAUKEE DEPARTMENT OF PUBLIC WORKS

As noted above, following completion of Summary Notes for the April 26, 2011 meeting of the Steering Committee, the Commission staff received additional information for Chapters III and IV from Mr. Thur by electronic mail. A copy of Mr. Thur's email is attached herein as Exhibit E.

Mr. Thur indicated that the Department of Public Works received 12,203 reports of basement backups and flooding as a result of the July 15, 2010 and July 22, 2010 storms.

[Secretary's Note: Data on annual precipitation for General Mitchell International Airport for 2010 were obtained from the National Climatic Data Center. These data and the basement backup data were added to Table III-7. A copy of the revised table is attached herein as Exhibit F. The third and fourth sentences in the third paragraph on page 16 of Chapter III were revised to read:

"From 1999 to **2010**, there were a total of **14,622** reported **basement** backwater problems within the City of Milwaukee ranging up to **12,203** in one year as shown in Table III-7. The greatest number of reported backwater problems **occurred in 2010, with all of the incidents being reported during the month of July. Although total annual precipitation during 2010 was only 1.17 inches above average annual precipitation, precipitation for July 2010 was 7.35 inches greater than average July precipitation. In addition, precipitation for the month of June 2010 was 3.37 inches greater than average June precipitation. The second greatest number of reported backwater problems occurred in** 2008, when total annual precipitation was about nine inches above normal **and precipitation for the month of June was 8.71 inches greater than average June precipitation**. **Many of these backups were associated with storms that occurred on June 7 and 8, which deposited about 7.18 inches of rainfall at General Mitchell International Airport.**"]

Mr. Thur submitted revised language for the recommendation that the City complete its stormwater master planning.

[Secretary's Note: The last sentence in the first partial paragraph on page 17 in Chapter III was revised to read:

"The City of Milwaukee should **identify specific locations where the major stormwater management system is inadequate to handle the runoff from storms with annual probabilities of occurrence of one percent or greater and prepare stormwater management plans to address those deficiencies.**"]

Relative to stormwater management, Mr. Thur indicated that the City used a 20-percent-annual-probability storm event for the design of storm sewer facilities and a 10-percent-annual-probability storm event for the design of combined sewer facilities.

[Secretary's Note: Standard No. 2 under Objective No. 4 in Table IV-1 was revised to read:

"In order to provide for an acceptable level of access to property and of traffic service, the minor components of the stormwater management system should be designed to accommodate a runoff from a 10-percent-annual-probability storm event **in the combined sewer area of the City and a 20-percent-annual-probability storm event in the separate sewer area of the City**."

Standard No. 3 under Objective No. 4 in Table IV-1 was revised to read:

"In order to provide for an acceptable level of access to property and of traffic service, the stormwater management system should be designed to provide two clear 10-foot lanes for moving traffic on existing arterial streets, and one clear 10-foot lane for moving traffic on existing collector and land access streets during storm events up to and including the 10-percent-annual-probability event **in the combined sewer**

area of the City and a 20-percent-annual-probability event in the separate sewer area of the City.

Standard No. 4 under Objective No. 4 in Table IV-1 was revised to read:

"Flow of stormwater along and across the full pavement width of collector and land access streets shall be acceptable during storm events exceeding a 10-percent-annual-probability event **in the combined sewer area of the City and a 20-percent-annual-probability event in the separate sewer area of the City** when the streets are intended to constitute integral parts of the major stormwater drainage system."]

Respectfully Submitted,

Joseph E. Boxhorn
Secretary

#157487 V1 - CAPR-282-2ED SUMMARY NOTES 05/31/11
330-3027
MGH/LLK/JEB/pk
06/21/11

CITY OF MILWAUKEE ALL HAZARD
MITIGATION STEERING COMMITTEE

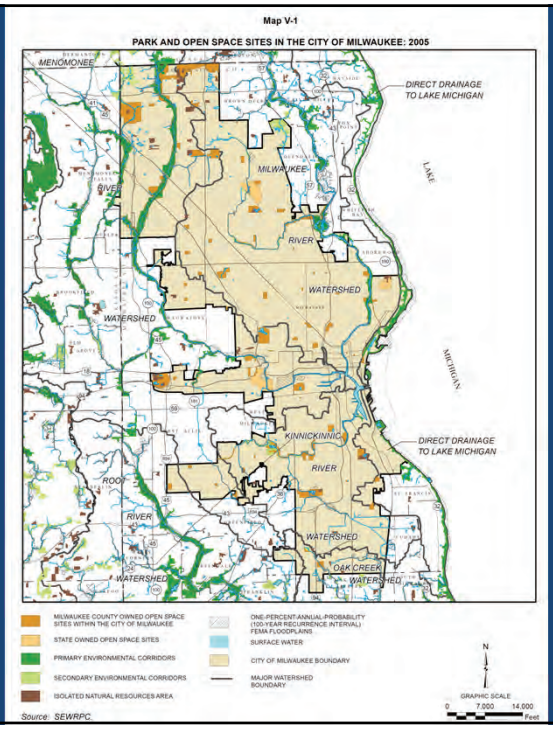
May 31, 2011

DOCS #157387

CHAPTER 5:
HAZARD MITIGATION STRATEGIES

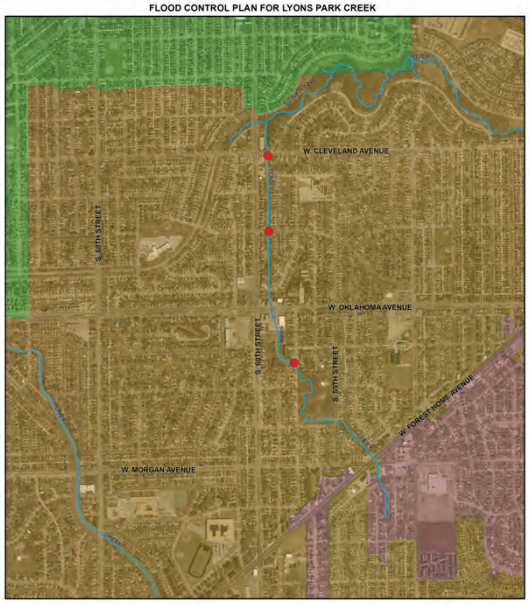
General Scheme of Presentation in Chapter V

- Identification of alternative mitigation strategies
- Review of current programs
  - Federal and State
  - Local
- Evaluation of alternatives and identification of mitigation actions
- Priority mitigation actions



Map V-2

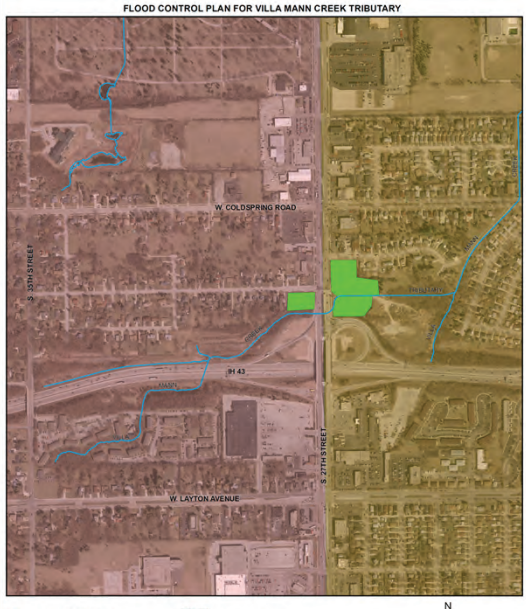
FLOOD CONTROL PLAN FOR LYONS PARK CREEK



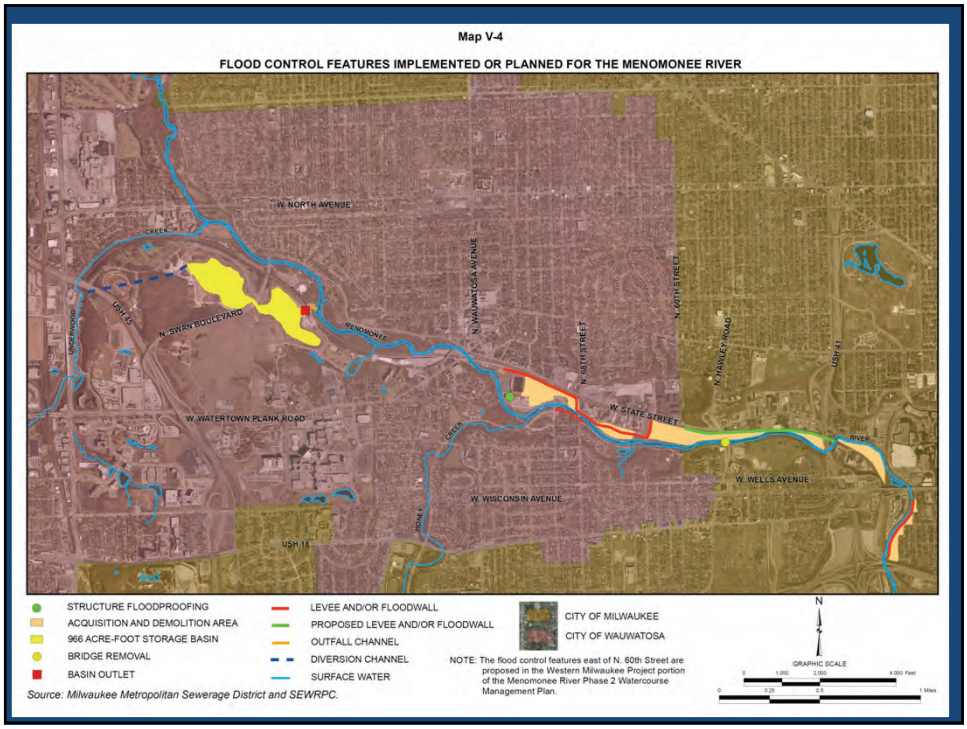
Source: Harza Engineering Company and SEWRPC.

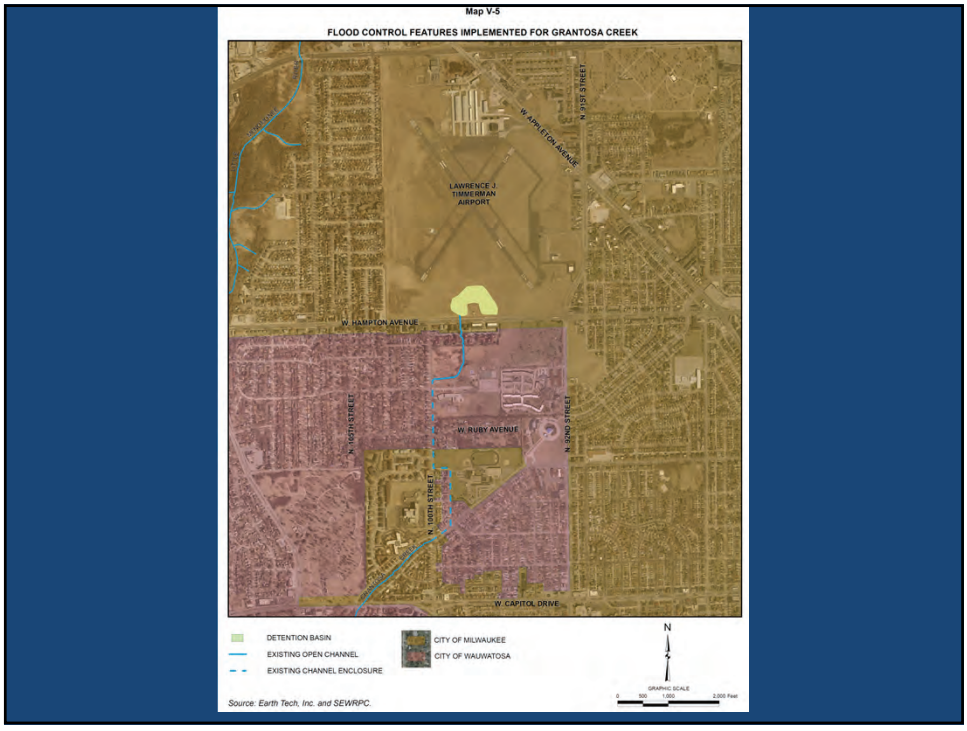
Map V-3

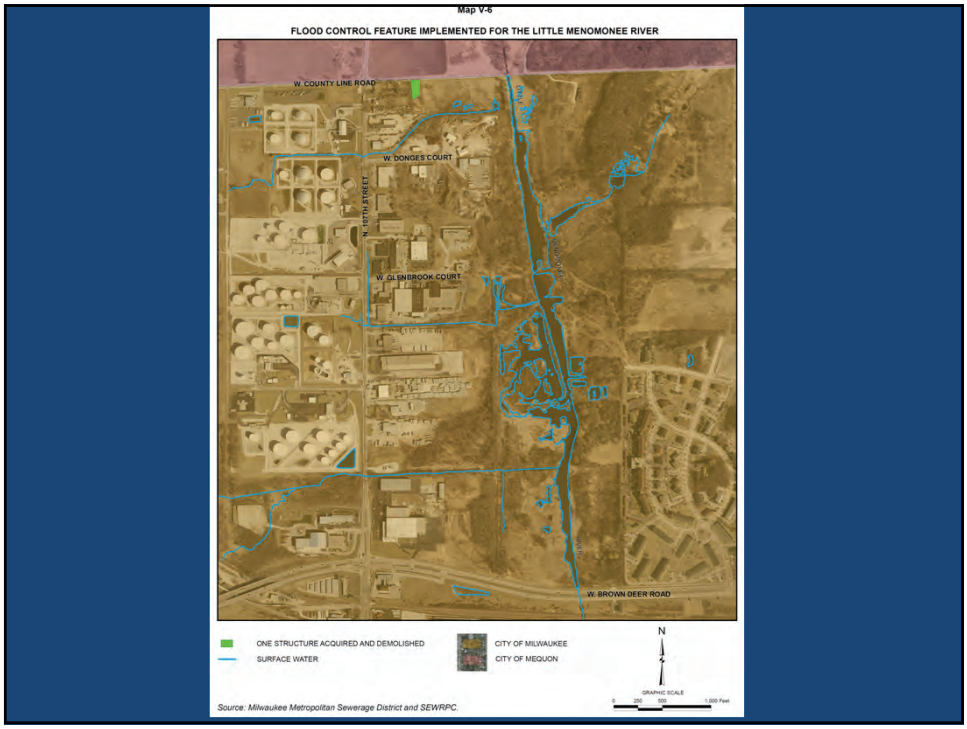
FLOOD CONTROL PLAN FOR VILLA MANN CREEK TRIBUTARY

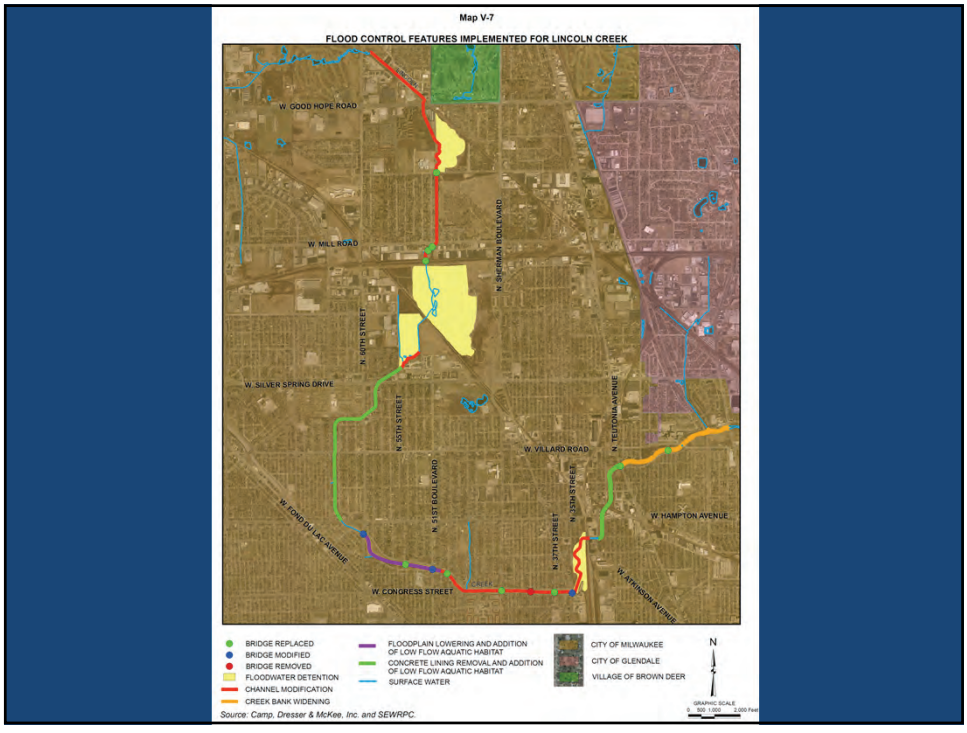


Source: SEWRPC.


Map V-4
FLOOD CONTROL FEATURES IMPLEMENTED OR PLANNED FOR THE MENOMONEE RIVER
W. NORTH AVENUE
N. WAUWATOSA AVENUE
N. 60TH STREET
N. HAWLEY ROAD
USH 41
N. SWAN BOULEVARD
USH 45
UNDERWOOD
MENOMONEE
N. 68TH STREET
W. STATE STREET
W. WATERTOWN PLANK ROAD
W. WISCONSIN AVENUE
W. WELLS AVENUE
USH 18
RIVER
STRUCTURE FLOODPROOFING
ACQUISITION AND DEMOLITION AREA
966 ACRE-FOOT STORAGE BASIN
BRIDGE REMOVAL
BASIN OUTLET
LEVEE AND/OR FLOODWALL
PROPOSED LEVEE AND/OR FLOODWALL
OUTFALL CHANNEL
DIVERSION CHANNEL
SURFACE WATER
CITY OF MILWAUKEE
CITY OF WAUWATOSA
NOTE: The flood control features east of N. 60th Street are proposed in the Western Milwaukee Project portion of the Menomonee River Phase 2 Watercourse Management Plan.
N
GRAPHIC SCALE
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

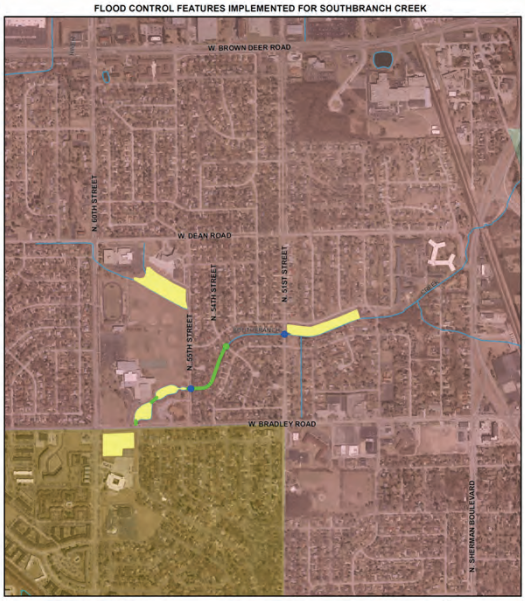

Map V-5
FLOOD CONTROL FEATURES IMPLEMENTED FOR GRANTOSA CREEK
N. 31ST STREET
W. APPLETON AVENUE
LAWRENCE J. TIMMERMAN AIRPORT
W. HAMPTON AVENUE
N. 16TH STREET
W. RUBY AVENUE
N. 32ND STREET
N. 100TH STREET
W. CAPITOL DRIVE
DETENTION BASIN
EXISTING OPEN CHANNEL
EXISTING CHANNEL ENCLOSURE
CITY OF MILWAUKEE
CITY OF WAUWATOSA
N
GRAPHIC SCALE
Source: Earth Tech, Inc. and SEWRPC.


Map V-6
FLOOD CONTROL FEATURE IMPLEMENTED FOR THE LITTLE MENOMONEE RIVER
W. COUNTY LINE ROAD
W. DONGES COURT
N. 107TH STREET
W. GLENBROOK COURT
W. BROWN DEER ROAD
ONE STRUCTURE ACQUIRED AND DEMOLISHED
SURFACE WATER
CITY OF MILWAUKEE
CITY OF MEQUON
N
GRAPHIC SCALE
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.


Map V-7
FLOOD CONTROL FEATURES IMPLEMENTED FOR LINCOLN CREEK
W. GOOD HOPE ROAD
W. MILL ROAD
N. SHERMAN BOULEVARD
N. 60TH STREET
W. SILVER SPRING DRIVE
N. 35TH STREET
N. 51ST BOULEVARD
W. VILLARD ROAD
N. TEUTONIA AVENUE
N. 35TH STREET
W. HAMPTON AVENUE
W. FOND DU LAC AVENUE
N. 27TH STREET
N. APPLETON AVENUE
W. CONGRESS STREET
BRIDGE REPLACED
BRIDGE MODIFIED
BRIDGE REMOVED
FLOODWATER DETENTION
CHANNEL MODIFICATION
CREEK BANK WIDENING
FLOODPLAIN LOWERING AND ADDITION OF LOW FLOW AQUATIC HABITAT
CONCRETE LINING REMOVAL AND ADDITION OF LOW FLOW AQUATIC HABITAT
SURFACE WATER
CITY OF MILWAUKEE
CITY OF GLENDALE
VILLAGE OF BROWN DEER
N
GRAPHIC SCALE
Source: Camp, Dresser & McKee, Inc. and SEWRPC.

Map V-8

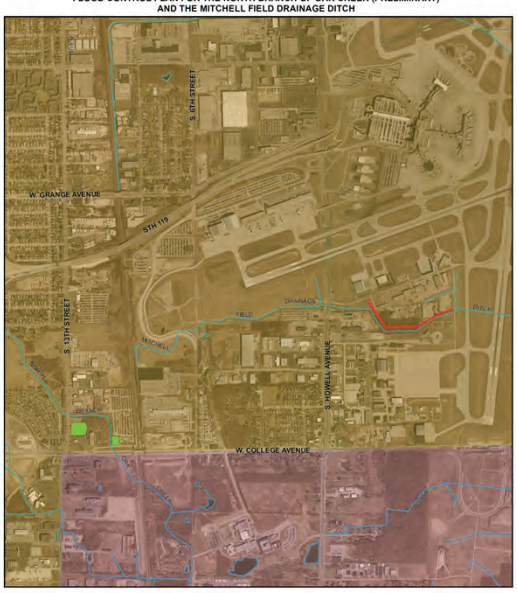
FLOOD CONTROL FEATURES IMPLEMENTED FOR SOUTHBRANCH CREEK



Source: Earth Tech, Inc. and SEWRPC.

Map V-9

FLOOD CONTROL PLAN FOR THE NORTH BRANCH OF OAK CREEK (PRELIMINARY) AND THE MITCHELL FIELD DRAINAGE DITCH



Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Priority Ranking of Hazards
(Tables V-6 and V-7)

Mortality and Injury	Property and Crop Damage
Medical and health risks	Major fire and emergency incidents
Temperature extremes	Flooding
Major fire and emergency incidents	Thunderstorm and associated
Tornadoes	Tornadoes
Thunderstorms, high wind, hail, and lightning	Hazardous material Incidents
Hazardous material incidents	Winter storms
Winter Storms	Coastal erosion
Flooding	Temperature extremes
Contamination or loss of water supply	Terrorism incidents
Terrorism incidents	Earthquake
Coastal erosion	Contamination or loss of water supply
Earthquake	Medical and health risks

CHAPTER 6:
PLAN ADOPTION, IMPLEMENTATION, MAINTENANCE, AND REVISION

For each priority mitigation strategy

- Estimated costs
- Designated management agencies
- Noted current implementation status
- Identified potential funding sources
  - These are continually changing

SUBMITTING COMMENTS OR DATA ON THE PLAN CHAPTERS:

SEWRPC website:
http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

or

Email: jboxhorn@sewrpc.org

• City of Milwaukee All Hazards Mitigation Plan Update

Preliminary Draft Chapters:

Chapter 1 – Introduction and Background

Chapter 2 – Kenosha Study Area Inventory

Appendix E – Critical Community Facilities in the City of Milwaukee

Meeting Materials:

March 30, 2011 Agenda

Comment Opportunity

Use the box below to submit any comments you may have about the City of Milwaukee All Hazards Mitigation Plan Update. A record of public comments will be assembled and provided to the Plan Steering Committee and to the Commission for deliberations in preparing the final plan.

Your Contact Information:

First Name:*
Last Name:*
Email Address:*
Organization:
Mailing Address:
City:*
State:*
Zip:

* Denotes a required field

You may also submit a comment via the following:

Email: [redacted]
Fax: 262-547-1103
U.S. Mail: Southeastern Wisconsin Regional Planning Commission
P.O. Box 1607
Waukesha, WI 53187-1607

If you have any questions, please contact: Michael Hahn
SEWRPC Chief Environmental Engineer
262-547-6722, Ext 243

Press the "Submit" button when finished.

Submit

Exhibit B

Boxhorn, Joseph E.

From: Fronk, Steve [SFRONK@milwaukee.gov]
Sent: Monday, May 23, 2011 11:56 AM
To: Ddevine@westalliswi.gov; Jdidier@wauwatosa.net; dayt@ci.cudahy.wi.us; alr@stfranwi.org; presidentjohnson@villageofshorewood.org; mayor@ci.mequon.wi.us; manager@browndeerwi.org; admin@menomonee-falls.org; jat1941@aol.com; PresidentSiegel@wfbvillage.org; zepecki@ci.south-milwaukee.wi.us; jhermes@greendale.org; ponto@ci.brookfield.wi.us; Kim.Egan@westmilwaukee.org
Cc: Boxhorn, Joseph E.; Korban, Ghassan; Mortwedt, Matthew
Subject: Milwaukee All-Hazard Mitigation Plan Update
Attachments: Letter to Adjoining Municipalities.pdf

Please see the attached letter. The City of Milwaukee is in the process of updating its all-hazard mitigation plan and you are invited to review the draft and recommend a representative from your jurisdiction to participate in the review process. Preliminary draft chapters of the updated mitigation plan can be viewed at www.sewrpc.org. Click on "Community Assistance" then "Project Planning Services" then "City of Milwaukee Hazard Mitigation Plan Update". Select the chapter that you want to review.

Our next meeting is on Tuesday May 31st from 1:30-3:30 p.m. in Room 501 of the Zeidler Municipal Building, 841 N. Broadway, Milwaukee. Please let me know if someone from your jurisdiction will be attending this meeting so that we can be sure to greet him/her.

Feel free to call or email if you have additional questions.

Steven Fronk, Director
Emergency Management & Homeland Security
200 East Wells Street, Room 605
Milwaukee, WI 53202
Office: 414-286-5062
Mobile: 414-217-6829
FAX: 414-286-5141
steve.fronk@milwaukee.gov

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City of Milwaukee

Office of Emergency Management & Homeland Security

Tom Barrett
Mayor

Steven Fronk
Director

May 23, 2011

To: Municipalities Adjoining City of Milwaukee

Re: All-Hazard Mitigation Plan Update Process

The City of Milwaukee, with assistance from the Southeastern Wisconsin Regional Planning Commission, is in the process of updating our existing Hazard Mitigation Plan. The purpose of hazard mitigation planning is to identify policies and actions that will reduce potential risks and future losses. While many disasters cannot be prevented, implementation of a hazard mitigation plan is intended to lessen the impact of major disruptive events and help us to become more resilient.

Earlier this year the City of Milwaukee Department of Public Works and the Office of Emergency Management and Homeland Security convened a Hazard Mitigation Task Force comprised of citizens, government officials, business leaders, volunteers, non-profit organizations and other stakeholders. The primary mission of this task force is to update the City of Milwaukee's Hazard Mitigation Plan. The most recent meeting was held on April 26, 2011. Work on this important project continues.

I am inviting you, as a representative of an adjoining municipality, to recommend someone from your jurisdiction to participate in the process of revising the City of Milwaukee Hazard Mitigation Plan. The next public meeting is Tuesday, May 31st from 1:30-3:30 in Room 501 of the Zeidler Municipal Building, 841 N. Broadway Avenue, Milwaukee. Preliminary draft chapters of the updated mitigation plan can be viewed at www.sewrpc.org. Click on "Community Assistance" then "Project Planning Services" then "City of Milwaukee Hazard Mitigation Plan Update". Select the chapter that you want to review. Meeting summary notes and meeting agendas may also be accessed from that web page.

Please let me know via email no later than May 30, 2011 if someone from your jurisdiction is interested in participating in the process. Provide me with the name, address, phone and email of that person so that I may keep him/her apprised of our meetings and progress.

If your jurisdiction does not wish to participate directly, I hope that you will check back on the web site periodically for updates on the planning process. Feel free to contact me at any time via e-mail or at 414-286-5062 if you have questions or feedback.

Very truly yours,

Steven Fronk

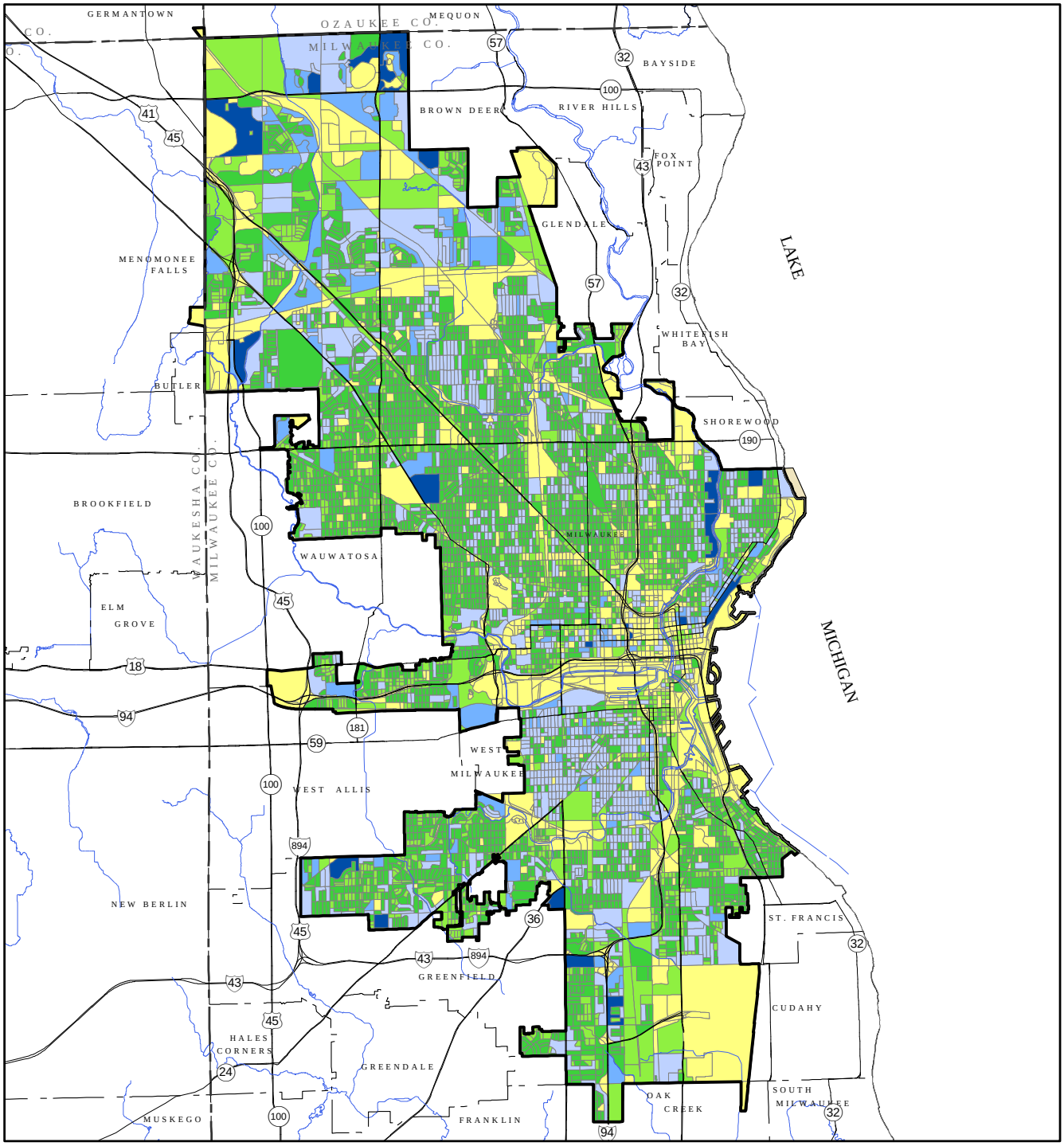
Cc: J. Boxhorn
G. Korban

Room 605 – City Hall, 200 East Wells Street, Milwaukee, Wisconsin 53202
E-mail ohs@milwaukee.gov Phone (414) 286-5136 Fax (414) 286-5141

Exhibit C

Map II-2

POPULATION DISTRIBUTION BY CENSUS BLOCK FOR THE CITY OF MILWAUKEE: 2010



NUMBER OF PEOPLE IN EACH CENSUS BLOCK

	0		131-300
	1-50		301-750
	51-130		GREATER THAN 750

N

GRAPHIC SCALE

0 7,000 14,000 Feet

Source: U.S. Bureau of the Census and SEWRPC.

Exhibit D

City of Milwaukee All Hazard Mitigation Plan Update

Notice of Public Meetings

June 7th, 2011, 1-3PM
Andersen Lake Tower, 3rd Floor
4001 S. 6th St.
Milwaukee, WI

June 7th, 2011, 4-6PM
DPW Field Headquarters, Assembly Room
3850 N. 35th St
Milwaukee, WI

Citizens are invited to two public information meetings related to the mitigation of impacts from natural and human-induced hazards in the City of Milwaukee, Wisconsin. The plan includes recommendations related to the mitigation of impacts from hazards such as flooding and related stormwater drainage problems; weather-related hazards such as tornados, winter storms, and severe thunderstorms; and hazardous material incidents in the City of Milwaukee. The plan constitutes an update of the initial hazard mitigation plan which was adopted by the City of Milwaukee in 2005. Copies of the report chapters, including the recommended plan chapter are now available for review on the Southeastern Wisconsin Regional Planning Commission (SEWRPC) website:

http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm#Milwaukee

Meeting Agenda

1. Open house, written comment, discussion with City & SEWRPC staff
2. Presentation by SEWRPC representatives
3. Questions and Answers
4. Adjournment

In addition to providing comments at the public meeting, written comments may also be submitted through a comment screen on SEWRPC's website. The comment screen may be found at:

http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

Representatives from the City of Milwaukee Department of Public Works and Office of Emergency Management will be in attendance. Questions or comments should be directed to:

Joseph E. Boxhorn, SEWRPC, Senior Planner
W239 N1812 Rockwood Drive
Waukesha, Wisconsin 53187-1607
Phone: 262-547-6721 Fax: 262-547-1103
Email: jboxhorn@sewrpc.org

Members of the Common Council and its standing committees who are not members of this committee may attend this meeting to participate or to gather information. Notice is given that this meeting may constitute a meeting of the Common Council or any of its standing committees, although they will not take any formal action at this meeting.

Upon reasonable notice, efforts will be made to accommodate the needs of persons with disabilities through sign language interpreters or auxiliary aids. For additional information or to request this service, contact the Council Services Division ADA Coordinator at 286-2998, (FAX)286-3456, (TDD)286-2025 or by writing to the Coordinator at Room 205, City Hall, 200 E. Wells Street, Milwaukee, WI 53202.

Persons engaged in lobbying as defined in s. 305-43-4 of the Milwaukee Code of Ordinances are required to register with the City Clerk's Office License Division. More information is available at www.milwaukee.gov/lobby.

Boxhorn, Joseph E.

From: Kletti, Laura L.
Sent: Thursday, May 19, 2011 3:29 PM
To: Boxhorn, Joseph E.
Subject: FW: City Hazard Plan follow-up - for mtg minutes

Joe – response from the City on Ch 3 & 4 discussion. I can update the meeting minutes if desired.
Laura

From: Thur, Timothy [mailto:Timothy.Thur@milwaukee.gov]
Sent: Thursday, May 19, 2011 2:19 PM
To: Kletti, Laura L.
Cc: Owens, Aaron W.
Subject: RE: City Hazard Plan follow-up

Laura,

Here is the additional information for Chapter 3 & 4 of teh Hazard Mitigation Plan:

1. We received 12,203 reports of basement backups/flooding complaints as a result of the July 15 and July 22 storms.

2. Please revise the last sentence of the 1st paragraph on page 17 to read:

The City of Milwaukee should identify specific locations where the major storm water management system is inadequate to handle the runoff from storms with annual probabilities of one percent or greater, and prepare storm water management plans to address those deficiencies.

3. The City uses a five year storm event (20-percent annual probability) for the design of storm sewer facilities and a 10 year storm event (10-percent annual probability) for the design of combined sewer facilities.

Please let me know if you have any questions.

Tim Thur
Environmental Engineering
City of Milwaukee
414-286-2463
timothy.thur@milwaukee.gov

From: Kletti, Laura L. [mailto:LKLETTI@SEWRPC.org]
Sent: Mon 5/16/2011 1:45 PM
To: Thur, Timothy
Cc: Owens, Aaron W.
Subject: City Hazard Plan follow-up

Tim –

I just wanted to follow up on some items from the last Hazard Mitigation Plan meeting on 4/26. You were going to provide additional information on the following for Chapters 3 & 4:

1. July 2010 event – number of basement flooding complaints.
2. Chapter 3 page 17 top – review wording for storm water master planning recommendation.
3. Table IV-1 Objective 4 – review the event standards for storm water and floodland management components.

Let me know any questions or concerns.

Laura L. Kletti P.E., CFM
SEWRPC
W239 N1812 Rockwood Drive
P.O. Box 1607
Waukesha, WI 53187-1607
Direct 262-547-6722 x224
lkletti@sewrpc.org

The City of Milwaukee is subject to Wisconsin Statutes related to public records. Unless otherwise exempted from the public records law, senders and receivers of City of Milwaukee e-mail should presume that e-mail is subject
to release upon request, and is subject to state records retention requirements. See City of Milwaukee full e-mail disclaimer at www.milwaukee.gov/email_disclaimer

Exhibit F

Table III-7

REPORTED SANITARY SEWER BACKWATER PROBLEMS[a] AND ANNUAL PRECIPITATION SUMMARIES WITHIN THE CITY OF MILWAUKEE: 1999-2009

Year	Backwater Complaints (number)	Annual Precipitation Departures from Normal (inches)	Annual Total Precipitation (number of days)			
			Greater than 0.01 to 0.1 Inch	Greater than 0.1 to 0.5 Inch	Greater than 0.5 to 1.0 Inch	Greater than 1.0 Inch
1999	187	+4.95	42	43	16	8
2000	112	+11.44	61	38	16	9
2001	2	+3.80	38	35	22	9
2002	60	-8.12	45	38	11	5
2003	0	-12.51	52	34	11	2
2004	86-400[b]	-1.87	45	48	14	6
2005	0	-8.89	43	50	9	3
2006	0	+3.12	42	46	18	9
2007	0	-1.75	47	46	14	6
2008	1,000	+8.71	44	50	13	11
2009	658	+1.00	36	49	14	7
2010	12,203	+1.17	50	31	17	6

[a]*These are meant to illustrate rain-related sanitary sewer backwaters reported and does not include any backups that occurred due to clogged sewers or a problem in the building sewer.*

[b]*86 backwater complaints were reported by property owners during two community meetings held after the May 2004 rainfall period and are considered to be related to specific sanitary sewer problems. Newspaper reports indicate that over 400 basement backup complaints of various types were filed during the May 2004 rainfall events. There also were likely to have been more homes that were affected but not reported.*

Source: City of Milwaukee Department of Public Works, National Weather Service Milwaukee/Sullivan Weather Forecast Office, and SEWRPC.

Figure A-3

PUBLIC INFORMATION MEETINGS ON THE CITY OF MILWAUKEE ALL HAZARDS MITIGATION PLAN UPDATE

On Tuesday, June 7, 2011 staff from the City of Milwaukee Department of Public Works, the City of Milwaukee Office of Emergency Management and Homeland Security, and the Southeastern Wisconsin Regional Planning Commission (SEWRPC) conducted two public informational meetings on the update of the City of Milwaukee All Hazards Mitigation Plan. These sessions provided the public an opportunity to learn about and comment on the findings and recommendations documented in the preliminary draft of SEWRPC Community Assistance Planning Report No. 282, 2nd Edition, *City of Milwaukee All Hazards Mitigation Plan Update*. The first meeting was held from 1:00-3:00 p.m. at the Andersen Lake Tower, 4001 S. 6th Street, Milwaukee, Wisconsin. The second meeting was held from 4:00-6:00 p.m. at the City of Milwaukee Department of Public Works Field Headquarters, 3850 N. 35th Street, Milwaukee, Wisconsin.

Announcements of the meeting were posted in public areas of three City facilities. In addition, copies of the announcement were sent to local media as a press release. A copy of the announcement is attached herein as Exhibit A.

The session began with a meeting in “open house” format, which provided an opportunity for the public to meet with the City and Commission staffs to receive information, ask questions, and provide comments. A copy of the Commission staff presentation is attached herein as Exhibit B.

In addition to accepting comments on the preliminary draft of the plan update at this meeting, City and Commission staffs accepted written comments until June 17, 2011 through U.S. Mail and through a comment screen on the Commission’s website. Not comments were received.

Exhibit A

City of Milwaukee All Hazard Mitigation Plan Update

Notice of Public Meetings

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Milwaukee, WI

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4. Adjournment

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Phone: 262-547-6721 Fax: 262-547-1103
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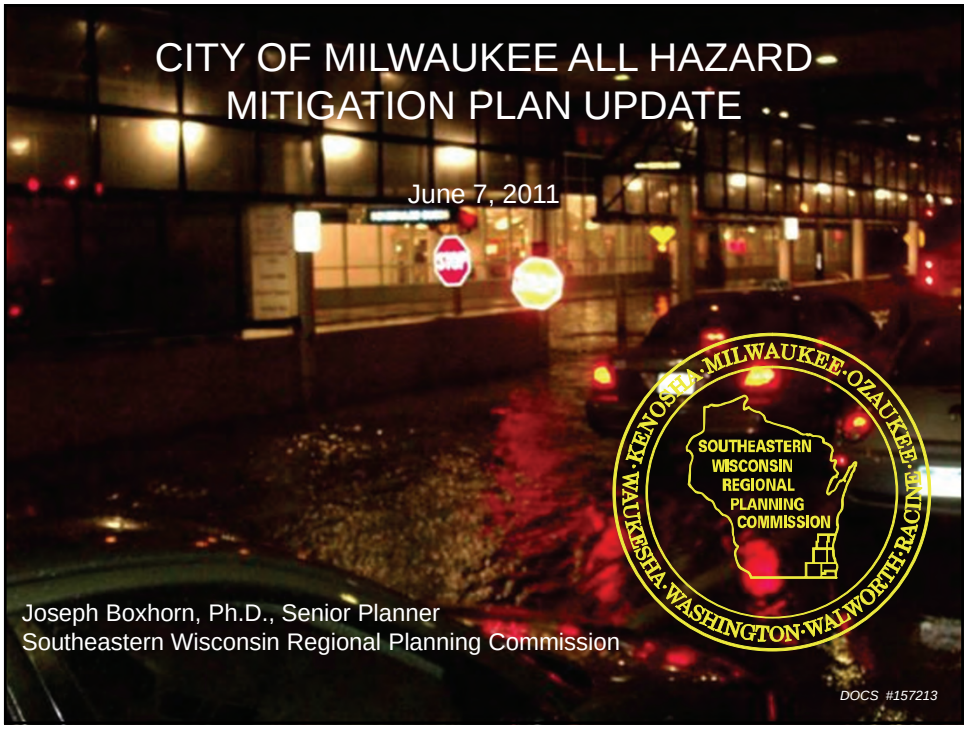
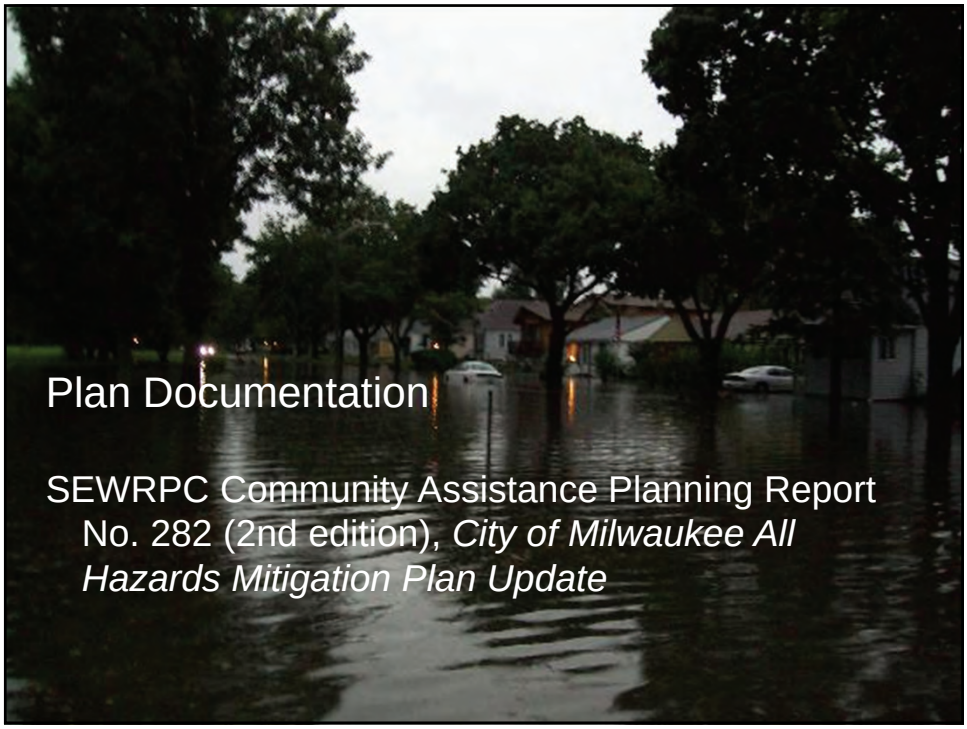
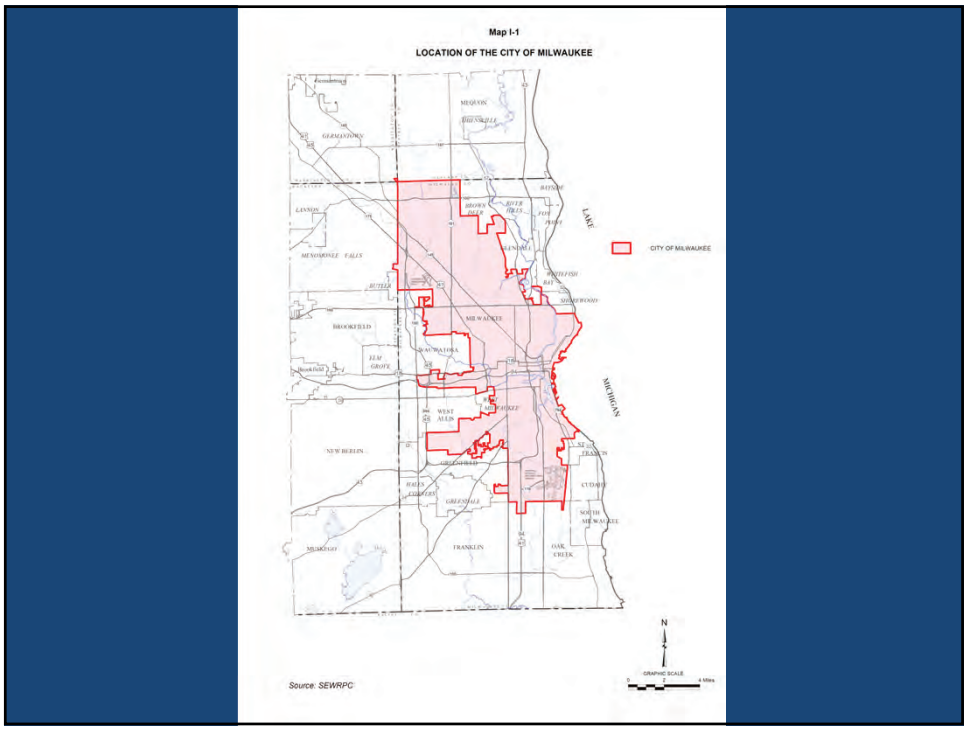


Plan Preparation Staff

- City of Milwaukee Department of Public Works
- City of Milwaukee Office of Emergency Management and Homeland Security
- Southeastern Wisconsin Regional Planning Commission


Plan Documentation
SEWRPC Community Assistance Planning Report No. 282 (2nd edition), *City of Milwaukee All Hazards Mitigation Plan Update*


Map I-1
LOCATION OF THE CITY OF MILWAUKEE
CITY OF MILWAUKEE
Source: SEWRPC

Scope and Purpose
(Chapter I)
Set forth the most appropriate, feasible, and effective hazard mitigation strategy for the City of Milwaukee
Maintain eligibility for hazard mitigation funding streams through the Federal Emergency Management Agency (FEMA)

City of Milwaukee All Hazard Mitigation Plan Steering Committee
Oversaw plan updating activities
Comprised of
Departmental staff, appointed officials, agency representatives, knowledgeable citizens
Police Department, Fire department, City Development department, Public Works department, County Emergency Management and Transit departments, MMSD, Health care community

Plan Update Activities
(Described in Chapter I)

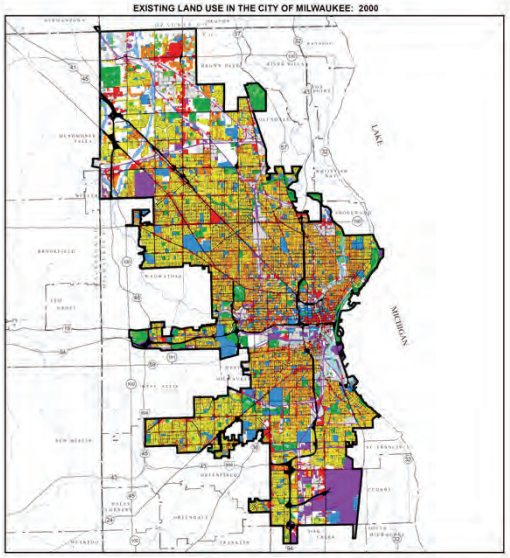
- Review implementation activities
- Update inventories of natural and built features
- Review and reevaluate identification of hazards
- Update and reevaluate risk analysis
- Review and revise mitigation goals
- Review and revise mitigation strategies
- Update plan implementation and maintenance
  - Update potential funding sources

Inventory Data
(Chapter II)

- Demographic characteristics
- Existing and planned land use
- Surface water and Lake Michigan shoreline
- Transportation and utility systems
- Critical community facilities
- Existing regulations and programs

Map II-3

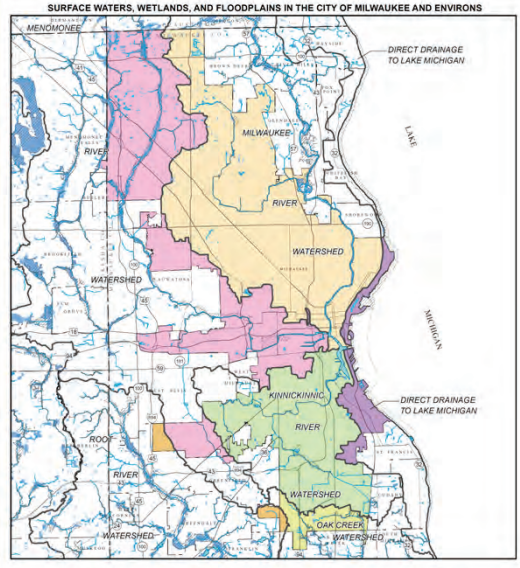
EXISTING LAND USE IN THE CITY OF MILWAUKEE: 2000



Source: SEWRPC.

Map II-4

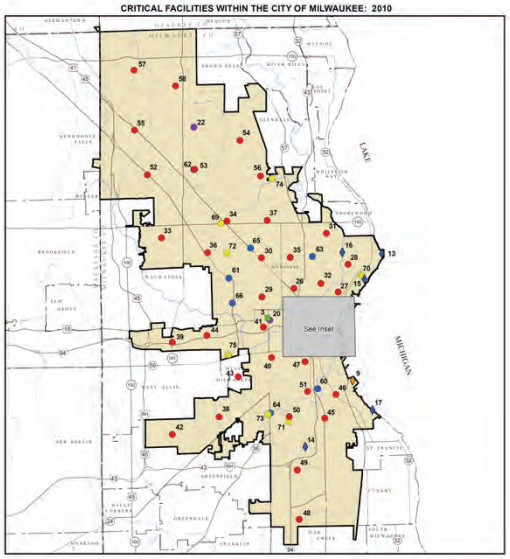
SURFACE WATERS, WETLANDS, AND FLOODPLAINS IN THE CITY OF MILWAUKEE AND ENVIRONS



Source: Federal Emergency Management Agency and SEWRPC.

Map II-8

CRITICAL FACILITIES WITHIN THE CITY OF MILWAUKEE: 2010



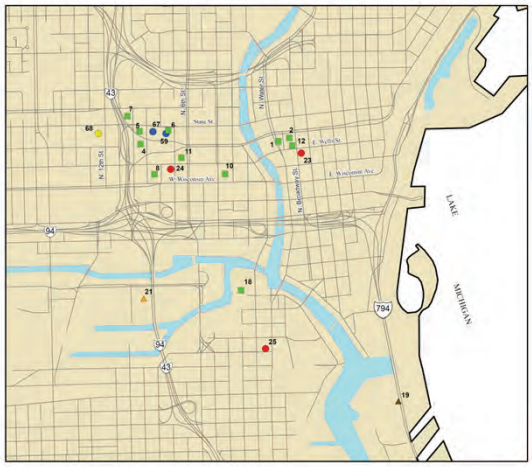
CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
WATER PURIFICATION PLANTS AND PUMPING STATIONS
PORT OF MILWAUKEE
OTHER CRITICAL FACILITIES
CITY OF MILWAUKEE
75 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

N

GRAPHIC SCALE
0 7,000 14,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

INSET to Map II-8



CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
WASTEWATER TREATMENT PLANT
POWER PLANT
24 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)

N

GRAPHIC SCALE
0 1,000 2,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), and SEWRPC.

Hazard Identification
(Chapter III)

Steering Committee Input

- From original plan
- Hazard and Vulnerability Assessment Tool

Past Hazard Experience

- Frequency of occurrence
- Property damages
- Fatalities and injuries

Hazard Identification
(Chapter III)

<u>Natural Hazards</u>

- Flooding
- Thunderstorm, high wind, hail, lightning
- Winter Storms
- Tornadoes
- Temperature extremes
- Coastal erosion
- Earthquakes

Hazard Identification
(Chapter III)

Other Hazards

* Contamination or loss of water supply
* Hazardous Material incidents

* Medical/Health Risks
* Terrorism
* Major fire or emergency incident

Vulnerability Assessment Format
(Chapter III)

Description of Hazard

Historical Experience with the Hazard

Recent Hazard Events

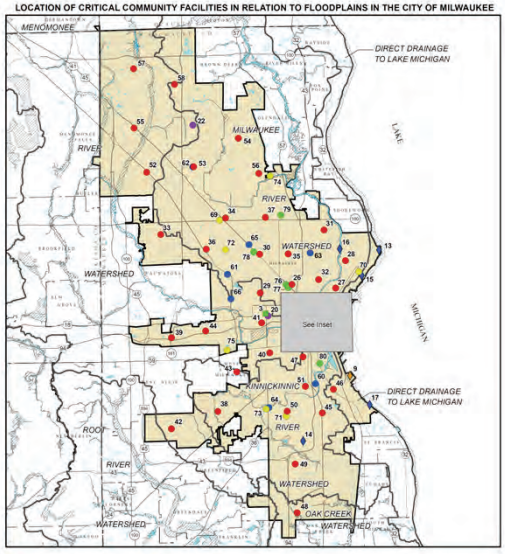
Vulnerability and Community Impacts Assessment

Potential Future Changes

Multi-Jurisdictional Risk Assessment

Map III-1

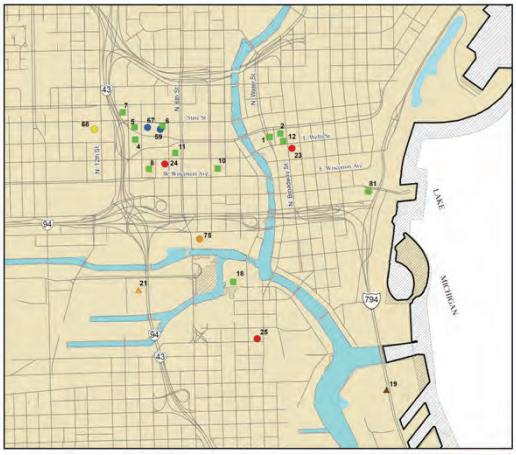
LOCATION OF CRITICAL COMMUNITY FACILITIES IN RELATION TO FLOODPLAINS IN THE CITY OF MILWAUKEE



CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
WATER PURIFICATION PLANTS AND PUMPING STATIONS
PORT OF MILWAUKEE
OTHER CRITICAL FACILITIES
CITY OF MILWAUKEE
75 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS
SURFACE WATER
MAJOR WATERSHED BOUNDARY
N
GRAPHIC SCALE
0 7,000 14,000 Feet

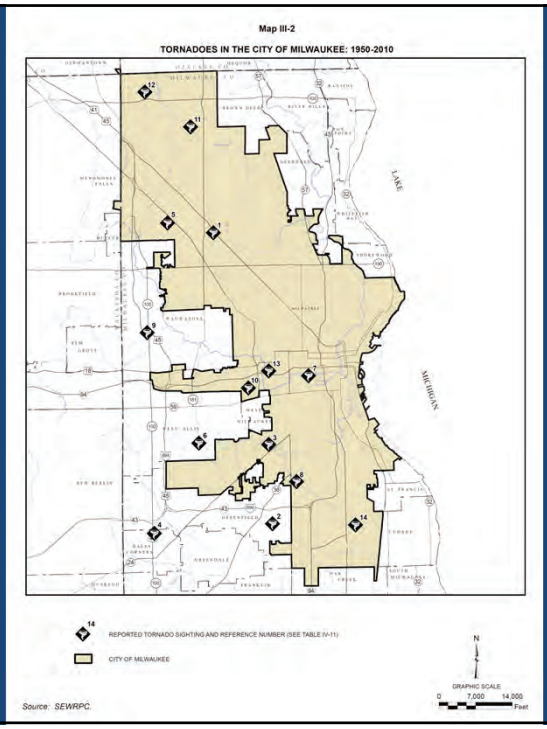
Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.

INSET to Map III-1



CRITICAL GOVERNMENT FACILITY
LAW ENFORCEMENT STATION
FIRE STATION
HOSPITALS AND MEDICAL CENTERS
MILWAUKEE INTERMODAL STATION
MILWAUKEE COUNTY TRANSIT SYSTEM FACILITY
WASTEWATER TREATMENT PLANT
POWER PLANT
24 CRITICAL FACILITY REFERENCE NUMBER (SEE APPENDIX B, TABLES B-1 TO B-4)
ONE-PERCENT-ANNUAL-PROBABILITY (100-YEAR RECURRENCE INTERVAL) FEMA FLOODPLAINS
N
GRAPHIC SCALE
0 1,000 2,000 Feet

Source: Milwaukee County Automated Mapping and Land Information System (MCAMLIS), City of Milwaukee Master Property File (MPROP), FEMA, and SEWRPC.



Hazard Mitigation Goals
(Chapter IV)

1. A spatial distribution of the various land uses that minimizes hazards and dangers to health, welfare, and safety as well as further enhancing the economic base of the City, and will result in a compatible arrangement of land uses properly related to the existing and proposed supporting transportation, utility, public safety systems, and public facility systems.

2. A spatial distribution of the various land uses that maintains biodiversity and which will result in the protection and wise use of the natural resources of the City, including its soils, inland lakes and streams, groundwater, wetlands, woodlands, wildlife, and natural areas and critical species habitats.

Hazard Mitigation Goals
(Chapter IV)

3. The provision of facilities necessary to maintain a high quality of fire and police protection and emergency medical services throughout the County.
4. The development of a stormwater management system, floodland management system, and sanitary sewer systems which reduce the exposure of people to drainage- and flooding-related inconvenience and to health and safety hazards and which reduces the exposure of real and personal property to damage through inundation resulting from flooding, inadequate stormwater drainage, or sewerage system capacity.

Hazard Mitigation Goals
(Chapter IV)

5. The identification of high erosion risk Lake Michigan shoreline areas and the development of a coastal erosion management program which reduces the exposure of people and real and personal property to shoreline erosion and bluff recession.
6. The identification and development of programs which complement emergency operations plans from the County and adjacent municipalities, to mitigate the potential exposure to health and safety and the exposure of real and personal property resulting from a broad range of hazards which are unpredictable and not geographically specific in nature.

Development of Hazard Mitigation Strategies
(Chapter V)

- Identified alternative strategies
  - Nonstructural, structural, public information and education
- Reviewed current programs
  - Federal and State, local
- Evaluation of alternatives and identification of mitigation actions
- Selected and set forth priority mitigation measures

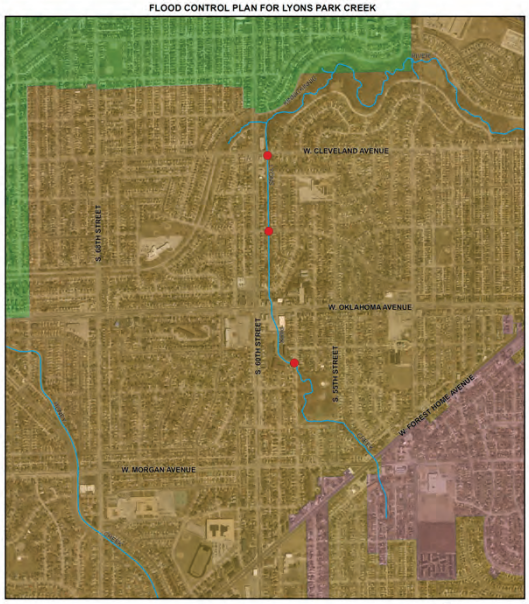
Priority Flood Mitigation Strategies
(Chapter V)

- Floodland and wetland zoning and zoning review
- Preservation of open and sensitive areas
- Purchase, demolition, and removal or floodproofing of 94 structures
- Channel cleaning, maintenance, or rehabilitation
- Stormwater management planning and regulation
- Stormwater management facility maintenance
- NFIP map updating
- Survey of buildings near flood hazard areas

- Levee and floodwall construction and improvement

Map V-2

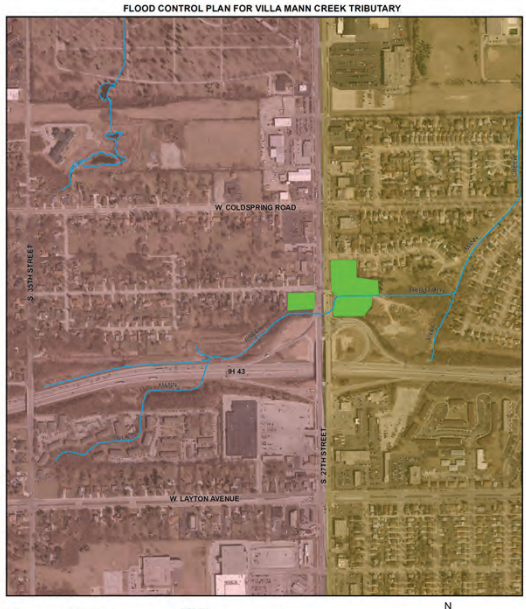
FLOOD CONTROL PLAN FOR LYONS PARK CREEK



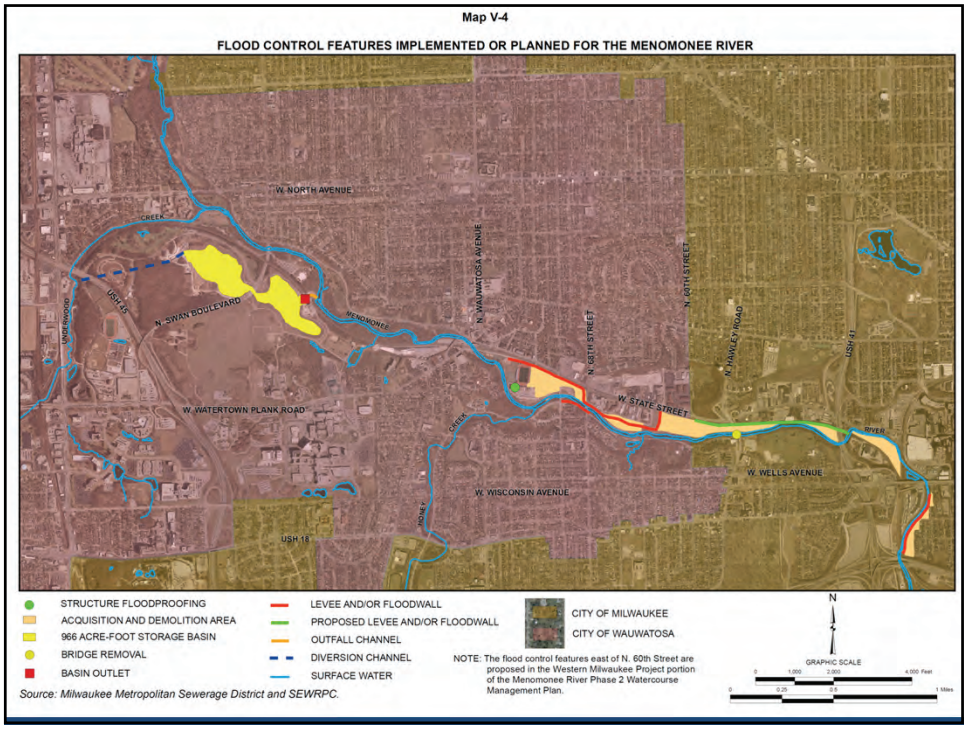
Source: Harza Engineering Company and SEWRPC.

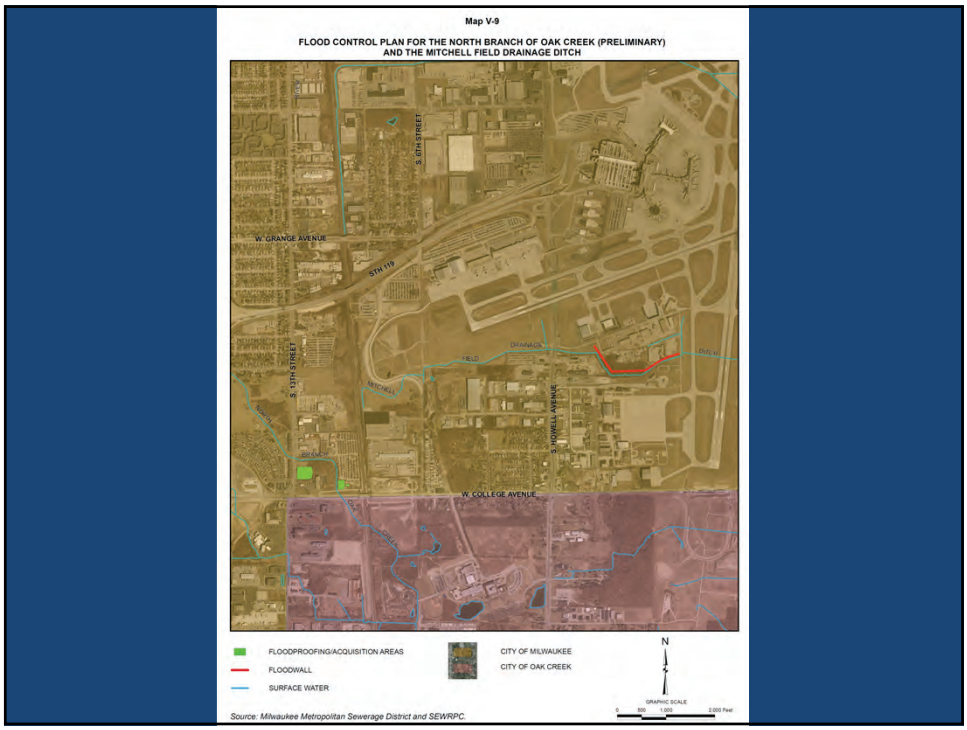
Map V-3

FLOOD CONTROL PLAN FOR VILLA MANN CREEK TRIBUTARY



Source: SEWRPC.


Map V-4
FLOOD CONTROL FEATURES IMPLEMENTED OR PLANNED FOR THE MENOMONEE RIVER
W. NORTH AVENUE
N. SWAN BOULEVARD
W. WATERTOWN PLANK ROAD
W. WISCONSIN AVENUE
W. STATE STREET
W. WELLS AVENUE
N. 76TH STREET
N. 60TH STREET
N. 50TH STREET
N. PARKLEY ROAD
USH 41
USH 18
STRUCTURE FLOODPROOFING
ACQUISITION AND DEMOLITION AREA
966 ACRE-FOOT STORAGE BASIN
BRIDGE REMOVAL
BASIN OUTLET
LEVEE AND/OR FLOODWALL
PROPOSED LEVEE AND/OR FLOODWALL
OUTFALL CHANNEL
DIVERSION CHANNEL
SURFACE WATER
CITY OF MILWAUKEE
CITY OF WAUWATOSA
NOTE: The flood control features east of N. 60th Street are proposed in the Western Milwaukee Project portion of the Menomonee River Phase 2 Watercourse Management Plan.
GRAPHIC SCALE
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.


Map V-9
FLOOD CONTROL PLAN FOR THE NORTH BRANCH OF OAK CREEK (PRELIMINARY)
AND THE MITCHELL FIELD DRAINAGE DITCH
S. 6TH STREET
W. GRANGE AVENUE
STH 119
S. 13TH STREET
S. HOWELL AVENUE
W. COLLEGE AVENUE
FLOODPROOFING/ACQUISITION AREAS
FLOODWALL
SURFACE WATER
CITY OF MILWAUKEE
CITY OF OAK CREEK
GRAPHIC SCALE
Source: Milwaukee Metropolitan Sewerage District and SEWRPC.

Priority Mitigation Strategies for Weather-related Hazards

(Chapter V)

- Maintain early warning systems
  - NOAA Weather Radio, EAS broadcasting, HAZCollect, warning sirens
- Public information and education
- Identify and advertise shelters
- Review and enforcement of building code requirements
- Continued coordination of local government emergency operations and response plan
- Continued implementation of National Incident Management System (NIMS)

Priority Mitigation Strategies for Human-induced Hazards

(Chapter V)

- Public information and education
- Continued coordination of emergency response
- Continued support of training, equipping, planning and preparedness for emergency responders
- Continued implementation of NIMS

Priority Ranking of Hazards

Mortality and Injury	Property Damage
Medical and health risks	Major fire and emergency incidents
Temperature extremes	Flooding
Major fire and emergency incidents	Thunderstorms, high wind, hail, and lightning
Tornadoes	Tornadoes
Thunderstorms, high wind, hail, and lightning	Hazardous material Incidents
Hazardous material incidents	Winter storms
Winter Storms	Coastal erosion
Flooding	Temperature extremes
Contamination or loss of water supply	Terrorism incidents
Terrorism incidents	Earthquake
Coastal erosion	Contamination or loss of water supply
Earthquake	Medical and health risks

Plan Adoption
(Chapter VI)

The plan will need to be reviewed by the Wisconsin Division of Emergency Management and their comments incorporated.

The plan will need be approved by FEMA

The plan will need to be adopted by:

Milwaukee Common Council

Submit Feedback on the Study:
(Up to June 17, 2011)

Comment Sheets

SEWRPC website:
http://www.sewrpc.org/SEWRPC/communityassistance/ProjectPlanningServices.htm

Email: jboxhorn@sewrpc.org

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Appendix B

CRITICAL COMMUNITY FACILITIES IN THE CITY OF MILWAUKEE

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Table B-1

CRITICAL COMMUNITY FACILITIES FOR THE CITY OF MILWAUKEE: 2010

Number on Map II-8	Facility Name	Address	Municipality	2010 Assessed Value[a]
1	City Hall and the Office of the Mayor	200 E. Wells Street	Milwaukee	$ 9,424,200
2	City Department of Public Works Municipal Building	841 N. Broadway Street Room 501	Milwaukee	22,647,600
2	City of Milwaukee Health Department City Municipal Building	841 North Broadway Street 3rd Floor	Milwaukee	22,647,600
3	Milwaukee County Department of Transportation and Public Works	2711 W. Wells Street 3rd Floor	Milwaukee	592,100
4	Milwaukee County Courthouse Office of the County Executive	901 N. 9th Street	Milwaukee	33,500,000
5	Milwaukee County Jail	949 N. 9th Street	Milwaukee	33,500,000
6	City of Milwaukee Municipal Court	951 N. James Lovell Street	Milwaukee	33,500,000
7	Milwaukee Secure Detention Facility-Wisconsin Department of Corrections	1015 N. 10th Street	Milwaukee	- -
- -	Milwaukee County Juvenile Detention Center	10201 Watertown Plank Road	Wauwatosa	- -
8	Milwaukee Public Library-Central	814 W. Wisconsin Avenue	Milwaukee	10,840,000
9	Port of Milwaukee	2323 S. Lincoln Memorial Drive	Milwaukee	38,500,000
10	Henry S. Reuss Federal Plaza	310 W. Wisconsin Avenue	Milwaukee	24,877,800
11	Wisconsin State Office Building	819 N. 6th Street	Milwaukee	8,960,000
12	Milwaukee Water Works City Municipal Building	809 N. Broadway Room 406	Milwaukee	7,921,800
13	Linwood Avenue Station Water Purification Plant	3000 N. Lincoln Memorial Drive	Milwaukee	20,000,000
14	Howard Avenue Water Purification Plant	725 W. Howard Avenue	Milwaukee	31,519,000
15	North Point Pumping Station	2275 N. Lincoln Memorial Drive	Milwaukee	3,733,000
16	Riverside Pumping Station	1311 E. Chambers Street	Milwaukee	3,440,000
17	Texas Pumping Station	2900 E. Texas Avenue	Milwaukee	- -
18	Milwaukee Metropolitan Sewerage District	260 W. Seeboth Street	Milwaukee	200,000
19	Jones Island Water Reclamation Facility-Veolia Water North America	700 E. Jones Street	Milwaukee	5,250,400
- -	South Shore Wastewater Treatment Plant	8500 S. 5th Street	Oak Creek	- -
20	American Red Cross	2600 W Wisconsin Avenue	Milwaukee	994,200
- -	Milwaukee County Power Plant (We Energies)	9250 W. Watertown Plank Road	Wauwatosa	- -
- -	Oak Creek Power Plant (We Energies)	4801 E. Elm Road	Oak Creek	- -
21	Valley Power Plant (We Energies)	1035 W. Canal Street	Milwaukee	32,732,000
- -	Falk Landfill	13th Avenue North of Rawson	South Milwaukee	- -
- -	Veolia ES Emerald Park Landfill	W124 S10629 124th Street	Muskego	- -
- -	Waste Management-Metro Recycling & Disposal	10712 S. 124th Street	Franklin	- -
- -	Waste Management-Orchard Ridge Recycling & Disposal	W124 N9355 Boundary Road	Menomonee Falls	- -
22	Waste Management Transfer Station	6710 N. Industrial Road	Milwaukee	- -
75	Milwaukee Intermodal Station	433 W. Saint Paul Avenue	Milwaukee	
76	MCTS Hillside Administration Facility	1942 N. 17th Street	Milwaukee	
77	MCTS Hillside Fleet Maintenance Facility	1525 W. Vine Street	Milwaukee	
78	MCTS Fond du Lac Bus Garage	3343 W. Fond du Lac Avenue	Milwaukee	
79	MCTS Fiebrantz Bus Garage	1900 W. Fiebrantz Avenue	Milwaukee	
80	MCTS Kinnickinnic Bus Garage	1710 S. Kinnickinnic Avenue	Milwaukee	
81	MCTS Downtown Transit Center	909 E. Michigan Avenue	Milwaukee	

[a]*Current assessment value of improvements based on 2010 Milwaukee Properties Master file (MPROP).*

[b]*Unknown Web addresses.*

Source: City of Milwaukee, Milwaukee County, Milwaukee Green Map, and SEWRPC.

Table B-2

FIRE STATIONS IN THE CITY OF MILWAUKEE: 2010

Number on Map II-8	Battalions/Bureaus	Facility Name	2010 Assessed Value[a]	Address
23	1st Battalion	Engine #1, Ladder #1	$115,000	784 N. Broadway Street
24		Engine #2, Ladder #2, Fire Investigation Unit, MFD Bureau of Administration	340,930	755 N. James Lovell Street
25		Engine #3, DIVE	320,000	100 W. Virginia Street
26		Engine #5, MED 7	200,000	1313 W. Reservoir Avenue
27		Engine #6	250,000	1693 N. Franklin Place
28		Engine #27, Ladder #5	33,600	2647 N. Bartlett Avenue
29		Engine #32, Ladder #9	- -	1551 N. 30th Street
30	2nd Battalion	Engine #13	144,000	2901 N. 30th Street
31		Engine #18	139,600	3628 N. Holton Street
32		Engine #21, MED 6	32,600	2050 N. Palmer Street
33		Engine #22	350,000	8814 W. Lisbon Avenue
34		Engine #24, Ladder #13	304,000	4927 W. Fiebrantz Avenue
35		Engine #30, Ladder #12	40,000	2903 N. Teutonia Avenue
36		Engine #34, MED 13	240,000	6205 W. Burleigh Street
37		Engine #36, MED 5	- -	4060 N. 27th Street
38	3rd Battalion	Engine #10, Ladder #17, MED 18	320,000	5600 W. Oklahoma Avenue
39		Engine #25, HAZMAT	650,000	300 S. 84th Street
40		Engine #26, MED 3	120,000	1140 S. 26th Street
41		Engine #28, MED 14	37,600	424 N. 30th Street
42		Engine #29	- -	3529 S. 84th Street
43		Engine #33, Hi-Vol Unit	- -	4515 W. Burnham Street
44		Engine #35, Ladder #16	- -	100 N. 64th Street
45	4th Battalion	Engine #7, MED 15	200,000	3174 S. Chase Avenue
46		Engine #11, Ladder #6	48,000	2526 S. Kinnickinnic Avenue
47		Engine #12, Ladder #11, HURT, Rescue 1	440,000	1400 S. 9th Street
48		Engine #14, Ladder #8	267,000	6074 S. 13th Street
49		Engine #17, MED 17	240,000	4653 S. 13th Street
50		Engine #23, Ladder #14	128,000	2130 W. Oklahoma Avenue
51		Engine #31	105,600	2400 S. 8th Street
52	5th Battalion	Engine #4, Ladder #3	333,000	9511 W. Appleton Avenue
53		Engine #8	672,000	5585 N. 69th Street
54		Engine #9, MED 4, Communications Van	500,000	4141 W. Mill Road
55		Engine #16, MED 16	- -	10320 W. Fond du Lac Avenue
56		Engine #37, Ladder #15	467,000	5335 N. Teutonia Avenue
57		Engine #38, MED 19	260,000	8463 N. Granville Road
58		Engine #39, Ladder #7	400,000	8025 W. Bradley Road
- -	Administration	- -	960,000	711 W. Wells Street
- -	Special Operations	Emergency Medical Services and Special Teams	960,000	711 W. Wells Street
- -	Fire and Police Commission	City Hall Room 706A	- -	200 E. Wells Street

NOTE: The following abbreviations have been used:

DIVE = Dive Rescue Team
HURT = Heavy Urban Rescue Team
MED = Emergency Medical Services Unit
Hi-Vol = High Volume Division
HAZMAT = Hazardous Materials Response Team

[a]*Current assessment value of improvements, based on 2010 Milwaukee Properties Master file (MPROP).*

Source: City of Milwaukee Fire Department and SEWRPC.

Table B-3

LAW ENFORCEMENT FACILITIES IN THE CITY OF MILWAUKEE: 2010

Number on Map II-8	Facility Name	Address	Contact	2010 Assessed Value[a]
59	Police District 1	749 W. State Street	Captain Stephen Basting	$9,240,000
60	Police District 2	245 W. Lincoln Avenue	Captain Donald Gaglione	528,000
61	Police District 3	2333 N. 49th Street	Captain Michael Brunson	- -
62	Police District 4	6929 W. Silver Spring Drive	Captain Jerome J. O'Leary	517,300
63	Police District 5	2920 N. 4th Street	Captain Edith L. Hudson	420,000
64	Police District 6	3006 S. 27th Street	Captain Michael D. Young	778,000
65	Police District 7	3626 W. Fond du Lac Avenue	Captain William R. Jessup	350,000
66	Police Switching Station, District 3	4715 W. Vliet Street	- -	500,000
67	Milwaukee County Sheriff's Department, Safety Building	821 W. State Street	Sheriff David Clarke, Jr.	14,000,000
- -	Wisconsin State Patrol District 2 (DOT)	21115 East Moreland Boulevard, Waukesha, WI 53186-2985	- -	- -

[a]*Current assessment value of improvements, based on 2010 Milwaukee Properties Master file (MPROP).*

Source: Milwaukee Police Department and the Milwaukee County Sheriff's Office.

Table B-4

CRITICAL FACILITIES: HOSPITALS AND MAJOR CLINICS

Number on Map II-8	Facility Name	Municipality	Address	2010 Assessed Value[a]
68	Aurora Sinai Medical Center	Milwaukee	945 N. 12th Street	$ 2,945,000
69	Milwaukee Community Medical Center	Milwaukee	5310 W. Capitol Avenue	550,000
70	Columbia St. Mary's Hospital[b]	Milwaukee	2301 N. Lake Drive	50,560,000
71	Wheaton Franciscan Healthcare-St. Francis	Milwaukee	3237 S. 16th Street	43,500,000
72	Wheaton Franciscan Healthcare-St. Joseph	Milwaukee	5000 W. Chambers Street	261,000
73	Aurora St. Luke's Medical Center	Milwaukee	2900 W. Oklahoma Avenue	4,082,400
74	Wheaton Franciscan Healthcare-Family Care Center	Milwaukee	2400 W. Villard Avenue	385,100
75	Clement J. Zablocki Veterans Affairs Medical Center	Milwaukee	5000 W National Avenue	46,377,000
- -	Children's Hospital of Wisconsin	Wauwatosa	9000 W. Wisconsin Avenue	- -
- -	Community Memorial Hospital	Menomonee Falls	W180 N8085 Town Hall Road	- -
- -	Wheaton Franciscan Healthcare-Elmbrook Memorial Hospital	Brookfield	19333 West North Avenue	- -
- -	Froedtert Memorial Lutheran Hospital	Wauwatosa	9200 W. Wisconsin Avenue	- -
- -	Wauwatosa Surgery Center	Wauwatosa	10900 West Potter Road	- -
- -	Kindred Hospital, Milwaukee	Greenfield	5017 S 110th Street	- -
- -	Northwest Surgery Center	Wauwatosa	2300 North Mayfair Road, Suite 295	- -
- -	Orthopaedic Hospital of Wisconsin	Glendale	475 West River Woods Parkway	- -
- -	Wheaton Franciscan-St Joseph's Outpatient Center	Wauwatosa	201 N. Mayfair Road	- -
- -	Aurora St. Luke's South Shore Hospital	Cudahy	5900 S. Lake Drive	- -
- -	Columbia St. Mary's Hospital Ozaukee	Mequon	13111 N. Port Washington Road	- -
- -	Surgicenter of Greater Milwaukee	Wauwatosa	3223 S 103rd Street	- -
- -	Aurora West Allis Medical Center	West Allis	8901 W Lincoln Avenue	- -
- -	Wisconsin Health Center	Greenfield	4448 West Loomis Road	- -
- -	Wheaton Franciscan-The Wisconsin Heart Hospital	Wauwatosa	10000 W Blue Mound Road	- -

[a]*Current assessment value of improvements based on 2010 Milwaukee Properties Master file (MPROP).*

[b]*Sacred Heart Rehabilitation Institute is part of Columbia-St. Mary's Hospital campus.*

Source: Wisconsin Department of Health and Family Services and SEWRPC.

Table B-5

PUBLIC, PRIVATE, CHARTER, CHOICE, AND PARTNERSHIP SCHOOLS IN THE CITY OF MILWAUKEE: 2010

School Name	Address
Elementary Schools and K-8	
Academia de Lenguaje y Bella Artes	1712 S. 32nd Street
Academy of Accelerated Learning	3727 S. 78th Street
Alcott Elementary School	3563 S. 97th Street
Allen-Field Elementary School	730 W. Lapham Boulevard
Auer Avenue Elementary School	2319 W. Auer Avenue
Barton Elementary School	5700 W. Green Tree Road
Bethune Academy	1535 N. 35th Street
Brown Street Academy Elementary School	2029 N. 20th Street
Browning Elementary School	5440 N. 64th Street
Bruce Elementary School	6453 N. 89th Street
Bryant Elementary School	8718 W. Thurston Avenue
Burbank Elementary School	6035 W. Adler Street
Burdick K-8 School	4348 S. Griffin Avenue
Carson Academy of Science	4920 W. Capitol Drive
Carver Academy of Mathematics and Science	1900 N. 1st Street
Cass Street K-8 School	1647 N. Cass Street
Clarke Street Elementary School	2816 W. Clarke Street
Clemens Elementary School	4229 N. 36th Street
Clement Avenue Elementary School	3666 S. Clement Avenue
Congress Elementary School (North)	5225 W. Lincoln Creek Drive
Cooper Elementary School	5143 S. 21st Street
Craig Montessori Elementary School	7667 W. Congress Street
Curtin Elementary School	3450 S. 32nd Street
Doerfler Elementary School	3014 W. Scott Street
Dover Street Elementary School	619 E. Dover Street
Eighty-First Street Elementary School	2964 N. 81st Street
Elm Creative Arts Elementary School	900 W. Walnut Street
Emerson Elementary School	9025 W. Lawrence Avenue
Engleburg Elementary School	5100 N. 91st Street
Fairview Elementary School	6500 W. Kinnickinnic River Parkway
Fernwood Montessori School	3239 S. Pennsylvania Avenue
Fifty-Third Street Elementary School	3618 N. 53rd Street
Forest Home Avenue Elementary School	1516 W. Forest Home Avenue
Franklin Elementary School	2308 W. Nash Street
Fratney Bilingual Elementary School	3255 N. Fratney Street
Gaenslen K-8 School	1250 E. Burleigh Street
Garden Homes Elementary School	4456 N. Teutonia Avenue
Garden Homes Montessori School	2475 W. Roosevelt Drive
Garland Elementary School	1420 W. Goldcrest Avenue
Goodrich Elementary School	8251 N. Celina Street
Grant Elementary School	2920 W. Grant Street
Grantosa Drive Elementary School	4850 N. 82nd Street
Green Bay Avenue Elementary School	3872 N. 8th Street
Greenfield Avenue Elementary School	1711 S. 35th Street
Guadalupe Head Start	2669 N. Richards
Guadalupe Loyola Head Start	1645 S. 36th Street
Hampton Elementary School	5000 N. 53rd Street
Hartford Avenue K-8 School	2227 E. Hartford Avenue
Hawley Road Elementary School	5610 W. Wisconsin Avenue
Hawthorne Elementary School	6945 N. 41st Street
Hayes Bilingual Elementary School	2431 S. 10th Street
Hi-Mount Elementary School (main campus)	4921 W. Garfield Avenue
Hmong American Peace Academy	4601 N. 84th Street
Holmes Elementary School	2463 N. Buffum Street
Honey Creek Elementary School	6701 W. Eden Place
Hopkins Elementary School	1503 W. Hopkins Street
Humboldt Park Elementary School	3230 S. Adams Avenue

Table B-5 (continued)

School Name	Address
Elementary Schools and K-8 (continued)	
IDEAL K-8 School	4965 S. 20th Street
Jackson Early Childhood and Elementary School	2121 W. Hadley Street
Kagel Elementary School	1210 W. Mineral Street
Keefe Avenue Elementary School	1618 W. Keefe Avenue
Kilbourn Elementary School	5354 N. 68th Street
King Jr. Elementary School	3275 N. 3rd Street
Kluge Elementary School	5760 N. 67th Street
La Causa	1643 S. 2nd Street
La Causa ELC	809 W. Greenfield Avenue
LaFollette Elementary School	3239 N. 9th Street
Lancaster Elementary School	4931 N. 68th Street
Lincoln Avenue Elementary School	1817 W. Lincoln Avenue
Lloyd Street Elementary School	1228 W. Lloyd Street
Longfellow Elementary School	1021 S. 21st Street
Lowell Elementary School	4360 S. 20th Street
MacDowell Elementary and Montessori School	1706 W. Highland Boulevard
Manitoba Elementary School	4040 W. Forest Home Avenue
Maple Tree Elementary School	6644 N. 107th Street
Maryland Avenue Montessori K-8 School	2418 N. Maryland Avenue
Meir, Golda Elementary School	1555 N. Martin Luther King Drive
Metcalfe Elementary School	3400 W. North Avenue
Milwaukee Academy of Chinese Language	2430 W. Wisconsin Avenue
Milwaukee French Immersion School	2360 N. 52nd Street
Milwaukee German Immersion School	3778 N. 82nd Street
Milwaukee Sign Language School	7900 W. Acacia Road
Milwaukee Spanish Immersion School	2765 S. 55th Street
Mitchell Elementary School	1728 S. 23rd Street
Morgandale Elementary School	3635 S. 17th Street
Neeskara Elementary School	1601 N. Hawley Road
Next Door Charter School	2545 N 29th Street
Ninety-Fifth Street Elementary School	3707 N. 94th Street
Parkview Elementary School	10825 W. Villard Avenue
Pierce Elementary School	2765 N. Fratney Street
Riley Elementary School	2424 S. 4th Street
River Trail Elementary School	12021 W. Florist Avenue
Rogers Street Academy	2430 W. Rogers Street
Sherman Elementary School	5110 W. Locust Street
Siefert Elementary School	1547 N. 14th Street
Silver Spring Elementary School	5131 N. Green Bay Avenue
Sixty-Eighth Street Early Childhood Center	6720 W. Moltke Avenue
Sixty-Fifth Street Elementary School	6600 W. Melvina Street
Starms Discovery Learning Center	2035 N. 25th Street
Starms Early Childhood Center	2616 W. Garfield Avenue
Starms Monumental Early Childhood Center	2407 W. North Avenue
Story K-8 School	3815 W. Kilbourn Avenue
Stuart Elementary School	7001 N. 86th Street
Thirty-Fifth Street Elementary School	3517 W. Courtland Avenue
Thoreau Elementary School	7878 N. 60th Street
Thurston Woods Elementary School	5966 N. 35th Street
Tippecanoe Elementary School	357 E. Howard Avenue
Townsend Street Elementary School	3360 N. Sherman Boulevard
Trowbridge Street Elementary School	1943 E. Trowbridge Street
Victory K-8 School	2222 W. Henry Avenue
Vieau Elementary School	823 S. 4th Street
Westside Academy I	1945 N. 31st Street
Westside Academy II	1940 N. 36th Street
Wheatley Elementary School	2442 N. 20th Street
Whitman Elementary School	4200 S. 54th Street
Whittier Elementary School	4382 S. 3rd Street
Wings Academy	1501 S. Layton Avenue

Table B-5 (continued)

School Name	Address
Elementary Schools and K-8 (continued)	
Wisconsin Avenue Elementary School	2708 W. Wisconsin Avenue
WI Conservatory of Life-Long Learning (WCLL)	3120 W. Green Avenue
Zablocki Elementary School	1016 W. Oklahoma Avenue
Middle Schools	
Audubon Middle School	3300 S. 39th Street
Burroughs Middle School	6700 N. 80th Street
Fritsche Middle School	2751 S. Lennox Street
Lad Lake/ULTRA	225 W. Capitol Drive
Lad Lake/ULTRA	2820 W. Grant Street
Lady Pitts/District School Age Parent Center	5075 N. Sherman Boulevard
LEAP at Fritsche	2969 S. Howell Avenue
Lincoln Middle School of the Arts	820 E. Knapp Street
Milwaukee Education Center	3620 N. 18th Street
Milwaukee School of Languages	8400 W. Burleigh Street
Morse Marshall Middle School	4141 N. 64th Street
Northwest Secondary School	5496 N. 72nd Street
Northwest Opportunities Vocational Academy	2320 W. Burleigh Street
Project Excel	1115 S. 7th Street
Roosevelt Middle School	800 W. Walnut Street
Satori Middle School	9155 N. 76th Street
Southeastern Youth and Family	4050 N. 34th Street
St. Charles Education Center	151 S. 84th Street
Wedgewood Park International School	6506 W. Warnimont Park
Wisconsin Career Academy	4801 S. 2nd Street
High Schools	
Advanced Language and Academic Studies	971 W. Wind Lake Avenue
Alliance School	850 W. Walnut Street
Assata Alternative High School	2023 W. Wisconsin Avenue
Audubon Technology & Communication Center	3300 S. 39th Street
Banner Preparatory School of Milwaukee	5126 N. 38th Street
Banner Preparatory School of Milwaukee	5460 N. 64th Street
Bay View High School	2751 S. Lenox Street
Bradley School of Technology & Trade	700 S. 4th Street
Career Youth Development School	3026 W. Concordia Avenue
Carmen High School of Science and Technology	1712 S. 32nd Street
Community High School	6415 Mt. Vernon Avenue
Cornerstone Achievement Academy	3040 W. Capitol Drive
Custer High School	5075 N. Sherman Boulevard
El Puente High School	611 W. National Avenue
Genesis School	1011 W. Center Street
Grandview High School	615 W. Washington Street
Hamilton High School	6215 W. Warnimont Avenue
International Peace Academy	1236 S. Layton Avenue
Kilmer South High School	4807 S. 2nd Street
King High School	1801 W. Olive Street
Loyola Academy	1645 S. 36th Street
Madison High School	8135 W. Florist Avenue
Milwaukee African American Immersion School	1011 S. Center Street
Milwaukee County Youth Education Center	949 S. 9th Street
Milwaukee High School of the Arts (MHSA)	2300 W. Highland Boulevard
Milwaukee Learning Laboratory and Institute	6506 W. Warnimont Avenue
Milwaukee School of Entrepreneurship	6914 W. Appleton Avenue
Montessori International Baccalaureate High School	6415 Mount Vernon Avenue
New School for Community Service	609 N. 8th Street
Professional Learning Institute	2430 W. Wisconsin Avenue
Project Stay	609 N. 8th Street
Pulaski High School	2500 W. Oklahoma Avenue
Reagan High School	4965 S. 20th Streeet
Riverside University High School	1615 E. Locust Street
School for Urban Planning and Architecture (SARUP)	1712 S. 32nd Street

Table B-5 (continued)

School Name	Address
High Schools (continued)	
Shalom High School	1749 N. 16th Street
South Division High School	1515 W. Lapham Boulevard
Spotted Eagle	3134 W. State Street
Transitional High School	2610 W. North Street
Vincent High School	7501 N. Granville Road
Washington High School	2525 N. Sherman Boulevard
Wisconsin Transition Success Center	4200 N. Holton Street
Work Institute	3620 N. 18th Street
Other Schools	
Alstons Preparatory Academy	921 N. 49th Street
Atlas Preparatory School	2911 S. 32nd Street
Atonement Lutheran School	4224 W. Ruby Avenue
Believers in Christ Academy	4065 N. 25th Street
Believers Institute	2947 N. Dr. Martin Luther King Drive
Blessed Sacrament School	3126 S. 41st Street
Blessed Savior Catholic School	5140 N. 55th Street
Catholic East Elementary School	2461 N. Murray Avenue
Carter School of Excellence	2001 W. Vliet Street
Carter's Christian Academy	4920 N. Sherman Boulevard
Ceria M. Travis Academy	2733 W. Wisconsin Avenue
CEO Leadership Academy	2004 N. 33rd Street
Child Development Center of St. Joseph	3027 S. 16th Street
Christ Memorial Lutheran School	5719 N. Teutonia Avenue
Christ-Saint Peter Lutheran School	2229 W. Greenfield Ave
Christian Faith Academy of Higher Learning	2327 N. 52nd Street
Clara Muhammad School	317 W. Wright Street
COA Youth and Family Center	909 E. North Avenue
Concordia University School	8242 N. Granville Road
Cross Trainers Academy	830 N. 19th Street
Daughters of the Father Christ	1874 N. 24th Place
Destiny High School	7210 N. 76th Street
Divine Savior Holy Angels High School	4257 N. 100th Street
Dr. Brenda Noach Elementary and Secondary Choice Schools	222 E. Burleigh Street
Early View Academy of Excellence	7132 W. Good Hope Road
Eastbrook Academy	5375 N. Green Bay Avenue
Emmaus Lutheran	2818 N. 23rd Street
Family Montessori School	5806 Burleigh Street
Garden Homes Lutheran School	2475 W. Roosevelt Drive
Grace Christian School	9900 W. Capitol Drive
Grace Preparatory School of Excellence	7903 W. Capitol Drive
Greater Holy Temple Christian Academy	5575 N. 76th Street
Guardian Angel Learning Center	1540 N. Jefferson Street
Harambee Community School	110 W. Burleigh Street
Hickman Academy Preparatory School	6401 W. Capitol Drive
Hillel Academy	6401 N. Santa Monica Boulevard
Holy Redeemer Christian Academy	3500 W. Mother Daniels Way
Holy Wisdom Academy	3344 S. 16th Street
Hope Christian School	2345 N. 25th Street
Hope Christian School	3601 N. Port Washington Road
Hope School	3215 N. Martin Luther King Drive
HR Academy	4858 N. 35th Street
Institute of Technology and Academics	8940 N. 85th Street
Jared C. Bruce Academy	6090 N. 35th Street
Jewish Beginnings	6401 N. Santa Monica Boulevard
Kindergarten Plus	6123 N. Teutonia Avenue
Learning Bridges Kingdom Academy	3014 W. North Avenue
Life 101 THINK Institute	6618 N. Teutonia Avenue
Life Skills Academy	2328 W. Capitol Drive

Table B-5 (continued)

School Name	Address
Other Schools (continued)	
Loving Shepherd Lutheran School	3909 W. Clinton Avenue
Lutheran Special School and Education Services	9700 W. Grantosa Drive
Malaika Early Learning Center	125 W. Acer Avenue
Margaret Howard Christian Leadership Institute	4840 W. Fond du Lac Avenue
Marquette University High School	3401 W. Wisconsin Avenue
Messmer High School	742 W. Capitol Drive
Messmer Preparatory Catholic School	3027 N. Fratney Street
Mills Christian Academy	817 W. National Avenue
Milwaukee Lutheran High School	9700 W. Grantosa
Milwaukee Montessori School	345 N. 95th Street
Milwaukee Seventh Day Adventist School	10900 W. Mill Road
Milwaukee Jewish Day School	6401 N. Santa Monica Boulevard
Mother of Good Counsel	3001 N. 68th Street
Mount Lebanon Lutheran School	6100 W. Hampton Avenue
Mount Olive Lutheran	5301 W. Washington Boulevard
Mt. Calvary Lutheran School	2862 N. 53rd Street
Mustard Seed International School	8980 N. 85th Street
Nativity Jesuit Middle School	1515 S. 29th Street
New Testament Christian Academy	10201 W. Bradley Road
New World Montessori School	1101 W. Brown Deer Road
Northwest Catholic School	8202 W. Denver Avenue
Northwest Lutheran Grade School	4119 N. 81st Street
Notre Dame Middle School	1420 W. Scott Street
Oklahoma Avenue Lutheran School	5335 W. Oklahoma Avenue
Our Lady Queen of Peace School	2733 W. Euclid Avenue
Outlook University Independent School	275 W. Wisconsin Avenue
Parklawn Christian School	3725 N. Sherman Boulevard
Pius XI High School	135 N. 76th Street
Prince of Peace	1114 S. 25th Street
Right Step, Inc.	2801 W. Wisconsin Avenue
Risen Savior Evangelical Lutheran School	9550 W. Brown Deer Road
Saint Adalbert	1913 W. Becher Street
Saint Aemelian Lakeside, Inc.	8901 W. Capitol Drive
Saint Anthony School	1747 S. 9th Street
Saint Bernadette School	8202 W. Denver Avenue
Saint Catherine School	2647 N. 51st Street
Saint Charles Borromeo	3100 W. Parnell Avenue
Saint Coletta Day School of Milwaukee	1740 N. 55th Street
Saint Francis Children's Center	6700 N. Port Washington Road
Saint Gregory the Great	3132 S. 63rd Street
Saint Joan Antida High School	1341 N. Cass Street
Saint John Kanty School	2840 S. 10th Street
Saint John's Lutheran School	4001 S. 68th Street
Saint Josaphat Parish School	801 W. Lincoln Avenue
Saint Lucas Lutheran School	648 E. Dover Street
Saint Marcus Lutheran School	2215 N. Palmer Street
Saint Margaret Mary	3950 N. 92nd Street
Saint Martini Lutheran Grade School	1557 W. Orchard Street
Saint Matthias	9300 W. Beloit Road
Saint Peter-Immanuel Lutheran Church and School	7801 W. Acacia Street
Saint Philip's Lutheran School	3012 N. Holton Street
Saint Rafael the Archangel	2251 S. 31st Street
Saint Roman Parish School	1810 W. Bolivar Avenue
Saint Rose and Saint Leo	514 N. 31st Street
Saint Rose Youth and Family Center	3801 N. 38th Street
Saint Sava Orthodox School	3201 S. 51st Street
Saint Sebastian	1747 N. 54th Street
Saint Thomas Aquinas Academy	341 E. Norwich Street
Saint Vincent Pallotti School	201 N. 76th Street
Salam School	4707 S. 13th Street

Table B-5 (continued)

School Name	Address
Other Schools (continued)	
Salem Lutheran School	6844 N. 107th Street
Sharon Jr. Academy School	1369 W. Meinecke Avenue
Sherman Park Lutheran School	2703 N. Sherman Boulevard
Siloah Lutheran School	3721 N. 21st Street
Tamarack Waldorf Community School	1150 E. Brady Street
Texas Bufkin Christian Academy	827 N. 34th Street
Thomas More High School	2601 E. Morgan Avenue
Torah Academy of Milwaukee	6800 N. Green Bay Avenue
Travis Technology High School	8350 N. Steven Road
Victory Christian Academy	2121 W. Wisconsin
Washington-DuBois Christian Leadership	5226 N. Hampton Avenue
Whole Village Institute	6401 W. Capitol Drive
Willow Glen Academy--Cornerstone	3903 W. Lisbon Avenue
Wisconsin Institute for Torah Study	3288 N. Lake Drive
Wisconsin Lutheran High School	300 N. Glenview Avenue
Word of Life	3558 S. 24th Street
Yeshiva Elementary School	5115 W. Keefe Avenue
Young Minds Preparatory School	2433 W. Roosevelt Drive

Sources: Milwaukee Public Schools and the Wisconsin Department of Public Instruction.

Table B-6

HISTORIC SITES AND DISTRICTS ON THE NATIONAL REGISTER OF HISTORIC PLACES, CITY OF MILWAUKEE: 2010

Site Name	Address	Year Listed
Abbot Row Building	1019-1043 E. Ogden Avenue	1983
Abresch, Charles, House Building	2126 W. Juneau Avenue	1986
Adler, Emanuel D., House Building	1681 N. Prospect Avenue	1991
All Saints' Episcopal Cathedral Complex Building	804-828 E. Juneau Avenue	1974
Allis, Charles, House Building (also known as Charles Allis Art Library)	1630 E. Royall Place	1975
American System Built Homes-Burnham Street District	W. Burnham Street	1985
Astor on the Lake Building. (also known as Hotel Astor)	924 E. Juneau Avenue	1984
Baasen House-German YMCA (also known as Wisconsin House Tavern)	1702 N. 4th Street	1984
Baumbach Building	302 N. Broadway Street	1983
Bay View Historic District (also known as Village of Bay View)	Roughly bounded by Lake Michigan, Meredith, Superior, Nock, Wentworth, Pryor, Clair, railroad tracks and Conway Street	1982
Bertelson Building	2101 – 2111 N. Prospect Avenue	1992
Blatz Brewery Complex	1001-1147 N. Broadway	1986
Blatz, Valentin, Brewing Company Office Building	1120 N. Broadway	1983
Bogk, Frederick C., House	2420 N. Terrace Avenue	1972
Brewers Hill Historic District. (also known as Vine-Reservoir Historic District)[a]	Vine, Reservoir, Palmer, 1st, 2nd, and Brown Streets	1984
Brewers Hill Historic District (Boundary Increase)[a]	Roughly, Brown and Lloyd Streets and Garfield and North Avenues from 2nd Street to Hubbard Street	1995
Buemming, Herman W., House	1012 E. Pleasant Street	1990
Burnham, J. L., Block	907 – 911 W. National Avenue	1988
Calkins, Elias A., Doublehouse (also known as Meddaugh,B.A.,House)	1612 – 1614 E. Kane Place	1990
Calvary Presbyterian Church	935 W. Wisconsin Avenue	1986
Carpenter, Michael, House (also known as Hope Parish House)	1115 35th Street	1986
Cass-Juneau Street Historic District (also known as All Saints' Episcopal Cathedral Complex)	Roughly bounded by E. Knapp and Marshall Streets, Juneau Avenue, and Van Buren Street	1988
Cass-Wells Street Historic District	712, 718, and 724 E. Wells Street and 801, 809, 815, 819, and 823 N. Cass Street	1986
Central Library (also known as Milwaukee Public Library and Museum)	814 W. Wisconsin Avenue	1974
Chief Lippert Fire Station (also known as Chemical Engine House No. 1)	642 W. North Avenue	1988
Christ Evangelical Lutheran Church	2235 W. Greenfield Avenue	1987
Clark Row House	2103 – 2109 W. Kilbourn Avenue	1989
Commerce Street Power Plant	1338 N. Commerce Street	1999
Concordia Historic District	Roughly bounded by W. State, N. 27th, W. Killbourn Avenue and N. 35th Street	1985
Congregation Beth Israel Synagogue (also known as Greater Galilee Missionary Baptist Church)	2432 N. Teutonia Avenue	1992
Cook, Thomas, House	853 N. 17th Street	1986
Dahinden, Edward J., House	3316 W. Wisconsin Avenue	1986
Desmond–Farnham–Hustis House	1535 N. Marshall Street	1990

Table B-6 (continued)

Site Name	Address	Year Listed
Eagles Club	2401 W. Wisconsin Avenue	1986
East Brady Street Historic District	E. Brady Street from N. Farwell Avenue to N. Van Buren Street	1990
East Side Commercial Historic District	Roughly bounded by E. Wells Street, N. Jefferson Street and N. Broadway, Michigan and E. Clybourn, and N. Water Streets	1986
East Village Historic District	Generally bounded by N. Humboldt, E. Brady, N. Warren, and the Milwaukee River	2004
Esbenshade, Abraham H., House	3119 W. Wells Street	1986
Excelsior Masonic Temple	2422 W. National Avenue	1988
Exton Apartments Building (also known as 1260 Apartments)	1260 N. Prospect Avenue	1997
Federal Building	515 – 519 E. Wisconsin Avenue	1973
Fiebing, Otto F., House	302 N. Hawley Road	1985
First Church of Christ, Scientist (also known as Renaissance Place)	1443 – 1451 N. Prospect Avenue	1989
First Unitarian Church	1009 E. Ogden Avenue	1974
First Ward Triangle Historic District	Roughly Franklin Place, N. Prospect and E. Juneau Avenues, and E. Knapp Street	1987
Florida and Third Industrial Historic District	234-500 (even side) W. Florida Street; 222 W. Pittsburgh Avenue; 212,222,305,331 S. Third Street; 400 S. Fifth Street	2008
Forest Home Cemetery and Chapel	2405 Forest Home Avenue	1980
Foth, Christian, House	1209 – 1211 S. 7th Street	1988
Fourth Street School (also known as Golda Meir School)	333 W. Galena Street	1984
Friedmann Row (also known as Patrician Row Condominiums)	1537, 1539, 1541, 1543 N. Cass Street and 731 E. Pleasant Street	1996
Gallun Tannery Historic District	Holton and Water Streets	1984
Garden Homes Historic District	Roughly bounded by W. Ruby and N. Teutonia Avenues, N. 24th Place, W. Atkinson Avenue and N. 27th Street	1990
German-English Academy (also known as B Building, Milwaukee School of Engineering)	1020 N. Broadway	1977
Germania Building (also known as Brumder Building)	135 W. Wells Street	1983
Gesu Church	1145 W. Wisconsin Avenue	1986
Gimbels Parking Pavilion	555 N. Plankinton Avenue	2001
Goodwill Industries Building	2102 W. Pierce Street	2004
Graham Row	1501, 1503, and 1507 N. Marshall Street	1979
Grand Avenue Congregational Church	2133 W. Wisconsin Avenue	1986
Greene, Thomas A., Memorial Museum (also known as Greene Geological Museum; Greene Museum)	3367 N. Downer Avenue	1993
Harley-Davidson Motorcycle Factory Building	3700 W. Juneau Avenue (1147 N. 38th Street)	1994
Harnischfeger, Henry, House	3424 W. Wisconsin Avenue	1986
Highland Avenue Methodist Church (also known as Solomon Community Temple; First German Methodist Episcopal Church)	2024 W. Highland Avenue	1986
Highland Boulevard Historic District	W. Highland Boulevard. roughly bounded by N. 33rd and N. 29th Streets	1985

Table B-6 (continued)

Site Name	Address	Year Listed
Historic Third Ward District	Bounded by the Milwaukee River, Chicago & NorthWestern Railroad, and E. St. Paul and N. Jackson Streets	1984
Hoelz, Alfred M., House	3449 – 3451 Frederick Avenue	1985
Holy Trinity Roman Catholic Church (also known as Our Lady of Guadalupe Roman Catholic Church)	605 S. 4th Street	1972
Home Office, Northwestern Mutual Life Insurance Company (also known as North Broadway Building No. 611)	605 – 623 N. Broadway	1973
Howie, David W., House	3026 W. Wells Street	1986
Immanuel Presbyterian Church	1100 N. Astor Street	1974
Iron Block	205 E. Wisconsin Avenue	1974
Johnston Hall (also known as Johnston Hall-Marquette University)	1121 W. Wisconsin Avenue	1986
Joseph Schiltz Company Brewery Complex	219 W. Galena Street	1999
Kalvelage, Joseph B., House	2432 W. Kilbourn Avenue	1978
Kane, Sanford R., House (also known as Lakeshore Montessori School)	1841 N. Prospect Avenue	1991
Kenwood Park-Prospect Hill Historic District	Roughly bounded by N. Hackett Avenue, E. Edgewood Avenue, N. Lake Drive and E. Newberry Avenue	2002
Ketter, Frederick, Warehouse	325 W. Vine Street	1984
Kilbourn Avenue Row House Historic District	Roughly bounded by N. 14th Street, W. Kilbourn Avenue, and N. 15th Street	1986
Kilbourn Masonic Temple	827 N. 11th Street	1986
Knapp-Astor House (also known as Montgomery House)	930 E. Knapp Street and 1301 N. Astor Street	1980
Knickerbocker Hotel	1028 E. Juneau Avenue	1988
Light Vessel No. 57 (Shipwreck) (also known as Grays Reef Lightship; Mi402)	Address restricted	1991
Lake Park	2900 N. Lake Drive and 2800 E. Kenwood Boulevard.	1993
Lindsay-Bostrom Building	133 W. Oregon Street	2002
Lohman Funeral Home and Livery Stable	804 W. Greenfield Avenue and 1325 S. 8th Street	1988
Machek, Robert, House	1305 N. 19th Street	1977
Mackie Building (also known as Chamber of Commerce)	225 E. Michigan Street	1973
Mayer Boot and Shoe Company Building	116 E. Walnut Street	1984
McIntosh-Goodrich Mansion (also known as Wisconsin Conservatory of Music)	1584 N. Prospect Avenue	2000
McKinley Boulevard Historic District	W. McKinley Boulevard. between N. 34th and N. 27th Streets	1985
Milwaukee City Hall	200 E. Wells Street	1973
Milwaukee County Courthouse	901 N. 9th Street	1982
Milwaukee County Dispensary and Emergency Hospital	2430 W. Wisconsin Avenue	1985
Milwaukee County Historical Center (also known as Second Ward Savings Bank)	910 N. 3rd Street	1973
Milwaukee Fire Department High Pressure Pumping Station (also known as Kinnickinnic River Pumping Station)	2011 S. 1st Street	1981
Milwaukee Harbor Piers and Breakwaters	Milwaukee Harbor, Lake Michigan	1996
Milwaukee Hospital	2200 W. Kilbourn Avenue	2006

Table B-6 (continued)

Site Name	Address	Year Listed
Milwaukee News Building and Milwaukee Abstract Association Building (Also known as Law Offices of Shellow and Shellow)	222 E. Mason Street	1982
Milwaukee Normal School-Milwaukee Girls' Trade and Technical High School	1820 W. Wells Street	1986
Milwaukee-Western Fuel Company Building (also known as North Western-Hanna Fuel Company Building; Electronic Data Systems)	2150 N. Prospect Avenue	1992
Milwaukee-Downer "Quad"	Northwest corner of Hartford and Downer Avenues	1974
Mitchell Building	207 E. Michigan Street	1973
Mitchell, Alexander, House Also known as Wisconsin Club	900 W. Wisconsin Avenue	1986
New Coeln House	5905 S. Howell Avenue	1988
Newberry Boulevard Historic District	1802 – 3000 E. Newberry Boulevard	1994
North First Street Historic District	Roughly 1st and 2nd Streets between North and Center Streets	1984
North Grant Boulevard Historic District	2370 – 2879 N. Grant Boulevard	1995
North Point Lighthouse	Wahl Street at Terrace Avenue	1984
North Point North Historic District	Roughly bounded by N. Downer Avenue, E. Park Place, and N. Wahl Avenue	2000
North Point South Historic District	Roughly bounded by North Avenue, Summit, Terrace, and Lafayette Streets	1979
North Point Water Tower	E. North Avenue between N. Lake Drive and N. Terrace Avenue	1973
North Sherman Boulevard Historic District	N. Sherman Boulevard Roughly bounded by W. Keefe Avenue and W. Lisbon Avenue	2004
North Third Street Historic District	Roughly N. 3rd Street between N. 3rd Avenue and Vine Street	1984
Northwestern Branch, National Home for Disabled Volunteer Soldiers Historic District (also known as National Soldiers Home Historic District)	Roughly bounded by W. Blue Mound Road, Mitchell Boulevard, IH 94 and the Veterans Affairs Medical Center	1994
Old St. Mary's Church	844 N. Broadway	1973
Old World Third Street Historic District	N. Old World 3rd Street, W. Highland Avenue, and W. State Street	1987
Oliver, Joseph B., House	1516 E. Brady Street	1990
Oneida Street Station (also known as East Wells Power Plant)	108 E. Wells and 816 N. Edison Streets	1984
Pabst Brewery Saloon (also known as Zion Rock Missionary Baptist Church)	1338 – 1340 W. Juneau Avenue, Milwaukee	1986
Pabst Brewing Company Complex	Roughly bounded by W. Highland Avenue, N. 11th Street, W. Winnebego Street, and N. 9th Street	2003
Pabst Theater	144 E. Wells Street	1972
Pabst, Frederick, House	2000 W. Wisconsin Avenue	1975
Parking Lot Site (Site - #94000670) (also known as 47 Mi-397)	Prehistoric-Late Archaic site; address restricted	1994
Pittsburgh Plate Glass Enamel Plant	201 E. Pittsburgh Avenue	2009
Plankinton, Elizabeth, House (also known as Knights of Columbus Building)	1492 W. Wisconsin Avenue	1980
Plankinton-Wells-Water Street Historic District	Roughly bounded by Wells, Bridge, N. Water, E. Mason, W. Wells, and N. 2nd Streets	1986
Prospect Avenue Apartment Buildings Historic District	N. Prospect Avenue area roughly between E. Kane Place and E. Windsor Street	1990

Table B-6 (continued)

Site Name	Address	Year Listed
Prospect Avenue Mansions Historic District	1363 – 1551 N. Prospect Avenue	1990
Prospect Hill Historic District (also known as Gilman's Subdivision of Park of Lockwood's Addition)	2700 block of N. Hackett Avenue, N. Shepard Avenue, N. Summit Avenue and 2804-06 E. Park Place	2005
Public School No. 27 (also known as Garfield Avenue School)	2215 N. 4th Street	1984
Public Service Building	231 W. Michigan Street	1998
Pythian Castle Lodge (also known as Crystal Palace)	1925 W. National Avenue	1988
Quarles, Charles, House	2531 N. Farwell Avenue	1979
Saint George Melkite Catholic Church	1617 W. State Street	1986
Saint James Court Apartments	831 W. Wisconsin Avenue	2008
Saint Peter's Evangelical Lutheran Church	1204, 1213, 1214, and 1215 S. 8th Street	1987
Saint Vincent's Infant Asylum	809 W. Greenfield Avenue	1987
Saints Peter and Paul Roman Catholic Church Complex	2474 and 2490 N. Cramer Street and 2479 and 2491 N. Murray Avenue	1991
Salem Evangelical Church (also known as St. Michaels Ukrainian Catholic Church)	1025 and 1037 S. 11th Street	1987
Schlitz, Joseph, Brewing Company Historic District	Roughly, along W. Walnut, N. 2nd, and N. 3rd Streets	1984
Schlitz, Joseph, Brewing Company Saloon (also known as Three Brothers Bar and Restaurant)	2414 S. St. Clair Street	1977
Schlitz, Victor, House	2004 W. Highland Avenue	1986
Schoonmaker Reef (also known as Wauwatosa Reef; Schoonmaker Quarry; Raphu Station; Francey Reef)	North of West Street, between N. 66th Street and N. 64th Street extended	1997
Schuster, George, House and Carriage Shed	3209 W. Wells Street	1986
Second Church of Christ Scientist (also known as Saint Luke Emmanuel Baptist Church)	2722 W. Highland Boulevard	1986
Shorecrest Hotel	1962 N. Prospect Avenue	1984
Sivyer, Fred, House	761 N. Twenty-fifth Street	1986
Sixth Church of Christ, Scientist (also known as First Church of Christ Scientist)	1036 N. Van Buren Street	1980
Smith, Lloyd R., House (also known as Villa Terrace Museum of Decorative Arts)	2220 N. Terrace Avenue	1974
Soldiers' Home Reef (also known as Rocky Point; National Military Asylum Reef; Veterans' Hill)	Northeast of junction of Wood Avenue and General Mitchell Boulevard, Clement J. Zablocki Veterans Affairs Medical Center grounds	1993
South Branch Library (also known as Southside Neighborhood Service Center)	931 W. Madison Street	1988
South First and Second Street Historic District	Roughly bounded by Menomonee River, Chicago & NorthWestern Railroad, Seeboth, S. 1st, Oregon, and S. 2nd Streets	1987
South Layton Boulevard Historic District	921 – 2264 S. Layton Boulevard	1996
Sovereign Apartments	1810 W. Wisconsin Avenue	1986
Spence, William G., House	1741 N. Farwell Avenue	1996
Spencerian Business Collage	2800 W. Wright Street	2008
Spring Grove Site	Address restricted prehistoric site	1979
St. Francis of Assisi Historic District	Roughly bounded by N. 5th, W. Brown, N. 4th Streets, and W. Reservoir Avenue	1984
St. James Episcopal Church	833 W. Wisconsin Avenue	1979
St. John de Nepomuc Rectory	4th and Court Streets	1984

Table B-6 (continued)

Site Name	Address	Year Listed
St. John's Evangelical Lutheran Church Complex	804 – 816 W. Vliet Street	1992
St. John's Roman Catholic Cathedral	812 N. Jackson Street	1974
St. Josaphat Basilica	601 W. Lincoln Avenue	1973
St. Martini Evangelical Lutheran Church	1557 W. Orchard Street	1987
St. Patrick's Roman Catholic Church	1105 S. 7th Street	1974
St. Paul's Episcopal Church	904 E. Knapp Street	1974
State Bank of Wisconsin (also known as Bank of Milwaukee Block)	210 E. Michigan Street	1984
Steinmeyer, William, House	1716-1722 N. 5th Street	1984
Steinmeyer, William, House	1724 – 1730 N. 5th Street	1984
Tire Swing Site (also known as 47 Mi-395)	Address restricted prehistoric site	1994
Train Trestle Site (also known as 47 Mi-396)	Address restricted prehistoric site	1994
Trinity Evangelical Lutheran Church	1046 N. 9th Street	1979
Tripoli Temple	3000 W. Wisconsin Avenue	1986
Turner Hall	1034 N. 4th Street	1977
Walker's Point Historic District	Roughly bounded by the Freeway, Menomonee Canal, Scott, 2nd, and W. Virginia Streets	1978
Walker, Harry B., House	3130 W. Wells Street	1986
Ward Memorial Hall (also known as Building 41; Theater at Woods Veterans Administration)	5000 W. National Avenue	1984
West Side Commercial Historic District	Roughly, W. Wisconsin Avenue, N. 3rd Street, N. Plankinton Avenue, and N. 2nd Avenue	2000
West Side Commercial Historic District	Roughly, W. Wisconsin Avenue, N. 3rd Street, N. Plankinton Avenue, and N. 2nd Street	2000
West Washington-North Hi-Mount Boulevards Historic District	4701 – 5929 W. Washington Boulevard; 1720 – 2049 N. Hi-Mount Boulevard	1994
Wisconsin Consistory Building (also known as Scottish Rite Masonic Center)	790 N. Van Buren Street	1994
Wisconsin Leather Company Building	320 E. Clybourn Street	2005
Woman's Club of Wisconsin (also known as The Athenaeum)	813 E. Kilbourn Avenue	1982

[a]*The boundary of this historic district was increased to its present boundary in 1995.*

Source: National Register of Historic Places.

Appendix C

EXAMPLE OF MATERIAL PUBLISHED AS PART OF MILWAUKEE COUNTY EMERGENCY MANAGEMENT'S INFORMATIONAL AND EDUCATIONAL EFFORTS DIRECTED TOWARD SOLVING LOCAL HOMEOWNERS' FLOODING AND SANITARY SEWER BACKUP PROBLEMS

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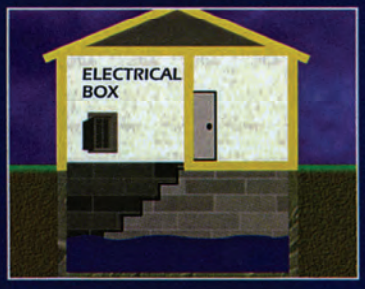
Milwaukee County Sheriff's Department
Division of Emergency Management

Sheriff
Leverett F. Baldwin

The Dry Facts:
Protecting Your Home From Flood-Related Damage

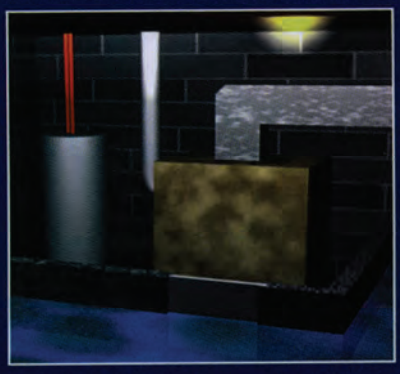
"Here are some simple and affordable measures you can take to protect your home and property from flood-related damage."



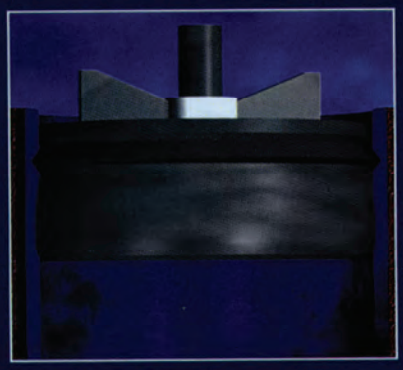
Raising or moving your appliances and electrical box can save them from flood-related damage.

FLOOD PROOFING?

Over the last decade, flood-related damage has averaged well over three billion dollars a year! But don't give up. While we can't stop flooding, we can do a lot to reduce the cost and amount of damage it does to our homes. We call it "flood mitigation." Here are some simple and affordable measures you can take to protect your home and property from flood-related damage.



Building a flood wall around appliances that can't be moved is an effective way to protect them from encroaching flood waters.



Test plugs are used to prevent usage backup in the basement floor drain and are a quick and easy preventative solution.

Sawhorses and an old board work well to elevate small appliances and knickknacks.

BEFORE YOU DO ANYTHING

Call your building inspector. Look in the blue section of your White Pages for the building inspector in your municipality.

Things to ask...

- Are there any building code restrictions on home flood mitigation measures?
- What is my Base Flood Elevation or BFE? (Base Flood Elevation is the highest point floodwaters are expected to reach under normal circumstances in your area.)
- What "Flood Protection Level" should I use? (Flood Protection Level is the level of flooding you want your house to be able to withstand.)

DO YOUR HOMEWORK

Some of the flood proofing alterations you decide to do may require the help of a professional contractor.

Things to ask...

- Is your contractor licensed and bonded?
- Do they have proper insurance for their company and their employees?
- Do they have references? What do those references say about the contractor's work?
- Are there any complaints against your contractor registered with The Better Business Bureau?
- Will they provide everything – schedules, quotes, contracts etc. - in writing?

FLOOD MITIGATION TECHNIQUES

ELEVATE items like your washer and dryer, personal items, hazardous chemicals, food products, electrical outlets, electrical box, furnace, and water heater 1 to 2 feet above your BFE.

Things to use...

- Pressure-treated wood pallets
- Concrete blocks, bricks or masonry
- Ceiling suspension devices
- Sawhorses

INSTALL devices that will warn you of the presence of water in your basement and help remove any water present. You can find these devices at any hardware store.

Things to ask for...

- Water alarm
- Sump pump
- Battery back up sump pump

BACKFLOW REDUCTION DEVICES in your basement drains and toilets can reduce or eliminate the dreaded backflow of sewage water into your home. There are a number of backflow reduction devices out there, most of which you'll find at your hardware store.

Things to ask for...

- Backflow Valve
- Test Plug
- Pneumatic plug for basement toilet

STRUCTURAL ALTERATIONS to protect your home against flood damage will require permission from your building inspector and, in some cases, the help of a professional contractor. There are two categories of structural alteration in regards to flood mitigation: Wet Flood Proofing and Dry Flood Proofing.

Dry Flood Proofing basically means sealing your house to keep floodwaters out.

Things to do...

- Replace low-level windows with glass block.
- Protect low-level windows with aluminum or exterior plywood window shields.
- Place plastic shields over window wells.
- Sandbag around low-level windows when flood is imminent.
- Build a 1.5' above grade brick flood wall around low-level windows.

NOTE: Sandbags and flood walls should be no higher than 1.5' high. Doing so will cause a buildup of hydrostatic pressure on your basement walls and may cause them to collapse!

Wet Flood Proofing involves fortifying flood-vulnerable areas in your home. With water-resistant building materials, you significantly reduce the amount of damage caused by floodwaters.

Things to do...

- Ask your building inspector if there are any code restrictions on wet flood proofing in your area.
- Elevate items in areas to be wet flood proofed above the BFE.
- Replace building materials in these areas with water-resistant materials such as concrete, pressure-treated lumber, rigid wall insulation, epoxy paints and synthetic indoor/outdoor carpeting.

LANDSCAPING, when done properly, can do a lot to direct flood waters away from your home.

Things to do...

- Ask your building inspector about any zoning restrictions on landscape alterations in your area.
- Build up the grade around your house so that water will flow away from your foundation.
- Clean your gutters out so they're not clogged or leaking.
- Attach flexible gutter extensions to your downspouts and sump pump exterior drains to direct water away from your house. (Extensions should be at least 3 feet in length.)
- Mudjack sidewalks and driveways to return them to their proper grade away from your house.

NOTE: Any adjustments to your landscape that may effect your neighbors should be discussed with them prior to implementing those adjustments.

WARNING SYSTEMS, such as the NOAA weather radio with emergency alarm, broadcast continuous updates for your area directly from the National Weather Service 24 hours a day. You can purchase one at most radio/TV electronics stores.

Standard radio and television stations will also carry emergency weather and/or disaster information.

Things to know...

- *Flood Watch:* An advisory that flooding is possible within a designated area.
- *Flood Warning:* An advisory that flooding is occurring or imminent.
- *Urban and Small Stream Flood Advisory:* High potential of flooding along a river or stream.
- *Flash Flood:* The occurrence of a dangerous rise in the water level of a stream or overland area in a few hours or less.

Be sure to route rain water far away from the foundation.

A NOAA weather radio with an emergency alarm can give you enough time in a weather emergency to protect you and your family. Get one!

Milw. County Sheriff's Dept.,
Division of Emergency Management
414-278-4709

Milwaukee American Red Cross
414-342-8680

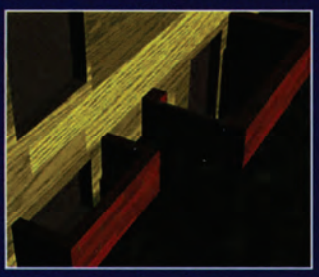
The Salvation Army
414-265-6360

Aging Services for Milw. County
414-289-6874

Better Business Bureau of WI
414-224-0900

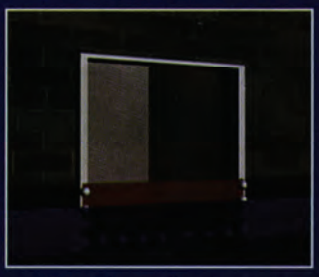
The WI Dept. of Agricultural
Trade & Consumer Protection
1-800-422-7128

Make sure that the landscaping around your home slopes away from the foundation.



Flood walls around basement and low-lying windows should be no taller than 1.5'.

Pressure-treated lumber, cinder block, and pallets can be used to raise your belongings off the floor and out of floodwaters.



In case of impending flood, temporary shields can prevent water from entering your home.

ASSISTANCE

THE NATIONAL FLOOD INSURANCE PROGRAM or NFIP is a federal program that allows you to buy adequate flood insurance. Most homeowner's insurance policies DO NOT cover flood-related damage to your home!

Things covered by NFIP...

- Damage to your house and its contents caused by surface water flooding.
- Cost of moving and storing your belongings for up to 45 days.
- Expenses related to removing debris after flood.
- House structure up to $250,000.
- House contents up to $100,000.
- Renters belonging up to $100,000.
- Businesses up to $500,000.

BENEFITS OF NFIP...

- You don't have to wait in line for Federal Disaster Assistance that you may have to pay back later...with interest!
- Average cost of annual coverage is $316.00.
- You can get a policy at any time; however, there may be a 30-day waiting period before policy is effective.
- Not taxpayer supported.
- Available without Presidential declaration of disaster. (Federal Disaster Assistance is available in less than 50% of flood incidents!)

NOTE: NFIP does NOT cover damage caused by sewer back up, unless it is caused by overland flooding. Ask your insurance agent about a sewer back up rider for your existing homeowner's policy.

For more information, or to sign up, call your insurance agent or The National Flood Insurance Program 1-800-720-1090.

A PRESIDENTIAL DECLARATION OF DISASTER in the event of a flood, opens up numerous federal and state aid programs to flood victims. These programs are coordinated through the Federal Emergency Management Agency.

Programs include...

- Disaster Housing Grants for assistance with mortgage and rent, repair costs and mitigation costs.
- The U.S. Small Business Administration (SBA) for low interest loans to residences and businesses.
- The Individual and Family Grants for assistance with previously uncovered needs.
- Disaster Unemployment Assistance provides benefits to those out of work due to flooding.
- Farm Assistance to cover losses in farm property and/or production.
- IRS amended returns allowing deductions for casualty losses for under and uninsured victims.

The corresponding video is available through the Milwaukee County Federated Library System or by calling the Milwaukee County Sheriff's Department, Division of Emergency Management.

Created by:
Watts Communications, Inc.
Advantage Printing & Graphics

Appendix D

HOMEOWNERS DISASTER PREPARATION INFORMATION

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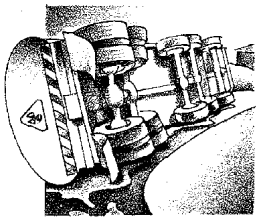
Your Family Disaster Supplies Kit

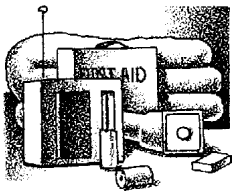
Disasters happen anytime and anywhere. And when disaster strikes, you may not have much time to respond.



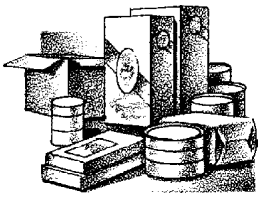
A highway spill of hazardous material could mean instant evacuation.

A winter storm could confine your family at home. An earthquake, flood, tornado or any other disaster could cut off basic services—gas, water, electricity and telephones—for days.

After a disaster, local officials and relief workers will be on the scene, but they cannot reach everyone immediately. You could get help in hours, or it may take days. Would your family be prepared to cope with the emergency until help arrives?



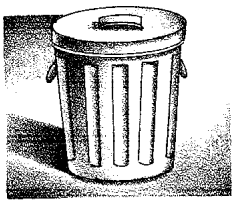
Your family will cope best by preparing for disaster *before* it strikes. One way to prepare is by assembling a Disaster Supplies Kit. Once disaster hits, you won't have time to shop or search for supplies. But if you've gathered supplies in advance, your family can endure an evacuation or home confinement.



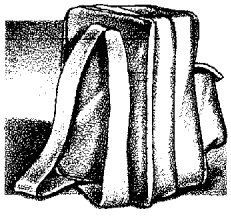
To prepare your kit

- Review the checklist in this brochure.
- Gather the supplies that are listed. You may need them if your family is confined at home.
- Place the supplies you'd most likely need for an evacuation in an easy-to-carry container. These supplies are listed with an asterisk (*).

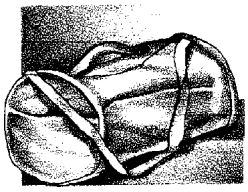
There are six basics you should stock in your home: water, food, first aid supplies, clothing and bedding, tools and emergency supplies and special items. Keep the items that you would most likely need during an evacuation in an easy-to-carry container—suggested items are marked with an asterisk (*). Possible containers include



a large, covered trash container,



camping backpack,



or a duffle bag.

Water

Store water in plastic containers such as soft drink bottles. Avoid using containers that will decompose or break, such as milk cartons or glass bottles. A normally active person needs to drink at least two quarts of water each day. Hot environments and intense physical activity can double that amount. Children, nursing mothers and ill people will need more.

- ❑ Store one gallon of water per person per day (two quarts for drinking, two quarts for food preparation/sanitation)*
- ❑ Keep at least a three-day supply of water for each person in your household.

Food

Store at least a three-day supply of non-perishable food. Select foods that require no refrigeration, preparation or cooking and little or no water. If you must heat food, pack a can of sterno. Select food items that are compact and lightweight.

*Include a selection of the following foods in your Disaster Supplies Kit:

- ❑ Ready-to-eat canned meats, fruits and vegetables
- ❑ Canned juices, milk, soup (if powdered, store extra water)
- ❑ Staples — sugar, salt, pepper
- ❑ High energy foods — peanut butter, jelly, crackers, granloa bars, trail mix
- ❑ Vitamins
- ❑ Foods for infants, elderly persons or persons on special diets
- ❑ Comfort/stress foods — cookies, hard candy, sweetened cereals lollipops, instant coffee, tea bags

First Aid Kit

Assemble a first aid kit for your home and one for each car. A first aid kit* should include:

- ❑ Sterile adhesive bandages in assorted sizes
- ❑ 2-inch sterile gauze pads (4-6)
- ❑ 4-inch sterile gauze pads (4-6)
- ❑ Hypoallergenic adhesive tape
- ❑ Triangular bandages (3)
- ❑ 2-inch sterile roller bandages (3 rolls)
- ❑ 3-inch sterile roller bandages (3 rolls)
- ❑ Scissors
- ❑ Tweezers
- ❑ Needle
- ❑ Moistened towelettes
- ❑ Antiseptic
- ❑ Thermometer
- ❑ Tongue blades (2)
- ❑ Tube of petroleum jelly or other lubricant
- ❑ Assorted sizes of safety pins
- ❑ Cleansing agent/soap
- ❑ Latex gloves (2 pair)
- ❑ Sunscreen

Non-prescription drugs

- ❑ Aspirin or nonaspirin pain reliever
- ❑ Anti-diarrhea medication
- ❑ Antacid (for stomach upset)
- ❑ Syrup of Ipecac (use to induce vomiting if advised by the Poison Control Center)
- ❑ Laxative
- ❑ Activated charcoal (use if advised by the Poison Control Center)

Contact your local American Red Cross chapter to obtain a basic first aid manual.

Tools and Supplies

- ❑ Mess kits, or paper cups, plates and plastic utensils*
- ❑ Emergency preparedness manual*
- ❑ Battery operated radio and extra batteries*
- ❑ Flashlight and extra batteries*
- ❑ Cash or traveler's checks, change*
- ❑ Non-electric can opener, utility knife*
- ❑ Fire extinguisher: small canister, ABC type
- ❑ Tube tent
- ❑ Pliers
- ❑ Tape
- ❑ Compass
- ❑ Matches in a waterproof container
- ❑ Aluminum foil
- ❑ Plastic storage containers
- ❑ Signal flare
- ❑ Paper, pencil
- ❑ Needles, thread
- ❑ Medicine dropper
- ❑ Shut-off wrench, to turn off household gas and water
- ❑ Whistle
- ❑ Plastic sheeting
- ❑ Map of the area (for locating shelters)

Sanitation

- ❑ Toilet paper, towelettes*
- ❑ Soap, liquid detergent*
- ❑ Feminine supplies*
- ❑ Personal hygiene items*
- ❑ Plastic garbage bags, ties (for personal sanitation ases)
- ❑ Plastic bucket with tight lid
- ❑ Disinfectant
- ❑ Household chlorine bleach

Clothing and Bedding

*Include at least one complete change of clothing and footwear per person.

- ❑ Sturdy shoes or work boots*
- ❑ Rain gear*
- ❑ Blankets or sleeping bags*
- ❑ Hat and gloves
- ❑ Thermal underwear
- ❑ Sunglasses

Special Items

Remember family members with special needs, such as infants and elderly or disabled persons.

For Baby*

- ❑ Formula
- ❑ Diapers
- ❑ Bottles
- ❑ Powdered milk
- ❑ Medications

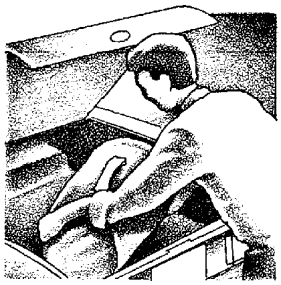
For Adults*

- ❑ Heart and high blood pressure medication
- ❑ Insulin
- ❑ Prescription drugs
- ❑ Denture needs
- ❑ Contact lenses and supplies
- ❑ Extra eye glasses
- ❑ **Entertainment** - games and books
- ❑ **Important Family Documents**
  Keep these records in a waterproof, portable container.

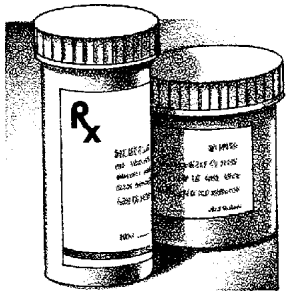
- Will, insurance policies, contracts, deeds, stocks and bonds
- Passports, social security cards, immunization records
- Bank account numbers
- Credit card account numbers and companies
- Inventory of valuable household goods, important telephone numbers
- Family records (birth, marriage, death certificates)

SUGGESTIONS AND REMINDERS

- Store your kit in a convenient place known to all family members. Keep a smaller version of the Disaster Supplies Kit in the trunk of your car.



- Keep items in air tight plastic bags.
- Change your stored water supply every six months so it stays fresh.
- Rotate your stored food every six months.
- Re-think your kit and family needs at least once a year. Replace batteries, update clothes, etc.
- Ask your physician or pharmacist about storing prescription medications.



CREATE A FAMILY DISASTER PLAN

To get started...

Contact your local emergency management or civil defense office and your local American Red Cross chapter.

- Find out which disasters are most likely to happen in your community.
- Ask how you would be warned
- Find out how to prepare for each.

Meet with your family.

- Discuss the types of disasters that could occur.
- Explain how to prepare and respond.
- Discuss what to do if advised to evacuate.
- Practice what you have discussed.

Plan how your family will stay in contact if separated by disaster.

- Pick two meeting places:
  1) a location a safe distance from your home in case of fire.
  2) a place outside your neighborhood in case you can't return home.
- Choose an **out-of-state** friend as a "check-in-contact" for everyone to call.

Complete these steps.

- Post emergency telephone numbers by every phone.
- Show responsible family members how and when to shut off water, gas and electricity at main switches.
- Install a smoke detector on each level of your home, especially near bedrooms; test monthly and change the batteries two times each year.
- Contact your local fire department to learn about home fire hazards.
- Learn first aid and CPR. Contact your local American Red Cross chapter for information and training

Meet with your neighbors.

Plan how the neighborhood could work together after a disaster. Know your neighbor's skills (medical, technical). Consider how you could help neighbors who have special needs, such as elderly or disabled persons. Make plans for child care in case parents can't get home.

Remember to practice and maintain your plan.

The Federal Emergency Management Agency's Community and Family Preparedness Program and the American Red Cross Community Disaster Education Program are nationwide efforts to help people prepare for disasters of all types. For more information, please contact your local emergency management office and American Red Cross chapter. This brochure and other preparedness materials are available by calling FEMA at 1-800-480-2520, or writing: FEMA, P.O. Box 2012, Jessup, MD 20794-2012. Publications are also available on the World Wide Web at:

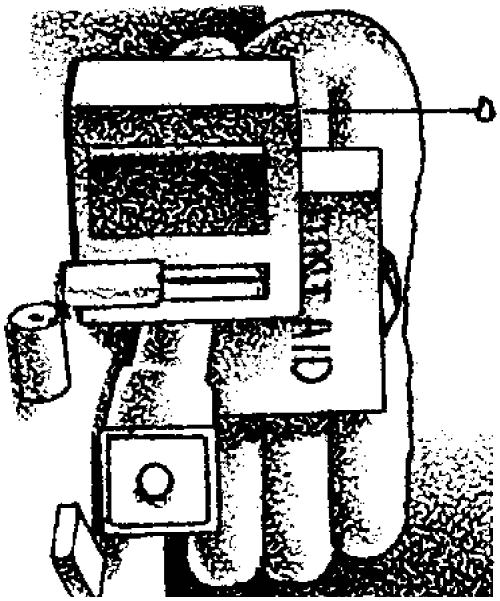
FEMA's Web site: http://www.fema.gov American Red Cross Web site: http://www.redcross.org

Local sponsorship provided by:

FEMA L- 189
ARC 4463

EARTHQUAKE • TORNADO • WINTER STORM • FIR

Federal Emergency Management Agency



Your Family Disaster Supplies Ki

HURRICANE • FLASH FLOOD • HAZARDOUS MATERIALS SPIL

FINAL DRAFT

Appendix E

WISCONSIN DEPARTMENT OF NATURAL RESOURCES CORRESPONDENCE REGARDING STANDARD EMERGENCY OPERATION PLAN FOR WATER SUPPLY FACILITIES

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State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Scott McCallum, Governor
Darrell Bazzell, Secretary

101 S. Webster St.
Box 7921
Madison, Wisconsin 53707-7921
Telephone 608-266-2621
FAX 608-267-3579
TTY 608-267-6897

October 8, 2001

Subject: Water System Security

Dear Water System Owner:

The events of September 11, 2001 will likely have profound affects on all our lives over the coming months and years. One effect that is already noticeable in the transportation industry is heightened security. The water supply industry, like the transportation industry, serves hundreds of millions of people every day. Therefore, as primary protectors of public health, we must be mindful of our responsibility to protect our customers and citizens against the potential of contaminated drinking water.

Toward that end, the Department would like to share with you some of our suggestions which may help keep your water system secure from external contamination, both intentional and accidental. Please keep in mind that the majority of these suggestions are either required by current State regulations or have been long recognized as sound operational security practices. We strongly urge you to implement as many of these suggestions as you find applicable and practicable in your individual situations.

The Department requests that every community water system perform a security analysis for their facilities. A standard emergency operation plan should be in place in event of mechanical failures, power outages, unsafe samples and threats or acts of terrorism.
Consider these basic security measures:

1. Cover all openings into reservoirs, treatment system vents and intakes with heavy hardware cloth, welded rods or other metal louvers resistant to removal. Code has always required these to be covered with fine mesh screen to exclude vermin. Now, these should also be designed to prevent intentional access. Frequent, regular inspections should be done of all vents in areas accessible to the public.

2. Lock all pumphouses, reservoirs, booster stations and other remote facilities.

3. Restrict public access, especially by vehicles, to reservoir and pump house service roads. Be mindful of the possibility of large vehicles that could contain explosives and the proximity they can access. This can be accomplished with substantial locked gates, staggered concrete barriers, grading moats or by parking a large vehicle (snow plow, garbage truck).

4. Prohibit parking/stopping on public roadways adjacent to reservoirs, pump stations, treatment facilities within proximity where vehicle bomb explosions could impact facilities.

5. Request increased routine police patrols in sensitive areas and strict parking enforcement.

6. Operators should visit all facilities daily and maintain a log.

7. Install security lighting, motion detectors and TV cameras.

8. Maintain effective disinfection capability. Chorine, ozone and UV can be effective in destroying many biological agents. Acquire emergency disinfection equipment now if not already chlorinating.

9. Maintain a free chlorine residual at the ends of the distribution system of at least 0.2ppm. A free chlorine residual of 0.5 ppm could reasonably inactivate most biological agents likely to be used by terrorists.

10. Maintain chemical additives (fluoride, alum, lime) etc. under secure conditions that discourage tampering. Assure that containers delivered by suppliers are intact, secure and quality checked as feasible. Use only reliable sources and known contractors.

11. Develop a list of alternate, emergency water sources within the community such as industrial, commercial and private wells. Update inspection and testing programs for these wells pursuant to NR811.10. Develop plans with neighboring communities for mutual assistance to provide emergency water.

12. Train operators and plant personnel in security awareness. To prevent sabotage, think how would *you* attack your system? Then take measures to discourage or prevent such schemes from being effective.

13. Restrict access to water main maps and plans of all facilities. Seek legal counsel on open records requests to obtain facility plans. Contact consultants, contractors and regulators who have plans in their possession and require guarantees that access to their copies be secured. Access to water distribution maps is most sensitive.

14. Consider the reliability and security status of current and former personnel.

15. Post the chain of action for reporting threats or acts of terrorism: Call local law enforcement first. Local law enforcement authorities would in turn contact Wisconsin Emergency Management and the Federal Bureau of Investigation if it is determined that tampering has actually occurred at your water system. Second, call your local health department, the local health department will in turn call the Division of Health and Family Services Emergency Hotline at 1-608-258-0099. Have a plan for rapid public notification in place and practice it.

16. Join a security network such as Infragard, and/or contact American Waterworks Association to become part of their security information system by e-mailing: security@awwa.org. Consider hiring a professional consulting firm such as Sandia National Labs to develop a security plan. Visit the following websites on water system security: www.infragard.net , www.wi-infragard.com , www.awwa.org , www.awwa.org/waterweek/wwlast.htm , www.amwa.net/isac/

In addition to the preceding suggestions, the Department has been actively reviewing and revising our own emergency management plans and we have taken the initial steps to try to obtain additional formal training for our staff. We intend to highlight security as an issue in upcoming sanitary surveys and water system inspections and you can expect continued emphasis from our staff regarding water system emergency plans. Please remember that while the tragic events of September 11 may be the impetus for some of this emphasis, system security and emergency planning are essential for many types of natural

catastrophes. The tornado damage in the Village of Siren this year, comes to mind. Finally, please rest assured that as we get additional information and are able to offer it to you, we will do so.

While we have not yet established a formal organizational conduit for information requests, please direct any questions you might have regarding security or emergency planning to our Regional Drinking Water Experts through your assigned regional drinking water specialist or engineer. If information is needed beyond the expertise of our Regional Staff and Experts, they will forward requests to central office staff for answers or advice.

Thank you for doing your part to protect Wisconsin's drinking water.

Sincerely,

Jill D. Jonas, Director
Bureau of Drinking Water & Groundwater

cc: Regional DG Experts
Regional Water Leaders
Barb, Zellmer, AD/5
Susan Sylvester, AD/5
Bill Sonzogni, SLH
Lynda Knobeloch, DHFS, Division of Health
Dave Sheard, PSC

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Appendix F

POTENTIAL FUNDING PROGRAMS TO IMPLEMENT PLAN RECOMMENDATIONS

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Table F-1

FUNDING PROGRAM DESCRIPTIONS

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
1	U.S. Federal Emergency Management Agency (FEMA)	Hazard Mitigation Grant Program	State agencies and participating National Flood Insurance Program (NFIP) communities	1. Floodproofing 2. Relocation 3. Elevation of structures 4. Property acquisition	75 percent Federal cost-share assistance; 12.5 percent State match and 12.5 percent local match required[a]	Within 60 days of a Presidential disaster declaration
2	FEMA	Flood Mitigation Assistance Program	State agencies and participating NFIP communities	1. Elevation, relocation, or demolition of insured structures 2. Acquisition 3. Dry floodproofing 4. Minor structural projects 5. Beach nourishment activities	$20 million available nationally;[b] 75 percent Federal cost-share assistance; 25 percent local match required; two types of grants: Planning grant and project grant[c]	- -
3	FEMA	Public Assistance Program	State agencies and local communities	1. Rebuilding infrastructure damaged during a flood 2. Building infrastructure for portions of a community that are to be relocated outside of floodplains 3. Limited assistance with structural elevation and relocation	75 percent Federal cost-share assistance; the State determines the local match	Within 30 days of a Presidential disaster declaration
4	FEMA	National Training and Education Division	State and local first responders	1. Provides preparedness training and exercise support to first responders in the event of a weapon of mass destruction event 2. Provides assistance for local units of government to obtain terrorism readiness equipment	Provides over 100 training courses for first responders	Varies
5	FEMA	Repetitive Flood Claims Program	State agencies and participating NFIP communities	1. Elevation, relocation, or demolition of insured structures 2. Floodproofing 3. Minor localized flood reduction projects	100 percent Federal cost-share assistance, if the proposed activity cannot be funded under the Flood Mitigation Assistance Program	- -
6	FEMA	Severe Repetitive Loss Program	State agencies and participating NFIP communities	1. Elevation, relocation, or demolition of insured structures 2. Floodproofing 3. Minor localized flood reduction projects 4. Mitigation reconstruction	75 percent Federal cost-share assistance, 25 percent State or local match is required	- -

Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
7	FEMA	Pre-Disaster Mitigation Program	State agencies and participating National Flood Insurance Program (NFIP) communities	1. Acquisition and relocation of structures in flood hazard areas 2. Floodproofing 3. Minor structural projects 4. Flood control projects for critical facilities 5. Management costs 6. Informational activities 7. Plan preparation 8. Technical assistance	75 percent Federal cost-share assistance; 25 percent State or local match is required	Applicants must have a FEMA-approved Mitigation Plan in order to qualify for project grants
8	FEMA	Homeland Security Preparedness Technical Assistance Program	State and local governments	1. Implementation of the National Infrastructure Protection Plan 2. Strengthen chemical, biological, radiological, nuclear, and explosive detection, response, and decontamination capability	No statutory matching requirements. Amounts awarded vary based on the scope of the project	Varies
9	U.S. Department of Homeland Security, U.S. Fire Administration	Assistance to Firefighters Grant Program	City, Counties, Village, and Township Fire Departments	1. Firefighter and EMT training 2. Fire fighting and EMS equipment 3. Firefighter personal protective equipment	Cost-share matching fund requirements dependent upon size of population served by Fire Department	See program guidance
10	U.S. Fire Administration	Staffing for Adequate Fire and Emergency Response Grants (SAFER)	City, Counties, Village, and Township Fire Departments	1. Rehiring of laid off firefighters 2. Hiring of new firefighters	Salary and associated benefits for rehired and new firefighters	See program guidance
11	U.S. Fire Administration	Fire Prevention and Safety Grants (FP&S)	City, Counties, Village, and Township Fire	1. Public education 2. Arson prevention 3. Prevention-related training 4. Fire prevention activities 5. Risk assessments	Cost-share matching fund requirements dependent upon size of population served by Fire Department	See program guidance
12	U.S. Fire Administration	Fire Management Assistance Grants	States, Indian tribal governments, and local governments	Provides assistance for the mitigation, management, and control of any fire burning on publicly or privately owned forest or grassland that threatens such destruction as would constitute a major disaster	75 percent Federal cost-share assistance; 25 percent State and local match[d]	Rolling
13	U.S. Fire Administration	National Fire Academy	Persons with substantial involvement in fire prevention and control, emergency medical services, fire-related emergency management activities, or allied professions	Provides tuition-free training in fire fighting, prevention, emergency medical services, and related areas	Provides tuition-free training in fire fighting, prevention, emergency medical services, and related areas	June 15 for fall semester, December 15 for spring semester

FINAL DRAFT

Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
14	U.S. Fire Administration	National Fire Academy Training Assistance Student Stipend Reimbursement Program	Members of fire departments or sponsoring department	Provides travel stipends for students attending National Fire Academy courses	Travel reimbursement	Rolling
15	U.S. Department of Homeland Security Office for Domestic Preparedness (ODP)	Urban Area Security Initiative	States working with metropolitan urban governments administer funding	Assistance for planning, equipment, training and exercise programs to prevent, respond to and recover from threats or acts of terrorism	Amounts are awarded to the state and vary based on need and scope of project	Early December
16	U.S. Army Corps of Engineers (USACE)	Small Flood Damage Reduction Program	State and local units of government	1. Projects designed to reduce the impact of flood events 2. Projects must be designed and constructed by the Corps	50 to 65 percent Federal cost-share assistance above $100,000; 35 to 50 percent local match is required; federal assistance provided for total project implementation cannot exceed $7 million	None
17	USACE	Clearing and Snagging for Flood Control Program	State and local units of government	1. Removal of obstructions that restrict floodflows of navigable waters 2. Projects must be designed and constructed by the Corps	Project studies are in most cases at Federal expense; 65 percent Federal cost-share assistance is provided for project implementation and cannot exceed $500,000; a local match of 35 percent is required	None
18	USACE	Emergency Bank Protection Program	Local communities	1. Bank protection of highways, highway bridges, essential public works, churches, hospitals, schools, and other nonprofit public services from flood induced erosion	Federal share cannot exceed $1,500,000 for a given project; cost-share program with local match of 35 percent for design and construction required	- -
19	USACE	Small Hurricane and Storm Damage Reduction Program	State agencies and local units of government	1. Beach nourishment 2. Floodproofing 3. Other structural and nonstructural storm damage reduction projects	Federal share cannot exceed $5,000,000 for a given project; cost-share program with local match of 35 percent for design and construction required	- -
20	USACE	Water Resources Development and Flood Control Acts	Local governments	1. Water resources planning assistance 2. Emergency streambank and shoreline protection	50 percent for studies and 65 percent for project implementation of Federal cost-share assistance; 35 to 50 percent local match is required	None

FINAL DRAFT

Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
21	USACE	Flood Hazard Mitigation and Riverine Ecosystem Restoration Program	Local governments	1. Flood hazard mitigation to include relocation of threatened structures 2. Riverine ecosystem restoration such as conservation or restoration of natural floodwater storage areas 3. Planning activities to determine responses to future flood situations 4. Project areas must be in a floodplain	50 percent for studies and 65 percent for project implementation of Federal cost-share assistance; 35 to 50 percent local match is required	Undetermined
22	U.S. Department of Agriculture, Farm Services Agency (FSA)	Conservation Reserve Program	Individual landowners in a 10- or 15-year contract	1. Riparian buffers 2. Trees 3. Windbreaks 4. Grassed waterways	50 percent Federal cost-share assistance; 50 percent local match from individual; an annual rental payment for the length of the contract is also provided	Annually or ongoing[d]
23	FSA	Conservation Reserve Enhancement Program	Individual landowners in a 10- or 15-year contract	1. Filter strips 2. Riparian buffers 3. Grassed waterways 4. Permanent grasses (only in specially designated grassland project areas) 5. Wetland development and restoration	50 percent Federal cost-share assistance; one-time signing incentive payment (up to $150 per acre); practice incentive payment (about 40 percent of cost of establishing practice); annual rental payment; State of Wisconsin lump sum payment; Wisconsin practice incentive payment (about 20 percent of cost of establishing practice)	Ongoing
24	U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS)	Watershed Protection and Flood Prevention Program	State and local units of government	1. Watershed protection 2. Flood prevention measures 3. Projects are intended to be larger scale 4. Watersheds can be no larger than 250,000 acres	$85.0 million available nationally[e]; technical assistance and cost-sharing are provided; up to 100 percent Federal cost-share assistance for flood control prevention; typical project range is $3.5 to $5.0 million in Federal financial assistance	Ongoing
25	NRCS	Emergency Watershed Protection Program	Individual landowners provided they have a local sponsor such as a local unit of government	1. Sale of agricultural floodprone lands to NRCS for floodplain easements 2. Land must have a history of repeated flooding (at least twice in the past 10 years) 3. Landowner retains most of the rights as before the sale 4. NRCS has authority to restore the floodplain function and value	The USDA pays the landowner one of three options: a geographic rate, a value based on the assessment of the land in agricultural production, or an offer made by the landowner; 75 percent Federal cost-share assistance; 25 percent local match is required[f]	Variable

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Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
26	NRCS	Environmental Quality Incentives Program	Individual landowner in a three-year contract	1. Animal waste management practices 2. Soil erosion and sediment control practices 3. Nutrient management 4. Groundwater protection 5. Habitat improvement	Up to 75 percent Federal cost-share assistance; 25 percent local match is required	Annually
27	NRCS	Emergency Conservation Program	Individual landowners	1. Regrading and shaping farmland 2. Restoring conservation structures 3. Redistribution of eroded soil 4. Debris removal 5. Projects must be in response to a natural disaster	Up to 64 percent federal cost-share assistance, the remaining percentage is the landowner's responsibility	After a designated State or presidential disaster declaration
28	U.S. Fish and Wildlife Service	North American Wetlands Conservation Program	Private or public organizations	1. Land acquisition 2. Restoration, management, and enhancement of wetland ecosystems and other habitat for migratory birds and other fish and wildlife	Provides up to $75,000 for small grants and $75,000 - $1 million for standard grants. Match share varies on grant-by-grant basis, but must be at least 50 percent of project costs	Standard grants due in March and July Small grants due in October
29	U.S. Department of Housing and Urban Development (HUD)	Community Development Block Grant Program	Local governments	1. Public Facilities Grants to fund tornado shelters and safe houses 2. Housing Grants to fund the rehabilitation of housing to meet current building codes 3. Funds continuous training course for the building code authority	75 to 100 percent Federal cost-share assistance; 0 to 25 percent local match may be required	- -
30	HUD	Healthy Homes Production Grant Program	State, tribal, and local governments	1. Identify and remediate priority (significant) housing-related health and safety hazards in privately owned, low income rental or owner occupied housing, 2. Projects that comprehensively address multiple residential health and safety hazards	Up to $2,000,000 Federal assistance, minimum 10 percent match required	June 9
31	HUD and Wisconsin Department of Commerce, Division of Housing and Community Development	Community Development Block Grant Program	Local governments	1. Emergency response activities related to flood events 2. Long-term needs related to flooding issues	75 to 100 percent Federal cost-share assistance; 0 to 25 percent local match may be required	After a Presidential disaster declaration

Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
32	U.S. Small Business Administration	Disaster Loan Program	Homeowners, renters, and businesses	1. Property repair 2. Property replacement 3. Meeting building code requirements 4. Involuntary relocations out of a special flood hazard area	Low interest loans	After a Presidential disaster declaration
33	U.S. Environmental Protection Agency (EPA)	Targeted Watershed Grants	Watershed organizations nominated by State Governors or Tribal leaders	1. Watershed-based projects to protect water resources 2. Training and technical assistance to local partnerships	75 percent maximum Federal cost-share assistance. Minimum 25 percent nonFederal match	November
34	EPA	Pesticide Environmental Stewardship Grants	State government, including state agencies	1. Implementation of pollution control measures 2. Plan development which includes strategies to reduce pesticide risk	Approximately $500,000 available nationally[b]; locally grants are provided up to a maximum of $50,000	Ongoing
35	EPA	Environmental Education Grants Program	Local or State education agencies, colleges, and nonprofit organizations, State environmental agencies, and noncommercial education broadcasting agencies	1. Improving environmental education teaching skills 2. Educating teachers, students, or the public about human health problems 3. Building capacity for environmental education programs 4. Education communities 5. Educating the public through print, broadcast, or other media	$3.4 million available nationally,[b] locally, grants are for $5,000; $5,000 to $25,000; and up to $125,000, up to 75 percent of the project cost, a 25 percent match in required	Mid-November
36	EPA, Office of Solid Waste and Emergency Response	Chemical Emergency Preparedness and Prevention (CEPP) Technical Assistance Grants Program	State, County, tribal and local government and agencies	1. Provides assistance for activities that relate to the Risk Management Program under the Clean Air Act (Section 112(r)) 2. Development of technical assistance or similar materials that could be used directly or adapted by other States of Local Emergency Planning Committees (LEPCs)	Average assistance given to each state annually is $37,000	Contact regional EPA office for deadlines

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Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
37	U.S. Department of Health and Human Services, Health Resources and Services Administration	Emergency Medical Services for Children	State governments and schools of medicine	1. Provides assistance for improvement and expansion of trauma and critical emergency medical services for children 2. Preferred programs provide assistance to populations with special needs (Native Americans, minorities, and the disabled)	No statutory matching requirements. Grants generally range from $115,000 to $2 million. Average grant awarded is $232,000 (2010). Amounts awarded vary based on the scope of the project	Rolling
38	U.S. Department of Health and Human Resources, National Institutes of Health	National Institute of Environmental Health Sciences (NIEHS) Hazardous Waste Worker Health and Safety Training	Public and private nonprofit organizations involved in hazardous waste cleanup	1. Assists organizations in the development of institutional competency to provide appropriate training and education to hazardous waste workers 2. Assists in development of model worker health and safety training programs consisting of classroom and practical health and safety training of workers in the treatment, storage, disposal, removal, containment, transportation or hazardous materials 3. Provides assistance for training and education emergency response in regards to a hazardous waste incident	No statutory matching requirements. Grants generally range from $24,000 to $3.4 million. Average grant awarded is $1.1 million (2010)	Contact NIEHS headquarters for deadlines
39	U.S. Department Of Transportation (USDOT)	Transportation Enhancement Program	State and local units of government	1. Land acquisition for: scenic easements, pedestrian and bike trails, and abandoned railway corridors	50 percent Federal cost-share assistance; 50 percent local match is required	Contact State Transportation Enhancement Manager
40	Wisconsin Department of Administration	Wisconsin Coastal Management Grant Program	State and local units of government, nonprofit organizations, and tribal agencies	Enhancement and restoration of coastal resources within the state's coastal zone	Approximately $1,500,000 is available to all counties adjacent to Lakes Superior and Michigan,	November 7
41	Wisconsin Department of Administration Division of Intergovernmental Relations	Comprehensive Planning Grant Program	Cities, villages, towns and counties	Helps communities adopt land use plans that address issues of urban sprawl and transportation infrastructure	Finance the cost of developing a comprehensive plan for eligible applicants. No grants will be awarded in 2011, funding may resume in 2012	- -
42	Wisconsin Department of Commerce Division of Housing and Community Development	Home Investment Partnerships Program	Local Communities	Supports rental rehabilitation, weatherization related repairs, accessibility improvements and rental housing development	75 percent Federal cost-share assistance; 25 percent homeowner match	- -

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Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
43	Wisconsin Department of Health Services (WDHS)	Special Needs Technical Assistance	Local Communities	Technical assistance to determine if an actual or potential human service and/or population threat is present	Provide technical assistance and support	- -
44	WDHS	Chemical Contamination Technical Assistance	Local Communities	Technical assistance can determine if an actual or potential public health threat is present and if hazard mitigation is warranted or desirable	Provide technical assistance and support	- -
45	WDHS	Communicable or Infectious Diseases Technical Assistance	Local Communities	Technical assistance to determine if an actual or potential human threat is present	Provide technical assistance and support	- -
46	Wisconsin Department of Natural Resources (WDNR)	Municipal Flood Control Grants Chapter NR 199 of the *Wisconsin Administrative Code*	Cities, villages, towns, metropolitan sewerage districts	1. Acquisition and removal of structures 2. Flood proofing and elevation of structures 3. Riparian restoration projects 4. Acquisition of vacant land or purchase of easements 5. Construction of stormwater and groundwater facilities related to flood control and riparian restoration projects 6. Flood mapping	70 percent State cost-share assistance; 30 percent local match	Tentatively April 15
47	WDNR	Stewardship Grant Program, Urban Green Space Program	Local units of government , lake protection and rehabilitation districts, and nonprofit conservation organizations	1. Land acquisition for greenway space in urban areas, protection of scenic or ecological features, and wildlife habitat improvement	50 percent State cost-sharing assistance; 50 percent local match is required	- -
48	WDNR	Remediation and Redevelopment Spills and Releases program	Responsible Party	Provide technical assistance and support within the agency and to those outside the agency	Provide technical assistance and support	Department will take emergency action to remove or contain a spill at the expense of the responsible party
49	WDNR	Lake Management Planning Grant Program, Chapter NR 190 of the *Wisconsin Administrative Code*	Local units of governments, lake districts, and nonprofit conservation organizations	1. Gathering and analyzing water quality information 2. Land use planning within lake watersheds 3. Gathering and compiling demographic information pertinent to individual lakes 4. Developing lake management plans	Up to 75 percent State cost-share assistance, not to exceed $10,000; 25 percent local match is required; lakes are eligible for more than one grant, however, the total amount of State dollars cannot exceed $100,000	February 1 and August 1

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Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
50	WDNR	Lake Protection and Classification Grant Program, Chapter NR 191 of the *Wisconsin Administrative Code*	Local units of government, lake districts, and nonprofit conservation organizations	1. Land acquisition for easement establishment 2. Wetland restoration 3. Lake restoration projects 4. Other projects involving lake improvement	75 percent State cost-share which cannot exceed $200,000; 25 percent local match is required	May 1
51	WDNR	Knowles-Nelson Stewardship Grant Program, Chapter NR 47 of the *Wisconsin Administrative Code*	Local government and nonprofit conservation organizations	1. Streambank protection projects 2. Land acquisition of stream corridors for water quality improvement	50 percent State cost-share assistance; 50 percent local match is required	May 1
52	WDNR	Urban Rivers Grant Program	Local government and nonprofit conservation organizations	1. Land acquisition to preserve open areas in urban environments adjacent to streams and rivers	50 percent State cost-share assistance; 50 percent local match is required	May 1
53	WDNR	Urban Nonpoint Source and Stormwater Grants Program. Funding is through Chapter NR 155 of the *Wisconsin Administrative Code*	Local units of government	1. Planning 2. Educational and information activities 3. Ordinance development and enforcement 4. Training 5. Storm water detention ponds 6. Streambank and shoreline stabilization	70 percent State cost-share assistance for projects not involving construction, requiring a 30 percent local match; 50 percent State cost-share assistance for projects involving construction, requiring a 50 percent local match	April 1
54	WDNR	Nonpoint Targeted Runoff Management Grants, Chapter 120 of the *Wisconsin Administrative Code*; in the future, specific rural nonpoint source abatement measures will be funded under proposed Chapter NR 151 of the *Wisconsin Administrative Code*	Local units of government	1. Complying with nonpoint source performance standards 2. Improving 303(d) waters 3. Protecting outstanding water resources 4. Compliance with a notice of discharge for an animal feeding operation 5. Addressing a water quality concern of national or statewide importance, such as the Upper Mississippi River concerns	70 percent State cost-share assistance; 30 percent local match is required. Grant awards not to exceed $150,000	May 1

Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
55	WDNR	River Protection Grant Program, Chapter NR 195 of the *Wisconsin Administrative Code*	Local units of government and nonprofit conservation organizations	1. Activities designed to develop partnerships that protect river ecosystems 2. Educational projects 3. Activities associated with river management plan development 4. Land acquisition 5. Ordinance development 6. Installation of practices to control nonpoint source pollution	75 percent State cost-share assistance; 25 percent local match is required; Planning grants not to exceed $10,000, and Management grants not to exceed $50,000	May 1
56	Wisconsin Emergency Management	Hazard Mitigation Grant Program	State and local units of government	1. Mitigation Planning 2. Technical Assistance 3. Mitigation Projects	75 percent Federal cost-share assistance; 25 percent local match	Contact State Hazard Mitigation Officer
57	Wisconsin Office of Justice Assistance	Wisconsin Homeland Security Grant Program	State and local government units that must comply with HSPD-5	1. NIMS and ICS training courses	Statewide $190,000 will be available	November 30
58	Wisconsin Public Service Commission	Telecommunications, Water, Gas and Electric Divisions	Local Communities	Incorporate disaster resistance into Regulation development, land use practices and environmental impacts of public utilities	General Utility Assistance	- -
59	University of Wisconsin Cooperative Extension	Extension Disaster Education Network	Local communities	Provides Community education and public information programs promoting hazard awareness and mitigation concepts	Education and Information provided through the University of Wisconsin System	- -
60	Eastman Kodak	American Greenway Grants	Land trusts, local units of government, and nonprofit organizations	1. Ecological assessments 2. Mapping and surveying 3. Planning activities 4. Creative projects that work to establish greenways in communities 5. Must have matching funds from other sources 6. Must show that the project will be completed	Grants with a maximum amount of $2,500	June 15
61	Great Lakes Protection Fund	Great Lakes Protection fund	State and local units of government, nonprofit organizations and individuals	1. To improve the health of the Great Lakes 2. To promote the interdependence of healthy ecological and economic systems 3. To support innovative, creative, and venturesome ideas	Finance the total cost of accepted projects	Continuous applications process

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Table F-1 (continued)

Reference Number	Administrator of Grant Program	Name of Funding Program	Eligibility	Types of Projects and Funding Eligibility Criteria	Assistance Provided	Application Deadline
62	Joyce Foundation	Joyce Foundation Grant program	State and local units of government, nonprofit organizations and individuals	1. To improve the health of the Great Lakes 2. To promote the interdependence of healthy ecological and economic systems 3. To support innovative, creative, and venturesome ideas 4. Developing improved regulatory approaches 5. Better understanding of the supply of and demand for Great Lake 6. Creating transportation alternatives to reduce over reliance on automobiles	Finance the total cost of accepted projects	Grant proposals are considered at meetings of the Foundation's Board of Directors in April, July, and December
63	National Fish and Wildlife Foundation (NFWF)	Wal-Mart Stores, Inc. Acres for America Program	State and local units of government, nonprofit conservation organizations	1. Acquisition of permanent easement for conservation of habitat	$2.5 million available nationally annually; minimum 50 percent local match required, higher local match preferred	Preproposals due April 1 and September 1 Full proposals due June 1 and November 1
64	NFWF	Five-star Restoration Program	Public or private organizations that engage in community-based restoration projects	1. Wetland restoration projects 2. Riparian restoration projects 3. Projects must be part of a larger watershed project 4. Projects must have at least five contributing parties	$225,000 available nationally annually; project awards range from $10,000 to $40,000, average award $20,000; minimum 50 percent local match required, higher local match preferred	February
65	NFWF	Sustain Our Great Lakes Community Grant Program	State and local units of government, nonprofit organizations	1. Wetland restoration, enhancement, and protection projects 2. Tributary restoration, enhancement, and protection projects 3. Shoreline restoration, enhancement, and protection projects 4. Projects must be in the Great Lakes watershed	Grant awards range from $25,000 to $150,000. No match is required; however, the ratio of matching funds offered is considered during review	October 15

[a] *The nonFederal share is 25 percent. In Wisconsin, the State Division of Emergency Management pays 12.5 percent and the local community pays 12.5 percent.*

[b] *Funding available on an annual basis.*

[c] *Municipalities must have a flood mitigation plan to be eligible for a project grant.*

[d] *The individual fire cost threshold for a State is the greater of $100,000 or five percent x $1.07 x state population. The cumulative fire cost threshold for a State is the greater of $500,000 or three times the five percent x $1.07 x State population. Both formulas are adjusted annually for inflation using the Consumer Price Index for All Urban Consumers published annually by the Department of Labor.*

[e] *Available on an annual basis.*

[f] *In kind services are allowed as a part of the local cost-share assistance.*

Source: FEMA, Department of Homeland Security, U.S. Environmental Protection Agency, Wisconsin Department of Natural Resources, U.S. Department of Justice, Wisconsin Emergency Management, the State of Wisconsin and SEWRPC.

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Appendix G

FUNDING PROGRAMS CONTACT INFORMATION[a]

Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
U.S. Department of Homeland Security, Federal Emergency Management Agency (FEMA)	Hazard Mitigation Grant Program Pre-Disaster Mitigation Program Flood Mitigation Assistance Program Repetitive Flood Claims Program Severe Repetitive Loss Program	Federal Emergency Management Agency Region V 6th Floor 536 S. Clark St. Chicago, IL 60605	(312) 408-5500	http://www.fema.gov/government/grant/hma/index.shtm
FEMA	Public Assistance Program	U.S. Department of Homeland Security Federal Emergency Management Agency Public Assistance Division 500 C Street, SW Washington, DC 20472	(202) 646-3057	http://www.fema.gov/government/grant/pa/index.shtm
FEMA	National Training and Education Division	U.S. Department of Homeland Security Federal Emergency Management Agency National Training and Education Division 500 C Street, SW Washington, DC 20472	(800) 368-6498	http://www.fema.gov/prepared/train.shtm
FEMA	Homeland Security Preparedness Technical Assistance Program	U.S. Department of Homeland Security Room 427 Centralized Scheduling and Information Desk 500 C Street, SW Washington, DC 20472	(800) 368-6498	http://www.fema.gov/about/divisions/pppa_ta.shtm
U.S. Department of Homeland Security, FEMA, U.S. Fire Administration	Assistance to Firefighters Grants Program Staffing for Adequate Fire and Emergency Response Grants Fire Prevention and Safety Grants National Fire Academy Fire Management Assistance Grants	U.S. Fire Administration 16825 S. Seton Avenue Emmitsburg, MD 21727	(301) 447-1000	http://www.usfa.dhs.gov/fireservice/grants/index.shtm

Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
U.S. Department of Homeland Security, Office for Domestic Preparedness	Urban Area Security Initiative grants (UASI)	U.S. Department of Homeland Security 500 C Street, SW Washington, DC 20472	(202) 646-2500	http://www.fema.gov/government/grant/hsgp/index.shtm
U.S. Army Corps of Engineers (USACE)	Small Flood Control Projects Program Snagging and Clearing for Flood Control Emergency Bank Protection Program Water Resources Development and Flood Control Acts Small Hurricane and Storm Damage Reduction Program	U.S. Army Corps of Engineers Detroit District 477 Michigan Avenue Detroit, MI 48231-1027	(313) 226-6762	www.usace.army.mil
USACE	Flood Hazard Mitigation and Riverine Ecosystem Restoration Program	U.S. Army Corps of Engineers Planning Division 20 Massachusetts Ave, NW Washington, DC 20314	(202) 761-0115	www.usace.army.mil
USDA, Farm Services Agency (FSA)	Conservation Reserve Program Conservation Reserve Enhancement Program	U.S. Department of Agriculture Farm Service Agency 1012 Vine Street Union Grove, WI 53182	(262) 878-1234	www.fsa.usda.gov
USDA, Natural Resources Conservation Service (NRCS)	Watershed Protection and Flood Prevention Program	Headquarters: Department of Agriculture Natural Resources Conservation Service P.O. Box 2890 Washington, DC 20013	(202) 720-3534	http://www.nrcs.usda.gov/programs/watershed
NRCS	Emergency Watershed Protection Program	U.S. Department of Agriculture Natural Resources Conservation Service 8030 Excelsior Drive, Suite 200 Madison, WI 53717-2906	(608) 662-4422	http://www.nrcs.usda.gov/programs/ewp/
U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)	Environmental Quality Incentives Program Emergency Conservation Program	U.S. Department of Agriculture Natural Resources Conservation Service 1012 Vine Street Union Grove, WI 53182	(262) 878-1234	http://www.nrcs.usda.gov/programs/eqip/ http://www.nrcs.usda.gov/
U.S. Environmental Protection Agency (EPA)	Targeted Watershed Grants	Erin Collard U.S. Environmental Protection Agency Office of Wetlands, Oceans, and Watersheds 1200 Pennsylvania Avenue, NW Washington, DC 20460	- -	http://www.epa.gov/twg
EPA	Environmental Education Grants	U.S. Environmental Protection Agency Office of Environmental Education (1704) 1200 Pennsylvania Avenue NW Washington, DC 20460 initiative.watershed@epa.gov	(202) 260-8619	http://www.epa.gov/enviroed/grants.html

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Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
EPA	Pesticide Environmental Stewardship Grants	U.S. Environmental Protection Agency Office of Prevention, Pesticides, and Toxic Substances Office of Pesticides Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460	(703) 308-7035	www.epa.gov/oppbppd1/PESP
EPA	Chemical Emergency Preparedness and Prevention Technical Assistance Grants Program	U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response Ariel Rios Building 1200 Pennsylvania Avenue, NW Washington, DC 20460	(202) 564-6174	http://www.epa.gov/emergencies/
U.S. Fish and Wildlife Service	North American Wetlands Conservation Fund	U.S. Fish and Wildlife Service Division of Bird Habitat Conservation 4401 North Fairfax Drive Arlington, VA 22203	(703) 358-1784	http://www.fws.gov/birdhabitat/Grants/NAWCA/index.shtm
U.S. Department of Health and Human Services, Health Resources and Services Administration	Emergency Medical Services for Children	Health Resources and Services Administration U.S. Department of Health and Human Services Parklawn Building 5600 Fishers Lane Rockville, Maryland 20857	(301) 443-1312	http://www.hrsa.gov
U.S. Department of Health and Human Resources, National Institutes of Environmental Health Sciences	National Institute of Environmental Health Sciences Hazardous Waste Worker Health and Safety Training	National Institutes of Environmental Health Sciences Worker Education and Training Program P.O. Box 12233 Research Triangle Park, NC 27709	(919) 541-5147	http://www.niehs.nih.gov/careers/hazmat/index.cfm
U.S. Department of Housing and Urban Development (HUD)	Community Development Block Grant Program	U.S. Department of Housing and Urban Development 451 7th Street, SW Washington, DC 20410	(202) 708-1322	http://www.hud.gov/offices/cpd/communitydevelopment/programs/drsi/index.cfm
HUD	Healthy Homes Production Grant Program	U.S. Department of Housing and Urban Development Room 8236 451 7th Street, SW Washington, DC 20410	(202) 402-5769	http://portal.hud.gov/portal/page/portal/HUD
U.S. Small Business Administration	Disaster Loan Program	U.S. Small Business Administration Disaster Loan Program 101 Marietta Street NW Atlanta, GA 30303-2725	(404) 331-0333	www.sba.gov/services/disasterassistance/index.html

Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
U.S. Department of Transportation	Transportation Enhancement Program	U.S. Department of Transportation 400 Seventh Street, SW Washington, DC 20590	(202) 366-4000	www.dot.gov
Wisconsin Department of Administration (WDOA)	Comprehensive Planning Grant	Department of Administration Division of Intergovernmental Relations P.O. Box 8944 Madison, WI 53708	(608) 267-3369	http://www.doa.wi.gov/compplanning
DOA	Wisconsin Coastal Management Program	Department of Administration 101 East Wilson Street Madison, WI 53702	(608) 267-6917	http://www.doa.state.wi.us/category.asp?linkcatid=751&linkid=65&locid=9
Wisconsin Department of Commerce	Community Development Block Grants	WI Department of Commerce Division of Community Development 201 West Washington Avenue Madison, WI 53707-7970	(608) 267-3682	http://commerce.wi.gov/
Wisconsin Department of Commerce Division of Housing and Community Development	Home Investment Partnerships Program	WI Department of Commerce Division of Community Development 201 West Washington Avenue Madison, WI 53707-7970	(608) 267-9185	http://commerce.wi.gov/
Wisconsin Department of Health Services (WDHS)	Chemical Contamination	Department of Health and Family Services Bureau of Environmental and Occupational Health 1 W. Wilson Street Madison, WI 53702	(608) 264-9880	http://www.dhs.wisconsin.gov/
WDHS	Communicable and Infectious Diseases	Department of Health and Family Services Bureau of Communicable Diseases 1 W. Wilson Street Madison, WI 53702	(608) 267-9363	http://www.dhs.wisconsin.gov/
Wisconsin Department of Natural Resources (WDNR)	Lake Planning Grant Program Lake Protection Grant Program	Wisconsin Department of Natural Resources Lake Coordinator-Southeast Region 141 NW Barstow Street, Room 180 Waukesha, WI 53188 UWEX-Lakes Partnership UW-Stevens Point 1900 Franklin Street Stevens Point, WI 54481	(262) 547-2130 (715) 346-2116	http://dnr.wi.gov/caer/cfa/Grants/Largelake.html http://dnr.wi.gov/caer/cfa/Grants/smalllake.html http://www.uwsp.edu/cnr/uwexlakes/grants
WDNR	Municipal Flood Control Grants	Wisconsin Department of Natural Resources Grant Program Manager-CF/2 P.O. Box 7921 Madison, WI 53707-7921	(608) 267-7152	http://dnr.wi.gov/org/caer/cfa/EF/flood/grants.html

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Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
WDNR	Stewardship Grant Program Urban Rivers Grant Program River Protection Grant Program	Wisconsin Department of Natural Resources 2300 N. Dr. Martin Luther King Jr. Drive P.O. Box 12436 Milwaukee, WI 53212	(414) 263-8610	http://dnr.wi.gov/org/caer/cfa/LR/Stewardship/Local/descrip.html http://dnr.wi.gov/org/water/rivers/grants/
WDNR	Targeted Runoff Management Grants Urban Nonpoint Source and Storm Water Grants Program	Wisconsin Department of Natural Resources Bureau of Watershed Management P.O. Box 7921 Madison, WI 53707-7921	(608) 267-7568	http://dnr.wi.gov/runoff/grants/
WDNR	Remediation and Redevelopment Program	Wisconsin Department of Natural Resources 2300 N. Dr. Martin Luther King Jr. Drive P.O. Box 12436 Milwaukee, WI 53212	(414) 263-8688	http://dnr.wi.gov/org/aw/rr/
Wisconsin Emergency Management	Hazardous Mitigation Section	Wisconsin Emergency Management 2400 Wright Street PO Box 7865 Madison WI 53707-7865	(608) 242-3232	http://emergencymanagement.wi.gov/
Wisconsin Office of Justice Assistance	Wisconsin Homeland Security Grant Program	Office of Justice Assistance 1 South Pinckney Street, Suite 615 Madison, WI 53703	(608) 266-3323	http://oja.state.wi.us/index.asp?locid=97
Wisconsin Public Service Commission	Public Utilities Assistance	Wisconsin Public Service Commission 610 North Whitney Way, P.O. Box 7854 Madison, Wisconsin 53707-7854	(608) 266-5481	http://psc.wi.gov/
University of Wisconsin – Extension	Extension Disaster Education Network	UW-Extension headquarters 432 N. Lake Street Madison, WI 53706	(608) 262-3980	http://lgc.uwex.edu/Disaster/Index.html
Eastman Kodak	American Greenway Grants	American Greenways The Conservation Fund 1800 North Kent Street, Suite 1120, Arlington, Virginia 22209-3199	(703) 525-6300	http://www.conservationfund.org
Great Lakes Protection Fund	Great Lakes Protection Fund Grants Program	Great Lakes Protection Fund 1560 Sherman Avenue, Suite 880 Evanston, IL 60201	(847) 425-8150	http://www.glpf.org/index.html
Joyce Foundation	Joyce Foundation Grant Program	The Joyce Foundation 70 West Madison Street Suite 2750 Chicago, Illinois 60602	(312) 782-2464	http://www.joycefdn.org/index.html
National Fish and Wildlife Foundation (NFWF)	Five-Star Restoration Program	National Fish and Wildlife Foundation 1133 15th Street, NW, Suite 1100 Washington, DC 20005	(202) 857-0166	http://www.nfwf.org/FiveStar/

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Administrator of Grant Program	Name of Grant Program	Address	Phone Number	Internet Web Address
NFWF	Wal-Mart Stores, Inc. Acres for America Program Sustain Our Great Lakes Program	National Fish and Wildlife Foundation Central Partnership Office 1 Federal Drive St. Paul, MN 55111	(612) 713-5173 (612) 713-5185	http://www.nfwf.org

[a]*A complete listing of U.S. government assistance programs can be found at the Catalog of Federal Domestic Assistance web site:* www.cfda.gov.

Source: SEWRPC.

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Appendix H

GLOSSARY

Asset – Any man-made or natural feature that has value, including, but not limited to people; buildings; infrastructure like bridges, roads, and sewer and water systems; lifelines like electricity and communication resources; or environmental, cultural, or recreational features like parks, dunes, wetlands, or landmarks.

Base Flood – Flood that has a 1 percent probability of being equaled or exceeded in any given year. The base flood is also known as the 1 percent annual probability flood event.

Base Flood Elevation (BFE) – Elevation of the base flood in relation to a specified datum, such as the National Geodetic Vertical Datum of 1929. The Base Flood Elevation is used as the standard for the National Flood Insurance Program.

Bedrock – The solid rock that underlies loose material, such as soil, sand, clay, or gravel.

Building – A structure that is walled and roofed, principally above ground and permanently affixed to a site. The term includes a manufactured home on a permanent foundation on which the wheels and axles carry no weight.

Coastal High Hazard Area – Area, usually along an open coast, bay, or inlet, that is subject to inundation by storm surge and, in some instances, wave action caused by storms or seismic sources.

Coastal Zones – The area along the shore where Lake Michigan meets the land as the surface of the land rises above the Lake. This land/water interface includes beaches, bluffs, and land areas having direct drainage to the Lake.

Community Rating System (CRS) – An NFIP program that provides incentives for NFIP communities to complete activities that reduce flood hazard risk. When the community completes specified activities, the insurance premiums of policyholders in these communities are reduced.

Contour – A line of equal ground elevation on a topographic (contour) map.

Critical Facility – Facilities that are critical to the health and welfare of the population and that are especially important following hazard events. Critical facilities include, but are not limited to, shelters, police and fire stations, and hospitals.

Displacement Time – The average time (in days) which the building's occupants typically must operate from a temporary location while repairs are made to the original building due to damages resulting from a hazard event.

Duration – How long a hazard event lasts.

Earthquake – A sudden motion or trembling that is caused by a release of strain accumulated within or along the edge of earth's tectonic plates.

Erosion – Wearing away of the land surface by detachment and movement of soil and rock fragments, during a flood or storm or over a period of years, through the action of wind, water, or other geologic processes.

Erosion Hazard Area – Area anticipated to be lost to shoreline retreat over a given period of time. The projected inland extent of the area is measured by multiplying the average annual long-term recession rate by the number of years desired.

Essential Facility – Elements that are important to ensure a full recovery of a community or state following a hazard event. These would include: government functions, major employers, banks, schools, and certain commercial establishments, such as grocery stores, hardware stores, and gas stations.

Extent – The size of an area affected by a hazard or hazard event.

Fault – A fracture in the continuity of a rock formation caused by a shifting or dislodging of the earth's crust, in which adjacent surfaces are differentially displaced parallel to the plane of fracture.

Federal Emergency Management Agency (FEMA) – Independent agency created in 1978 to provide a single point of accountability for all Federal activities related to disaster mitigation and emergency preparedness, response and recovery.

Fire Potential Index (FPI) – Developed by USGS and USFS to assess and map fire hazard potential over broad areas. Based on such geographic information, national policy makers and on-the-ground fire managers established priorities for prevention activities in the defined area to reduce the risk of managed and wildfire ignition and spread. Prediction of fire hazard shortens the time between fire ignition and initial attack by enabling fire managers to pre-allocate and stage suppression forces to high fire risk areas.

Flash Flood – A flood event occurring with little or no warning where water levels rise at an extremely fast rate.

Flood – A general and temporary condition of partial or complete inundation of normally dry land areas from: 1) the overflow of inland or tidal waters, 2) the unusual and rapid accumulation or runoff of surface waters from any source, or 3) mudflows or the sudden collapse of shoreline land.

Flood Depth – Height of the flood water surface above the ground surface.

Flood Elevation – Elevation of the water surface above an established datum, e.g. National Geodetic Vertical Datum of 1929, North American Vertical Datum of 1988, or Mean Sea Level.

Flood Hazard Area – The area shown to be inundated by a flood-of a given magnitude on a map.

Flood Insurance Rate Map (FIRM) – Map of a community, prepared by the Federal Emergency Management Agency, that shows both the special flood hazard areas and the risk premium zones applicable to the community.

Flood Insurance Study (FIS) – A study that provides an examination, evaluation, and determination of flood hazards and, if appropriate, corresponding water surface elevations in a community or communities.

Floodplain – Any land area, including watercourse, susceptible to partial or complete inundation by water from any source.

Floodway – The stream channel and that portion of the adjacent floodplain that must remain open to permit passage of the base flood without raising the water surface elevation.

Frequency – A measure of how often events of a particular magnitude are expected to occur. Frequency describes how often a hazard of a specific magnitude, duration, and/or extent typically occurs, on average. Statistically, a hazard with a 100-year recurrence interval is expected to occur once every 100 years on average, and would have a 1 percent chance—its probability—of happening in any given year. The reliability of this information varies depending on the kind of hazard being considered.

Functional Downtime – The average time (in days) during which a function (business or service) is unable to provide its services due to a hazard event.

Geographic Area Impacted – The physical area in which the effects of the hazard are experienced.

Geographic Information Systems (GIS) – A computer software application that relates physical features on the earth to a database to be used for mapping and analysis.

Ground Motion – The vibration or shaking of the ground during an earthquake. When a fault ruptures, seismic waves radiate, causing the ground to vibrate. The severity of the vibration increases with the amount of energy released and decreases with distance from the causative fault or epicenter, but soft soils can further amplify ground motions.

Hazard – A source of potential danger or adverse condition. Hazards include naturally occurring events such as floods, earthquakes, tornadoes, coastal storms, landslides, and wildfires that strike populated areas and man-made events such as hazardous material spills. An event is a hazard when it has the potential to harm people or property.

Hazard Event –A specific occurrence of a particular type of hazard.

Hazard Identification – The process of identifying hazards that threaten an area.

Hazard Mitigation – Sustained actions taken to reduce or eliminate long-term risk from hazards and their effects.

Hazard Profile – A description of the physical characteristics of hazards and a determination of various descriptors including magnitude, duration, frequency, probability, and extent. In most cases, a community can most easily use these descriptors when they are recorded and displayed as maps.

HAZUS (Hazards U.S.) – A GIS-based nationally standardized earthquake loss estimation tool developed by FEMA.

Hydrology – The science of dealing with the waters of the earth. A flood discharge is developed by a hydrologic study.

Infrastructure – Refers to the public services of a community that have a direct impact on the quality of life. Infrastructure includes communication technology, such as phone lines or Internet access; vital services, such as public water supplies and sewer treatment facilities; and includes an area's transportation system, such as airports, heliports; highways, bridges, tunnels, roadbeds, overpasses, railways, bridges, rail yards, depots; and waterways, canals, locks, seaports, ferries, harbors, dry-docks, piers and regional dams.

Intensity – A measure of the effects of a hazard event as a particular place.

Loss of Bearing Strength – Results when the soil supporting structures liquefies. This can cause structures to tip and topple.

Lowest Floor – Under the NFIP, the lowest floor of the lowest enclosed area (including basement) of a structure.

Magnitude – A measure of the strength of a hazard event. The magnitude (also referred to as severity) of a given hazard event is usually determined using technical measures specific to the hazard.

Mitigation Plan – A systematic evaluation of the nature and extent of vulnerability to the effects of natural hazards typically present in the State and includes a description of actions to minimize future vulnerability to hazards.

National Flood Insurance Program (NFIP) – Federal program created by Congress in 1968 that makes flood insurance available in communities that enact minimum floodplain management regulations in 44 CFR §60.3.

National Geodetic Vertical Datum of 1929 (NGVD) – Datum established in 1929 and used in the NFIP as a basis for- measuring flood, ground, and structural elevations, previously referred to as Sea Level Datum or Mean Sea Level. The Base Flood Elevations shown on most of the Flood Insurance Rate Maps issued by the Federal Emergency Management Agency are referenced to NGVD.

National Weather Service (NWS) – Prepares and issues flood, severe weather, and coastal storm warnings and can provide technical assistance to Federal and State entities in preparing weather and flood warning plans.

Planimetric – Describes maps that indicate only man-made features like buildings.

Planning – The act or process of making or carrying out plans; the establishment of goals, policies and procedures for a social or economic unit.

Probability – A statistical measure of the likelihood that a hazard event will occur.

Recurrence Interval – The time between hazard events of similar size in a given location. It is based on the probability that the given event will be equaled or exceeded in any given year.

Repetitive Loss Property – A property that is currently insured for which two or more National Flood Insurance Program losses (occurring more than 10 days apart) of at least $1,000 each have been paid within any 10-year period since 1978.

Replacement Value – The cost of rebuilding a structure. This is usually expressed in terms of cost per square foot, and reflects the present-day cost of labor and materials to construct a building of a particular size, type, and quality.

Richter Scale – A numerical scale of earthquake magnitude devised by seismologist C.F. Richter in 1935.

Risk – The estimated impact that a hazard would have on people, services, facilities, and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage. Risk is often expressed in relative terms, such as a high, moderate, or low likelihood of sustaining damage above a particular threshold due to a specific type of hazard event. It also can be expressed in terms of potential monetary losses associated with the intensity of the hazard.

Riverine – Of or produced by a river.

Scale – A proportion used in determining a dimensional relationship; the ratio of the distance between two points on a map and the actual distance between the two points on the earth's surface.

Scarp – A steep slope.

Scour – Removal of soil or fill material by the flow of flood waters. The term is frequently used to describe storm-induced, localized conical erosion around pilings and other foundation supports where the obstruction of flow increases turbulence.

Seismicity – Describes the likelihood of an area being subject to earthquakes.

Special Flood Hazard Area (SFHA) – An area within a floodplain having a 1 percent or greater chance of flood occurrence in any given year (100-year floodplain); represented on Flood Insurance Rate Maps by darkly shaded areas with zone designations that include the letter A or V.

Stafford Act – The Robert T. Stafford Disaster Relief and Emergency Assistance Act, PL 100-107 was signed into law November 23, 1988, and amended the Disaster Relief Act of 1974, PL 93-288. The Stafford Act is the statutory authority for most Federal disaster response activities, especially as they pertain to FEMA and its programs.

State Hazard Mitigation Officer (SHMO) – The representative of state government who is the primary point of contact with FEMA, other State and Federal agencies, and local units of government in the planning and implementation of pre- and post-disaster mitigation activities.

Storm Surge – Rise in the water surface above normal water level on the open coast due to the action of wind stress and atmospheric pressure on the water surface.

Structure – Something constructed. (See also Building).

Substantial Damage – Damage of any origin sustained by a structure in a Special Flood Hazard Area whereby the cost of restoring the structure to its before-damaged condition would equal or exceed 50 percent of the market value of the structure before the damage.

Surface Faulting – The differential movement of two sides of a fracture—in other words, the location where the ground breaks apart. The length, width, and displacement of the ground characterize surface faults.

Topographic – Characterizes maps that show natural features and indicate the physical shape of the land using contour lines. These maps may also include manmade features.

Tornado – A violently rotating column of air extending from a thunderstorm to the ground.

Vulnerability – Describes how exposed or susceptible to damage an asset is. Vulnerability depends on an asset's construction, contents, and the economic value of its functions. Like indirect damages, the vulnerability of one element of the community is often related to the vulnerability of another. For example, many businesses depend on uninterrupted electrical power—if an electric substation is flooded, it will affect not only the substation itself, but a number of businesses as well. Often, indirect effects can be much more widespread and damaging than direct ones.

Vulnerability Assessment – The extent of injury and damage that may result from a hazard event of a given intensity in a given area. The vulnerability assessment should address impacts of hazard events on the existing and future built environment.

Wave Runup – The height that the wave extends up to on steep shorelines, measured above a reference level (the normal height of the sea, corrected to the state of the tide at the time of wave arrival).

Wildfire – An uncontrolled fire spreading through vegetative fuels, exposing, and possibly consuming structures.

Zone – A geographical area shown on a Flood Insurance Rate Map (FIRM) that reflects the severity or type of flooding in the area.

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Appendix I

CITY OF MILWAUKEE ADOPTING RESOLUTION

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City of Milwaukee
Text File
As of May 20, 2005
Resolution

200 E. Wells Street
Milwaukee, Wisconsin
53202

Introduced: 3/16/2005 **File Number:** 041597

Status: Passed **Version:** 0

Sponsors: THE CHAIR

Resolution approving an All Hazards Mitigation Plan for the City of Milwaukee. (DPW)

With this resolution the City adopts an All Hazards Mitigation Plan for the City of Milwaukee. The plan was prepared under the terms of an agreement between the City and the Southeastern Wisconsin Regional Plan Commission (SEWRPC). Grant funds have been used to pay for SEWRPC's work with the City providing an in-kind match. The plan identifies various potential hazards (primarily natural such as weather events) that the City could face and describes what can or should be done to mitigate them. Preparation and adoption of the plan is required by the Federal Emergency Management Administration in order for the City to be eligible for disaster assistance in the event of an actual disaster.

Whereas, The City of Milwaukee must adopt an All Hazards Mitigation Plan in order to be eligible for various federal disaster relief programs; and

Whereas, The City of Milwaukee received a $16,500 planning grant from the Federal Emergency Management Administration to prepare such a plan; and

Whereas, The City then entered into an agreement with the Southeastern Wisconsin Regional Plan Commission whereby SEWRPC would prepare the plan with in-kind assistance from the City having a value of at least $5,500; and

Whereas, The All Hazards Mitigation Plan for the City of Milwaukee has now been completed; and

Whereas, The Plan has been reviewed and found to be satisfactory by the funding agency; and

Whereas, A copy of the plan is attached to this file; and

Whereas, An open public meeting allowing all interested parties to hear a presentation on the plan and to express their opinions was held by the City of Milwaukee Public Safety Committee on March 24, 2005; and

Whereas, A seven member task force representing agencies responsible for preventing and/or responding to various hazards that could potentially affect the community met on several occasions to review and guide plan preparation; and

Whereas, The All Hazards Mitigation Plan incorporates the findings and recommendations contained in the previously adopted Flood Mitigation Plan; now, therefore, be it

Resolved, By the Common Council of the City of Milwaukee, that the All Hazards Mitigation Plan attached to this file is hereby approved; and, be it

Further Resolved, That copies of the Plan be circulated to the various agencies that are responsible for preventing or responding to the hazards addressed in the Plan; and, be it

Further Resolved, That the appropriate City officers are hereby directed to consider the recommendations of the Plan in their planning and programming activities.

JJM:THM:ph
2/28/05
DOC: All Hazards Plan resolution.rtf