

# **Floodplain Management Plan**

*Draft (July 2005)*

## INTRODUCTION

The City of Portsmouth, like all of the cities of Southside Hampton Roads, faces the year round threat of flooding resulting from winter/spring coastal storms and summer/fall hurricanes. Given Portsmouth's proximity to the Chesapeake Bay and the number of tidal rivers around or within its boundaries, many areas of the city face the threat of damage resulting from rising water associated with storm surges. Also, the city's relatively low elevations result in non-tidal related flooding of streets and private property which are located within and outside the floodplains. This flooding is related to the inability of large volumes of rainwater to drain through the storm drain system during times of high tides.

The recent flooding produced by Hurricane Isabel in September 2003 was the worst the City of Portsmouth residents had witnessed since that from a coastal storm, the Ash Wednesday Storm, on March 7, 1962. These two storms, Isabel and the Ash Wednesday Storm, approached the benchmark set by the hurricane of 1933. In addition, the City of Portsmouth has experienced numerous occasions where street and minor property flooding has occurred as a result of smaller storms and substantial rainfalls at times of high tides. Although

major flooding from a storm event has just been experienced, it does not lessen the reality of potential that Portsmouth's location renders it vulnerable to a storm path and resulting damages year round. Hurricane Isabel was at best a very weak Category I storm when it reached Portsmouth. Had the storm been greater in strength the damage would have



**Flooding on High Street in front of the Social Services Building during surge of Hurricane Isabel 2003.**

been increased by several factors. As evidenced by the near miss of Hurricane Hugo in 1990, a major coastal storm or hurricane can result in property damages in the billions of dollars if a Tidewater Virginia landfall occurs. Therefore, preparations and planning for such an event can lessen or mitigate the damages resulting from a storm when it does occur.

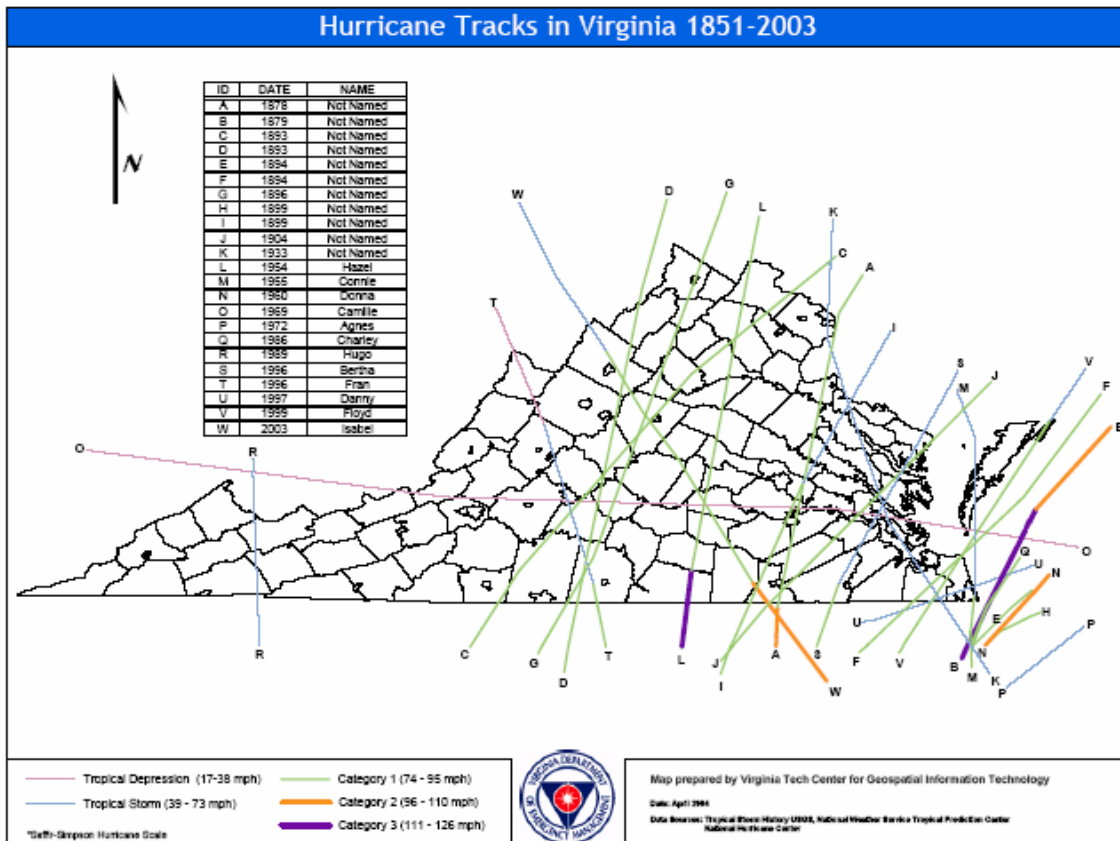
In 1970, Portsmouth became a participating community in the National Flood Insurance Program (NFIP) under emergency procedures. In 1983, after mapping was completed, Portsmouth became a "regular" participating community. This participation enabled citizens to obtain flood insurance protection for their properties. As a participating NFIP locality, Portsmouth is eligible to join the Community Rating System (CRS), which is a

program whereby communities that meet the requirements of the program will obtain for their citizens reductions in flood insurance policy premiums. A reduction of 5% in the first year could increase to as much as 10-15% in later years. One avenue for gaining CRS credit is the development of a floodplain management plan which identifies the activities that the community will undertake to increase preparedness for future flood episodes and a repetitive loss plan to address those properties that are constructed or located as to have received multiple damages from flooding conditions. These activities for both plans range from public information efforts to capital improvements, which mitigate potential flood damage. Given Portsmouth's susceptibility to future flood events and the need to assess the activities most likely to reduce future flood damage, the plan's recommendations outline various actions to be taken to help mitigate potential flood damage and reduce the number of structures that are damaged repetitively in the City of Portsmouth.

## FLOOD HISTORY

The City of Portsmouth and the Hampton Roads region have witnessed a number of hurricanes and coastal storms over the past 300 years. Probably the most famous prior to this century occurred in 1749. This storm was so severe that it reshaped a portion of Norfolk's Chesapeake Bay shoreline by creating a spit of land approximately two miles long and a quarter mile wide. This area is known as Willoughby Spit and has become a substantial residential area.

In the 20<sup>th</sup> century, Portsmouth has had numerous instances of substantial flooding relating to coastal storms or hurricanes. The greatest of these storms occurred in 1933



("K" on the map) resulted in the highest recorded tides in history at 8 feet above mean sea level in the harbor (Isabel recorded a 7.89 feet high tide at the Sewells Point Station). While this storm included minimal rainfall (1.24 inches in 24 hours), the storm surge produced by the storm coincided with the astronomical high tide, thus resulting in severe flooding. Most of downtown Portsmouth and other low-lying areas were under water. There was severe wind damage to many buildings and flood damage to many wharves and docks in the harbors. Another major storm in 1936 resulted in slightly less flooding and damage.

While not associated with flooding conditions the hurricane of 1944 was probably the greatest storm in intensity in the region's recent history. However, the storm moved very quickly and the accompanying storm surge was of short duration and occurred at the time of the astronomical low tide. Therefore, even though there was heavy rainfall, the damage relating to tidal flooding was minimal. The greatest structural damage resulted from winds clocked in excess of 130 miles per hour. This storm is important because it illustrates what could happen during a hurricane of similar intensity under different conditions relative to path, speed, time of storm surge in relation to tides, and direction of approach.

In 1954 a coastal storm produced relatively minor flooding. In 1956 a low-pressure system off the coast (commonly known as a Northeaster) produced prolonged northeasterly winds resulting in tides about 4 feet above normal. A maximum flood crest of 6.5 feet occurred resulting in flooding of much of the low-lying areas of the city. In 1960 a storm produced a storm surge of 7 feet that resulted in flooding equivalent to the 1956 levels.

Another benchmark storm and one often referred to by long term residents is a coastal storm in March 1962 known as the "Ash Wednesday Storm". This storm, like the one in 1933, produced relatively small amounts of rainfall (2.25 inches in 48 hours). However, the storm's track and slow movement resulted in a prolonged storm surge that inundated downtown Portsmouth.

The Hampton Roads area has also experienced several less significant storms and floods since 1962. Northeastern during the winter and spring of 1977 and 1978 caused damage in excess of \$2.5 million. The Hampton Roads area barely missed the effect of Hurricane Gloria in September 1985. During the past 100 years ten flooding events occurred between August and October, which is hurricane season along the Atlantic seaboard. The other two storms were late winter/early spring northeasters.

While Portsmouth today certainly faces the same threat of storm related flood damage, many of the city's characteristics have changed since the hurricane of 1933. In the 29 years since the last major storm and flooding event, the pattern of development in portions of the city has changed; some flood prevention measures have been undertaken; and flood related land use regulations have been developed. The following section outlines these factors.

Finally, one storm, Floyd in 1999, produced flooding damage different from all of the other storms. Floyd arrive as a weak tropical storm after several fronts had moved through the area leaving saturated ground. Floyd then proceeded to produce rainfall in excess of 20 inches in a 24 hour period. This rainfall produced urban storm water that, while not affecting the properties within the city, caused extensive damage to the City of Portsmouth's water system located in Suffolk, Virginia.

## **EXISTING CONDITIONS**

The City of Portsmouth was settled in 1752 and incorporated by the Virginia General Assembly in 1858. Over 250 years old, the city is home to one of the world's greatest natural harbors, situated on the James and Elizabeth Rivers, which empties into the Chesapeake Bay. Portsmouth, with a land area of approximately 30 square miles and a population of 99,790 people is located in the hub of the Hampton Roads Region. It is bordered by the cities of Chesapeake and Suffolk respectively to the south and west, and by the City of Norfolk to the east.

With 75.8 miles of shoreline at the zero milepost of the Intercoastal Waterway, which runs from Boston to Florida, Portsmouth's location on navigable waterways has been a dominant force in the City's history and economy. Its location on the over 40 feet deep Hampton Roads shipping channel, and the presence of both the CSX and Norfolk Southern Railroads supports the national and international port commerce activities and military presence in the region.

Portsmouth derives its governing authority from a charter granted by the General Assembly of the Commonwealth of Virginia. The governing body of the City is the City Council, which formulates policies for the administration of the City. The City's charter provides for a Council-Manager form of government.

There is no overlapping debt or taxing powers with other political subdivisions. The water and sewer systems are operated on a self-supporting basis.

56% of the land within the City of Portsmouth's boundaries is nontaxable property

Based on the 2000 Census and the 2002 estimates of the census bureau Portsmouth's population can be described as follows:

50.6 % African American

22% of the population over 5 years of age have a handicap

Per capita income (1999) \$16,507

Median Household income \$33,742

75.2% are High School graduates

13.8% of the population over 25 years of age have a Bachelor's degree or higher

51.7% of the population is female

58.6% of the dwelling units are owner occupied

72.5% of the residential parcels of land are owner occupied

28.4% of the units are in multi-family developments  
57% of the students in the school system qualify for free or reduced lunches

## **DEVELOPMENT TRENDS**

### **Physical**

As previously indicated the City of Portsmouth was founded in 1752. The city then grew in a series of annexations of the adjoining counties until 1968. At that time the surrounding counties incorporated into the Cities of Suffolk, Chesapeake and Virginia Beach. A copy of the annexation growth of the city of Portsmouth is provided in the appendix of this plan.

### **Commerce**

Portsmouth, Virginia. *The right place, the right time.* The City of Portsmouth is only 29 square miles in size and is characterized as having a limited amount of developable land, but there is a lot of new construction and business expansion happening in the city with more planned in the near future. There are two obvious reasons for this new growth. First, Portsmouth is situated in the middle of Hampton Roads and offers a strategic location advantage to many small and large businesses and residents and second, many areas in Portsmouth lie within state and federal incentive zones.

PortCentre Commerce Park is an incentive rich 60+ acre office and light industrial park located in close proximity to the Downtown Tunnel and I-264, the gateways to and from other Hampton Roads cities. In 2003, seven companies, representing over \$11.4 million, 275 new jobs and nearly 100,000 square feet in new office and industrial space, announced plans to relocate to the Park. Two other sites in the Park are under contract with announcements pending. A future expansion of the Park is on the horizon as demolition of the former Washington Park Public Housing complex progresses. This 12-acre site is located along the northwest corner of the Park and will offer the same federal and state incentives as the original Park.

Just off the I-264 and Victory Boulevard interchange, the Victory Crossing area boasts another 100,000 square feet of development and expansion projects. The planning phase for the new Victory Crossing Business Park progressed in 2003. The site for this 135-acre park is strategically located between I-264, Greenwood Drive, Victory Boulevard and McLean Street. The Economic Development Authority (EDA) issued a Request for Qualifications and then a Request for Proposals seeking a master developer for this emerging business park. Additionally, the EDA and the selected developer are working closely with the Tidewater Community College to plan the relocation of the school's Portsmouth campus to the new park.

### **Military**

Portsmouth's partnerships, service and reliance on the military has played a dominant role in the development of the city. The Gosport Shipyard, now known as the Norfolk Naval Shipyard is located along the Southern Branch of the Elizabeth River in the southern portion of the city. This facility has been active in the building, preparation and

repair of ships for military use since the Revolutionary War and continues today. The facility experienced its largest workforce expansion in the war years of 1940-1960 (World War II and the Korean Conflict). At the height of employment, the Norfolk Naval Shipyard had over 40,000 employees working three shifts. This workforce has decreased in size to today's total workforce of approximately 7,400 employees.

In addition to the "shipyard" two other major military facilities are located in Portsmouth. They are:

1. The U. S. Medical Facility employing approximately 5,500 employees and located along the Elizabeth River near the downtown portion of the city and
2. The U. S. Coast Guard Support Facility employing approximately 1,900 employees and located in the Churchland part of the city.

Ports and waterways are an important transportation element. Portsmouth is part of the Port of Hampton Roads, the world's largest natural harbor, just 18 miles from open sea at the confluence of the Chesapeake Bay and the Atlantic Ocean. A 50-foot channel depth allows the world's largest steamships to dock in the harbor. The Port of Hampton Roads is the largest volume port on the East Coast and the largest coal port in the world. Additionally, the port handles in excess of 12 million tons of general cargo annually.

The Portsmouth Marine Terminal (PMT) is one of four general cargo facilities owned and marketed by the Virginia Port Authority (VPA), the Commonwealth's leading agency for international transportation and maritime commerce. Three of the VPA's marine terminals, of which PMT is the second largest, are located in the Port of Hampton Roads. The fourth facility is the Virginia Inland Port, a truck and rail transfer facility in Front Royal, Virginia.

PMT covers 219 acres, including a 27-acre CSX rail facility with over 20,000 feet of direct rail access and 41 undeveloped acres. PMT has three shipping berths with 3,540 feet of marginal wharf. Five state-of-the-art container cranes handle containerized, break bulk and roll-on/roll-off cargo. One of these is the fourth Kone Supercrane with a lift capacity of 40 Long tons (LT). PMT is a versatile facility offering refrigerated hook-ups, specialized warehouse space, fumigation facilities and straddle-carrier container stacking. The VPA 2010 Plan recommends a \$46.4 million expansion of the PMT that includes: reconfiguring the site to maximize storage capability; paving remaining undeveloped terminal site for container storage; acquiring additional container-handling equipment; enhancing the gate to reduce the time that motor carriers have to spend on the terminal and reconfiguring existing rail facilities.

Universal Maritime Corporation borders PMT and offers an additional 1,000 feet of wharfage and two container cranes.

### **Workforce**

A successful workforce development strategy is fundamental to a successful economic development strategy. Business profitability and competitiveness depend on the

capability and productivity of the workforce. A well-paid and secure workforce depends on business profitability and competitiveness. One is not possible without the other.

We begin with the desire to develop our economy and recognize that to be successful in such an effort, we must be able to offer a competitive advantage to businesses seeking to locate in Portsmouth. In this New Economy, the workforce, more than any geographic location, will be the determining factor in attracting business and industry. Therefore, workforce development is meant to support our city's economic development strategy.

A key component of our economic development strategy is the desire to increase per capita income in Portsmouth by attracting businesses that are experiencing job growth within their specific industry sector and that pay above-average wages. This plan will support this effort by working to guarantee that our workforce is prepared to meet the needs of the businesses that have made a commitment to our city, as well as those that we are working to bring to Portsmouth.

We recognize that for our workforce development efforts to be successful, they must be employer-driver i.e., responsive to the present and future needs of business for skilled workers. Additionally, we must develop an approach to workforce development that is cohesive and systematic, and that provides our city, our employers, and our workers with a competitive advantage in the marketplace. Portsmouth's workforce development strategy aims to mirror the strategic initiatives implemented by the Hampton Roads Workforce Development Board and its staff organization, Opportunity, Inc. of Hampton Roads.

The Portsmouth Workforce Development Strategy will provide linkages between employers, trainers and educators, and employees. It will be demand-driven, based on a continuing effort to address the current, emerging, and dynamic training needs of existing and prospective businesses. It will require a supply response, one that meets the work/job/career-related needs of the individual worker and area employers. The Strategy, which parallels the HRWDB strategies, is designed to address the gap that exists between employer demand and workforce supply through the implementation of four key areas:

### **Medical**

Midtown Portsmouth, the most central location of the city, is home to Bon Secours Maryview Medical Center. Maryview Medical Center Bon Secours is an acute care facility with 346 beds offering comprehensive medical services and has approximately 2,000 employees. Over the last few years, Maryview has renovated and expanded its emergency room and added a birthing center and dialysis facility. In 2004 Maryview began construction on an open-heart surgery center. As a result of Maryview's long-standing commitment to the community, a host of entrepreneurial healthcare facilities dominate the area, as it is a mecca for healthcare related opportunities. Midtown also contains the long defunct 22-acre Midcity Shopping Center and the 25-acre former I.C. Norcom site. Both of these locations present opportunities for new tax revenue, job creation and office, industrial, commercial and residential developments for the Midtown

area. As a compliment to Maryview and the City of Portsmouth is the U.S. Naval Medical Center, Portsmouth, the Navy's regional medical center and the nation's oldest continuously operating hospital, military or civilian.

**Housing** The City of Portsmouth's housing market has been developed over the past three centuries. Currently there are five historic districts that delineate the most significant areas of historic housing and commercial buildings. These districts are, Olde Towne, Park View, Craddock, Truxtun and Port Norfolk.

Of the approximately 42,000 housing units in the city almost 50% are single-family detached residents and over 58% of the housing units are owner occupied. A detailed breakdown of housing conditions is found in the appendix.

The condition of housing within the city because of age and wide range of maintenance activities, or the lack thereof, can be described as poor to good.

Multifamily development is present in virtually all parts of the city's residential neighborhoods. Large complexes, those with over 16 units in the complex comprise approximately 50% of the tenant occupied properties in the city.

The development of the housing stock, single-family and multifamily has occurred along all of the various rivers, streams and creeks that bisect the city.

**Schools** Currently there are three high schools, three middle schools, fourteen elementary schools and two preschool centers in the city. Additionally there are four special centers that deal with learning, physical and mental disabilities and disciplinary challenged students.

A listing of these campuses is provided in the appendix.

**Power Generation** Electric power for the entire civilian portion of the city is obtained from a series of above ground and below ground power transmission lines.

**Water Systems** The potable water supply is provided through a series of water lines that are supplied from a series of wells and lakes in the City of Suffolk. A vast majority of this system is approaching, if not over 100 years of age.

Modifications to the dams, and pumping system have been made to prevent the reoccurrence of the flooding damages realized during the 1999 Hurricane Floyd event.

## **FLOODPLAIN DEVELOPMENT**

A floodplain study by the Army Corps of Engineers in 1970 and a Federal Emergency Management Agency (FEMA) Flood Insurance Study in 1979, supplemented in 1983 regarding the impact of wave heights, have been used to determine the areas of

Portsmouth covered by the 100 year floodplain and the base flood elevations for the city. Because of these analyses, flood zones have been established within which base flood elevations range from 8.5 to 9 feet generally in the city in areas along tidal rivers and streams.

Using these data as a base it can be estimated that approximately 1/3 of the properties in the City are partially or wholly in a Flood Hazard District. Along these same lines, approximately 9,900 of the structures in the city are located in the 100-year floodplain. This is approximately 33% percent of all structures. The areas most greatly impacted by floodplains and other storm related hazards such as wind and wave damage are the residential areas along the Elizabeth River southern and (western branches), Paradise Creek, Baines Creek and Scott's Creek.

Specific Neighborhoods that have had repetitive claims for flood damages include:

County Street Corridor, Cradock, Green Acres, Mayflower Park, Olde Towne, Park View, Prentis Park, Siesta Gardens, Simonsdale, Southside, Sterling Point, Truxton, Waterview, West Norfolk, and Westhaven

### **Impacted Public Facilities**

A review of principal facilities in the city indicates the following are located in or near Flood Hazard Districts:

City Hall, Building, Courts Building, Jail, I. C. Norcum High School, Police Headquarters, 911 emergency Dispatch Center, Probation Offices, Behavioral Healthcare Offices, Administrative office for the Fire Department, and Ntelos Pavilion.

There are other locations in the city where major thoroughfares are located within floodplains. This factor is due to the relatively low elevations of land and the presence of a number of tidal rivers and creeks that bisect many areas of the city. These routes are outlined on the facilities map in the Appendix. As seen on the map, vehicular circulation in sections of the city near the various branches of the Elizabeth River would be greatly impacted during severe tidal flooding. This could hamper evacuation measures and emergency services to certain areas of the city.

## **FLOOD MITIGATION ACTIVITIES**

1. Protect water and sewer utility system from damage and interruption of services due to flood damages
2. Increase ability of the school system to provide shelters/temporary housing for flood victims
3. Provide protection from surge flooding for the downtown and Olde Towne sections of the city

4. Provide the necessary maintenance to the storm drain system to reduce the potential of flooding from rain or storm events
5. Increase the educational activities to all citizens of the potential and effects of flooding in the city

## **PLANNING FACTORS AND GENERAL PLAN GOALS**

1. Include floodplain mitigation in the current Comprehensive Plan update
2. Include floodplain mitigation actions as a budget consideration
3. Include floodplain mitigation actions as a component of the overall Emergency Preparedness Plan

## **ECONOMIC DEVELOPMENT:**

1. Maintain physical and visual links between downtown and the waterfront.
2. Develop port and related used in waterfront locations with deepwater access, except in the downtown area.
3. Encourage development of smaller scale waterfront activities on lesser channels.

## **HOUSING:**

1. Insure high-quality design and construction in new housing built in the city
2. Insure that all repairs and additions are in compliance with the National Flood Insurance Program requirements
3. Advise property owners in the proper method for the selection of a contractor

## **ENVIRONMENTAL QUALITY:**

1. Protect, enhance, restore and manage wetlands, beaches, sand dunes, forests and other ecosystems including remaining waterfowl and wildlife habitats

2. Improve and maintain public access to city waterways including public beaches, parks and other natural areas
3. Develop, promote and manage a greenway and open space preservation program throughout the city, which provides protection to open space and environmentally sensitive areas
4. Manage a flood protection program for those areas threatened by the potential of damaging floodwaters
5. Coordinate the production and distribution of educational materials for the general public dealing with environmental issues

Portsmouth is a developed city with very little vacant buildable land. It has been estimated that approximately 94-96% of the developable land has been built upon. Consequently, future development in the city will likely be through infill of scattered vacant lots and the redevelopment of small geographic areas as market forces dictate. Because of Portsmouth's substantial port facilities, both military and cargo, waterfront development along the deep channels of the Elizabeth River will be maintained and in some cases expanded. One prime example of this type of development is the announced development of the deep-water container facility on the northern portion of the city owned by the MAERSK Corporation.

Given the importance of port functions to the city, the general development pattern in place, and the recreational and economic needs for waterfront access, it is apparent that a majority of the activities to take place regarding floodplain management will revolve around mitigating flood losses and hazards to existing development. This could include requirements that development meets upgraded floodplain regulations, and instituting programs and projects that will reduce flood hazards throughout the city.

There may be opportunities for acquiring land in floodplains for public recreational use over time, but acquisition will not be a primary floodplain management activity due to the expense of purchasing developed properties. However, the plan will encourage protecting and maintaining ownership of undeveloped public lands that are in floodplains so that future development will not occur on these properties. In the same way, because recreational use of the waterfront has been established and will be maintained as a city policy, flood protection activities that close the waterfront from public access, such as floodwalls or other structures, are not considered viable options at this time. It is a more attractive option to devise projects and programs that provide adequate flood protection while allowing public access and use of the waterfront. The following section outlines the overall goals that will shape Portsmouth's floodplain management plan.

## **FLOODPLAIN MANAGEMENT PLAN GOALS**

The overriding goals of the floodplain management plan can be summarized in the following statements:

1. Protect citizens from the life threatening hazards associated with flooding
2. Protect public and private property from damage relating to flooding
3. Provide for optimal use and enjoyment of public and private property while maintaining the greatest level of flood protection possible

The floodplain management plan will address each of these goals with a range of activities, which will improve general public information on the various aspects of flood prevention and mitigation, increase the level of regulatory review in regard to new development in floodplains, and provide the various public improvements, which will lessen future flood damage.

### **REPETITIVE LOSS PLAN GOALS**

Within the City of Portsmouth 43 properties have been identified as repetitive loss properties. These properties are found in the following neighborhoods:

Neighborhood	properties	claims	
County St Cur.	2	4	
Cradock	6	16	Historic Neighborhood
Green Acres	1	2	
Mayflower Park	1	2	
Olde Towne	12	30	Historic Neighborhood
Park View	2	4	Historic Neighborhood
Prentis Park	1	2	
Siesta Gardens	1	2	
Simonsdale	6	13	
Southside	4	10	
Sterling Point	1	2	
Truxton	1	3	Historic Neighborhood
Waterview	1	2	
West Norfolk	1	2	
Westhaven	3	7	
Totals	43	101	

This identification process will enable the City to continue with the following goals of the repetitive loss plan. These goals can be summarized in the following statements:

1. Protect citizens and the tax base from the economic disaster associated with repetitive flooding losses
2. Protect public and private property from damage relating to flooding

The repetitive loss plan will address each of these goals with a range of activities, which will improve general public information on the various aspects of flood prevention and mitigation. In addition the plan will increase the level of regulatory review in regards to existing development in the repetitive loss portions of the floodplains, and provide various public improvements, which will lessen future flood damage. While the repetitive loss plan and the flood plain management plan are dependent on each other and activities that will accomplish the goals of each are similar, these activities will be listed separately. Through the implementation of these activities it will be apparent where the emphasis exists.

## **FLOODPLAIN MANAGEMENT PLAN**

The floodplain management plan for Portsmouth is organized around the three basic components: public information, mapping and regulatory review, and flood damage prevention and reduction. For each of these components an overall goal is presented, which is supported by a series of policy statements. Along with these policy statements, various activities are listed that, when implemented, will contribute to the implementation of the policy. These activities, including timetable and estimated budgetary impacts, are listed with each policy under the heading “Items to Accomplish”.

### **PUBLIC INFORMATION**

***Goal: Provide all information available to the citizens of Portsmouth pertaining to flood potential, regulation requirements, and insurance and protection measures.***

Public information is critical in a number of ways to attaining the overall goal of reducing flood hazard and damage in the city. Providing site-specific flood related information to builders, developers, and property owners will enable new construction to be built to the latest specifications regarding such things as base floor elevations, setbacks, and elevations for mechanical equipment. The dissemination of this information will ultimately provide for more safe and sound construction in regards to reduction of flood damage and losses. Furthermore, public information will also provide a better basis for citizens to obtain flood insurance and to understand the extent of flooding threat to their particular properties.

- ***Require an elevation certificate to be provided with the “as built survey” prior to the issuance of a certificate of occupancy for all new or substantially improved structures located in a floodplain and in the “A” and “B” districts.***

This will provide accurate flood rating zone determination and building elevation information, which is necessary for the issuance of the property level of flood insurance. This information will be available to the general public to inform current and future property owners of pertinent flood related aspects of the site.

The survey shall include generally: building location in relation to property lines, elevations of lowest floor and garage if attached, location and elevation of HVAC equipment if in garage or outside, and grade elevations of the site to determine proper drainage.

Items to Continue: Maintain Policy  
Items to Accomplish: Modify Tidemark Permitting Program to handle the identification and maintenance of this data. on.  
Timetable: Continue and implement new item in next year  
Budget Impacts: Indirect – staff time

- ***Provide map interpretations concerning the location of any property in relation to established special flood hazard areas.***

This service will provide accurate information to the general public as to whether a property is located in a flood hazard district and the required base elevation for the F. E. M. A. Flood District. This information will help property owners, banks, insurance firms, and realtors who rely on this type of information for decision-making. Staff of the Department of Planning and Zoning will respond to all inquiries and will publicize the availability of this service. The method of response (form letter) has been developed. Though Portsmouth charges no fee for this service, a charge is permitted under FEMA regulations.

Items to Continue: 1. Publicize the service  
2. Determine if fee for service is warranted  
Timetable: Continue  
Budget Impacts: Indirect – staff time

- ***Provide opportunities for the dissemination of flood hazard related information to the general public especially those living in flood prone areas.***

This information will be instrumental in advising citizens of general flood hazards, the availability of flood insurance, and various flood-proofing techniques. This information can also provide the incentive for residents to obtain flood insurance, or to flood-proof their properties and heed future evacuation measures. The city will provide information in three ways: written information to the entire community through mass mailing; written information to floodplain residents only; and conducting community outreach programs.

Items to Continue: 1. Prepare or obtain pamphlets for distribution  
2. Determine which public fairs and festivals should be targeted for staff participation and information distribution and schedule for coming year

3. Attend Civic League meeting in areas of potential flood hazard and present flood related information
4. Obtain mailing lists for properties covered by flood insurance or having filed flood damage claims and distribute information by mail.
5. Distribute flood hazard related information to the general public through utility bills.

Timetable:

Continue

Budget Impacts:

Printing and mailing costs for mailers and pamphlets and Indirect – staff time

- ***Provide and maintain documents related to flood insurance, protection and floodplain management at various locations in the public library system.***

Documents relating to flood related topics generally and to Portsmouth specifically should be available to the public through the library system. The initial focus would be at the Downtown Branch Library followed by providing informational materials and books to branch libraries that are located in or adjacent to flood hazard areas. The availability of this information will be publicized both generally and at the library locations.

Items to Continue:

1. Obtain approval by library system for placement of books
2. Obtain various publications from available sources
3. Publicize the activity

Timetable:

Implement in first year

Budget Impacts:

Indirect – staff time

## **MAPPING AND REGULATORY REVIEW**

***Goal: Maintain floodplain regulations and mapping that meet or exceed the National Flood Insurance Program standards.***

The City of Portsmouth will maintain its land use and building code regulations and procedures in keeping with the minimum National Flood Insurance Program (NFIP) standards. The city should also strive to develop more stringent regulations in areas where localized unique circumstances exist and where potential flood hazard is greater than anticipated generally in the NFIP standards. In addition to the regulations themselves, the city shall provide for staff training to ensure proper enforcement and interpretation of these regulations.

- ***Develop and maintain a level of floodplain mapping that ensures proper interpretation of flood districts and clearly identifies Community Rating System credited activities.***

Accurate and understandable maps will aid in the dissemination of information to the public concerning potential flood hazards and location of properties in floodplains, and will identify areas within flood hazard districts where the city has implemented any special land use regulations that have direct positive impacts on potential flood hazards.

- Items to Accomplish:
1. Develop Regulation Floodplain Map using the GIS system
  2. Keep map up-to-date as conditions and circumstances change and as regulations affecting mapping of floodplains change
  3. Modify mapping to fit a format to be included in the City of Portsmouth Flood Preparedness Web Page

Timetable: Implement in first year

Budget Impacts: Indirect – staff time

- ***Adopt regulations that exceed minimum NFIP standards and provide the proper level of flood hazard protection in response to local conditions.***

Because of Portsmouth’s unique Elizabeth River shoreline and the area’s susceptibility to coastal storms, flood hazards in Portsmouth tend to differ from those found in non-coastal settings. Therefore, there are certain flood hazard regulations that may pertain to Portsmouth that would not affect other localities or are not found in general NFIP guidelines. As new circumstances are identified, regulations should be drafted or amended to address these potential flood hazard situations with NFIP supervision and approval.

- Items to Accomplish:
1. ***Examine*** the establishment of a “freeboard” of one foot in revision of floodplain districts (requires finished floors to be 1 foot above base flood elevations)
  2. ***Examine and identify*** any additional regulatory measures for adoption

Timetable: Implement in first year

Budget Impacts: Indirect – staff time

- ***Incorporate an Open Space Preservation District in the Zoning Ordinance.***

While the City of Portsmouth is approximately 95% developed there are sections that are adjacent or in the Flood Hazard Districts and are open, undeveloped property. To reduce the potential for flood damages these

properties need to remain vacant and be utilized for purposes such as open space and or parks.

- Items to Accomplish
1. Identify all of the open space in the City that is under City control
  2. Determine the use of the property and review the future use with all City Departments
  3. Map and determine the size of those parcels that will remain open

Timetable: Implement in first year

Budget Impacts: Indirect – staff time

- ***Coordinate and integrate regulatory review activities of the Chesapeake Bay Ordinance to ensure compliance with floodplain management regulations.***

The City’s site plan review process should be expanded to include all new development in the city except single-family houses outside of Chesapeake Bay Preservation Areas. This level of review will ensure that all development is properly elevated and drained so as to reduce flood hazard both from rising waters and from backup of stormwater runoff. Furthermore, all aspects of erosion and sediment control measures should be utilized with project development so as to minimize runoff into tidal streams or drainage areas, which over time, could impede drainage and exacerbate flood potential.

- Items to Accomplish:
1. Amend city ordinances to expand the site plan review process
  2. Review and approve plans as they are submitted

Timetable: Implement ordinance change in first year; plan review will then be ongoing

Budget Impacts: Indirect – staff time

- ***Provide proper staff training so as to ensure proper skill levels needed for plan review, policy and regulatory interpretation, and future program development.***

In order for staff to implement this floodplain management plan and administer the various regulations in place and to be put in place, it is important that time and effort be directed toward ongoing training and educational activities. This may include participation in training seminars, informational meetings workshops and other continuing education activities directed toward keeping staff as current as possible with floodplain management related programs and regulations.

- Items to Accomplish:
1. Identify critical training sessions and seminars for staff attendance
  2. Identify proposed cost of such activities
  3. Attend activities, which benefit staff most
  4. Identify and obtain periodicals and newsletters that may become part of reading material for affected staff
- Timetable: Implement as budgets allow
- Budget Impacts: Seminar registration fees, travel expenses

## FLOOD DAMAGE PREVENTION AND REDUCTION

***Goal: Provide timely and adequate public improvements and programs that will limit potential flood damage and reduce threat to both property and human life.***

The policies developed to attain this goal range from the programming of various capital projects that will improve stormwater drainage and protect natural features such as beaches to the development of flood warning and evacuation plans. All of these activities either directly or indirectly positively impact the overall efforts to mitigate or reduce the hazards the floodwaters represent.

- ***Maintain and improve the city’s stormwater drainage system.***

The city’s program of ongoing ditch and canal cleaning should be continued so to remove obstructions from drainage systems that would otherwise impede flows and increase stormwater backup. Furthermore, the Department of Public Works should continue to identify areas of poor storm drainage and develop measures to alleviate these problems ranging from public improvements such as increasing drain capacity to acquiring land for stormwater detention measures. These projects should be considered for inclusion in the city’s annual Capital Improvement Program.

- Items to Accomplish:
1. Continue with existing drainage evaluation.
  2. Identify and fund drainage improvement projects.
- Timetable: Implement Item #1 in the first year and succeeding years. #2 will have to be implemented, as budget funds are available.
- Budget Impacts: To be determined based on budgetary constraints.

- ***Review water and sewage facilities to determine flood damage potential and take corrective action to reduce the risk of loss of services.***

The City of Portsmouth operates and maintains its own water treatment and distribution system. This system draws raw water from a series of lakes and deep

wells in the City of Suffolk, Virginia. In addition the treatment plant for this system is also located in Suffolk.

- ***Continue redevelopment and conservation efforts in neighborhoods along the Elizabeth River shoreline.***

The city, under the auspices of the Portsmouth Redevelopment and Housing Authority, should continue its efforts to clear substandard housing units, to provide opportunities for improving other housing units, to create new housing units that meet all floodplain regulation standards, and to improve infrastructure such as storm sewers and streets that will help lessen flooding impacts.

Items to Accomplish: Continue ongoing program planning and funding.  
Timetable: Ongoing  
Budget Impacts: To be determined based on budget constraints.

- ***Continue, in cooperation with the Commonwealth of Virginia, to ensure the safety and security of Portsmouth's flood control infrastructure.***

Portsmouth has one major structure that many believe to be a flood control device located within its boundaries. The downtown seawall seems to protect the downtown area from intrusion by saltwater. This belief is not accurate. The seawall has not been extended in such a manner to provide the necessary protection. In addition no device or series of devices has been installed to remove storm water runoff that would be trapped by such a floodwall. Completion and continued structural integrity of this facility will be crucial in times of storm related flooding.

Items to Accomplish:

1. Prepare study to document the items necessary for the complete protection of the downtown area
2. Prepare as budget funds are available the costs of the improvements
3. Ensure periodic inspections and maintenance of facilities

Timetable: Ongoing  
Budget Impacts: N/A

- ***Obtain state and federal funding sources for flood hazard remediation projects.***

There are numerous programs at both the state and federal levels that may be available to Portsmouth such as matching monies for flood remediation projects. Such grants or matching funds could be used for a range of activities

including flood proofing of existing structures or floodplain acquisition programs. The city should pursue such funding sources as a part of its ongoing flood damage and reduction activities.

Items to Accomplish: 1. Identify funding sources.  
2. Apply for funds when appropriate.

Timetable: Identify and apply for funds in second year of program.

Budget Impacts: To be determined

- ***Identify repetitive loss properties and develop parameters for a future repetitive loss plan.***

Repetitive flooding accounts for over 40% of flood insurance losses nationally. These repetitive losses result from claims by only 3% of the total properties insured. Because of the number of claims submitted as the result of Hurricane Isabel, Portsmouth is now a repetitive loss community. 48 properties have been identified as repetitive loss properties. The city is required to prepare a repetitive loss property notification, identify the reasons for their repetitive losses, and develop a means to lessen future property losses.

Items to Accomplish: 1. Identify repetitive loss properties.  
2. Identify sources of flooding.  
3. Develop activities or projects to lessen flooding.  
4. Develop education programs that will detail the dangers these properties face.

Timetable: Property and flood cause identification in second year of program, undertake planning in third year of program or as situations dictate.

Budget Impacts: To be determined

- ***Implement and monitor the emergency evacuation plan for the City of Portsmouth.***

Timely identification of oncoming storms and their possible flood potential are critical to the mitigation of property loss and loss of life. With sufficient warning, residents in areas prone to flooding or storm related damage may be able to move belongings and families to higher ground or shelters. In Portsmouth, a flood warning program is closely related to a storm related warning and evacuation plan. The city should ensure that the emergency evacuation and warning plan is kept current, tested, and integrated with surrounding communities so as to aid in protecting the populace from storm related flood damages.

Items to Accomplish: 1. Complete an emergency evacuation plan under the auspices of the Department of Emergency Services with input from VDOT and with adoption by City Council.  
2. Test the warning and evacuation plans periodically.

Timetable: Implement in first year.

Budget Impacts: To be determined

- ***Encourage regional coordination of storm related emergency and damage assessment activities.***

While Portsmouth is partially bisected by the Western Branch of the Elizabeth River it does not suffer from the possible isolation that Norfolk and Virginia Beach endures. Still since these two cities must move a vast majority of their population through the City of Portsmouth, Portsmouth should encourage increased coordination of efforts in planning for storm related emergencies such as evacuation plans, communication systems, and damage assessment. Planning for such activities should be ongoing with communication systems and emergency plans tested.

Timetable: Begin implementation in second year.

Budget Impacts: Indirect – staff time

# Appendix

# **The Hurricane History of Coastal Virginia**

Continuous weather records for the Hampton Roads Area of Virginia began on January 1, 1871 when the National Weather Service was established in downtown Norfolk. The recorded history of significant tropical storms that affected the area goes back much further. Prior to 1871, very early storms have been located in ship logs, newspaper accounts, history books, and countless other writings. The residents of coastal Virginia during Colonial times were very much aware of the weather. They were a people that lived near the water and largely derived their livelihood from the sea. To them, a tropical storm was indeed a noteworthy event. The excellent records left by some of Virginia's early settlers and from official records of the National Weather Service are summarized below. Learning from the past will help us prepare for the future.

## **Seventeenth and Eighteenth Centuries**

### **1635 August 24**

First historical reference to a major hurricane that could have affected the Virginia coast.

### **1667 September 6**

It appears likely this hurricane caused the widening of the Lynnhaven River. The Bay rose 12 feet above normal and many people had to flee.

### **1693 October 29**

From the Royal Society of London: "There happened a most violent storm in Virginia which stopped the course of ancient channels and made some where there never were any."

### **1749 October 19**

Tremendous hurricane. A sand spit of 800 acres was washed up and with the help of a hurricane in 1806 it became Willoughby Spit. The Bay rose 15 feet above normal.

Historical records list the following tropical storms as causing significant damage in Virginia: September 1761; October 1761; September 1769; September 1775; October 1783; September 1785; July 1788.

## **Nineteenth Century**

### **1806 August 23**

Called the Great Coastal Hurricane of 1806.

### **1821 September 3**

One of the most violent hurricanes on record.

### **1846 September 8**

Hatteras and Oregon Inlets were formed.

**1876 September 17**

Average 5 minute wind speed at Cape Henry was 78 mph; 8.32" of rain

**1878 October 23**

Cobb and Smith Islands, on the Eastern Shore, were completely submerged. Average 5 minute wind at Cape Henry was 84 mph. Eighteen died when the A.S. Davis went ashore near Virginia Beach.

**1879 August 18**

Tide in Norfolk 7.77 feet above Mean Lower Low Water. Average 5 minute wind speed at Cape Henry 76 mph with 100 mph estimated gusts.

**1887 October 31**

Average 5 minute wind speed at Cape Henry 78 mph. The storm caused a record number of marine disasters.

**1893 August 23**

Average 5 minute wind speed at Cape Henry 88 mph.

**1894 September 29**

Five minute wind speed at Cape Henry 80 mph; gusts to 90 mph.

**1897 October 25**

Lasted **60 hours**. Norfolk tides 8.1 feet above Mean Lower Low Water.

**1899 October 31**

Average 5-minute wind at Cape Henry 72 mph. Tide in Norfolk reached 8.9 feet above Mean Lower Low Water.

Noteworthy storms also occurred in June 1825, August 1837, August 1850 and September 1856.

**Twentieth Century****1903 October 10**

Average 5 minute wind speed at Cape Henry 74 mph, the tide in Norfolk reached 9 feet above Mean Lower Low Water.

**1924 August 26**

Average 1 minute wind speed 72 mph at Cape Henry.

**1924 September 30**

Fastest 1 minute wind speed in Norfolk 76 mph.

**1926 August 22**

Fastest 1 minute wind speed in Cape Henry 74 mph.

**1928 September 19**

Fastest 1 minute wind speed at Cape Henry 72 mph. The tide reached 7.16 feet above Mean Lower Low Water in Norfolk.

**1933 August 23**

This hurricane established record high tide of 9.8 feet above Mean Lower Low Water. 18 people died. Highest 1 minute wind speed in Norfolk was 70 mph, 82 mph at Cape Henry, and 88 mph at NAS, Norfolk.

**1933 September 16**

Fastest 1 minute wind speed was 88 mph at Naval Air Station, Norfolk, 75 mph at the NWS City Office, and 87 mph at Cape Henry. The tide reached 8.3 feet above Mean Lower Low Water.

**1936 September 18**

The fastest 1 minute wind speed was 84 mph at Cape Henry and 68 mph at the NWS City Office. The tide reached 9.3 feet above Mean Lower Low Water and is the second highest tide of record.

**1944 September 14**

Fastest 1 minute wind speed was 134 mph at Cape Henry, which is the highest speed of record in this area. Gusts were estimated to 150 mph. The NWS City Office recorded 72 mph with gusts to 90 mph.

**1953 August 14**

**Barbara.** The fastest 1 minute wind speed was 72 mph at Cape Henry, 63 mph with gusts to 76 mph at Norfolk Airport.

**1954 October 15**

**Hazel.** Fastest 1 minute wind speed was 78 mph at Norfolk Airport with gusts to 100 mph, which is the highest wind speed of record for the Norfolk Airport location. A reliable instrument in Hampton recorded 130 mph.

**1959 September 30**

**Gracie.** Passed through western Virginia, 6.79 inches of rain at Norfolk Airport in 24 hours. Storm spawned a tornado eight miles west of Charlottesville, killing 11 people.

**1960 September 12**

**Donna.** Fastest 1 minute wind speed was 73 mph at Norfolk Airport, 80 mph at Cape Henry and estimated 138 mph at Chesapeake Light Ship. Lowest pressure of 28.65 inches holds the area record for a tropical storm. Three deaths.

**1964 September 1**

**Cleo.** A storm noted for its rain. 11.40 inches in 24 hours is the heaviest in the coastal area since records began in 1871.

**1969 August 19**

**Camille.** Made landfall in Mississippi on August 17. The storm tracked northward and dumped a record 27 inches of rain in the Virginia mountains, primarily in Nelson County. Flash flooding took the lives of 153 people.

**1971 August 27**

**Doria.** The fastest 1 minute wind speed 52 mph at Norfolk Airport and 71 mph at Naval Air Station, Norfolk.

**1972 June 21**

**Agnes.** Made landfall on the Gulf Coast of Florida. As the storm crossed Virginia, it dumped 13.6 inches of rain on the east slopes of the Blue Ridge Mountains. The James River crested at a record high in Richmond. Virginia sustained \$222 million in damage, and 13 people died from flash flooding.

**1979 September 5**

**David.** Passed through central Virginia. Spawned 2 severe tornadoes - one in Newport News with over \$2 million in damage and one in Hampton with a half million dollars in damage.

**1985 September 27**

**Gloria.** Passed 45 miles east of Cape Henry. Fastest 1 minute wind speed WNW 46 mph, peak gust 67 mph at the Airport, NE 94 mph gust to 104 mph at the South Island Chesapeake Bay Bridge-Tunnel. Highest tide 5.3 feet above Mean Lower Low Water, storm rainfall 5.65 inches and total Virginia damage \$5.5 million.

**1986 August 17**

**Charley.** The weak center passed over southeast Virginia Beach. Fastest 1 minute wind speed NNE 40 mph gust E 63 mph at Norfolk International Airport; NE 94 mph gust to 104 mph at South Island Chesapeake Bay Bridge-Tunnel; and NE 54 mph gust to 82 mph at Cape Henry. Highest tide 5.5 feet above MLLW. Less than \$1 million in damage in Virginia.

**1996 July 12-13**

**Bertha.** Passed over portions of Suffolk and Newport News. Fastest 1 minute wind speed SE 35 mph gust to 48 mph at Norfolk International Airport. Bertha spawned four tornadoes across east-central Virginia. The strongest, an F1 tornado, moved over Northumberland County injuring nine persons and causing damages of several million dollars. Other tornadoes moved over Smithfield, Gloucester and Hampton.

**1996 September 5**

**Fran.** Passed well west of the area over Danville. Fastest 1 minute wind speed SE 41 mph gust to 47 mph at Norfolk International Airport. Rainfall amounted to only 0.20 of an inch in Norfolk.

**1998 August 27**

**Bonnie.** Tracked over the northern Outer Banks. Fastest 1 minute wind speed NE 46 mph with gust to 64 mph at Norfolk Airport. NE 90 mph with gust to 104 mph at Chesapeake Bay Bridge-Tunnel. 4-7 inches of rain combined with near hurricane-force winds knocked out power to 320,000 customers. Highest tide 6.0 feet above MLLW. Most significant storm since 1960.

**1999 August 30 -  
September 5**

**Dennis.** Produced one of the most prolonged periods of tropical storm conditions in eastern Virginia. Fastest 1 minute wind speed NE 43 mph with gust to 53 mph at Norfolk Int'l Airport. Storm total rainfall 3.30 inches. Significant beach erosion reported.

**1999 September 15-16**

**Floyd.** Passed directly over Virginia Beach on a track similar to Hurricane Donna in 1960. Lowest pressure of 28.85" (977 MB) at Norfolk International Airport fourth lowest for a hurricane this century. Fastest 1 minute wind NE 31 mph with gust to 46 mph. Rainfall 6.80 inches with amounts of 12-18 inches in interior portions of eastern Virginia. Franklin, Virginia reported 500 year flood of record. Largest peacetime evacuation in U.S. history.

**Twenty-first Century****2003 September 18**

**Isabel.** Made landfall near Ocracoke North Carolina. The center passed west of Emporia and west of Richmond. Fastest 1 minute wind speed NE 54 mph with gusts to 75 mph at Norfolk NAS; NE 61 mph with gusts to 74 mph at the South Island Chesapeake Bay Bridge-Tunnel. Highest tide at Sewells Point was 7.9 feet above MLLW, which was a 5 foot surge. Significant beach erosion was reported. Numerous trees and power lines down over a wide area, with over 2 million households without power in Virginia. Virginia damage was over \$625 million, and there were over 20 deaths in Virginia.

Hurricanes come close enough to produce hurricane force winds approximately three times every 20 years. Two or three times a century winds and tides produce considerable damage and significantly threaten life. Three known storms have been powerful enough to alter coastal features.

MLLW = Mean Lower Low Water, which is the mean of the lowest of the low tide values

## Saffir-Simpson Hurricane Scale

### **Category 1: Winds of 74-95 mph**

Potential for minimal damage. Shrubbery, tree foliage and unanchored mobile homes damaged. No real damage to other structures. Low-lying coastal roads inundated, minor pier damage, some small boats in exposed areas torn from moorings. Storm surge four to five feet above normal tide level.

### **Category 2: Winds of 96-110 mph**

Potential for moderate damage. Considerable damage to shrubbery and tree foliage with some trees uprooted. Major damage to exposed mobile homes. Some damage to roofing material. Coastal roads and low-lying escape routes inland cut by rising water two to four hours before arrival of hurricane center. Considerable damage to piers and marinas flooded. Small boats in unprotected areas torn from moorings. Evacuation of some shoreline homes in low-lying areas. Storm surge of six to eight feet above normal tide level.

### **Category 3: Winds of 111-130 mph**

Potential for extensive damage. Foliage torn from trees with some large trees blown down. Some damage to roofing materials, windows and doors. Some structural damage to small buildings and mobile homes destroyed. Serious flooding at coast and many small structures near coast destroyed. Larger structures near coast damaged by waves and floating debris. Major erosion of beaches with low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives. Evacuation of all residences within 500 yards of shore and single-story homes on low ground within two miles of shore possible. Storm surge nine to 12 feet above normal tide level.

### **Category 4: Winds of 131-155 mph**

Potential for extreme damage. Shrubs, trees and signs blown down. Complete failure of roofs on small homes. Mobile homes destroyed. Flat terrain 10 feet or less above sea level flooded inland up to six miles. Major damage to lower floors of structures near shore due to flooding and floating debris. Major erosion of beaches. Low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives. Evacuation of all homes up to 500 yards from shore and single-story homes on low ground up to two miles from shore possible. Storm surge 13 to 18 feet above normal tide level.

### **Category 5: Winds of greater than 155 mph**

Potential for catastrophic damage. Shrubs and trees blown down, considerable damage to roofs of buildings. Major damage to lower floors of all structures less than 15 feet above sea level within 500 yards of shore. Low-lying escape routes inland cut by rising water three to five hours before hurricane center arrives. Massive evacuation of residential areas on low ground within five to 10 miles of shore possibly required. Storm surge greater than 18 feet above normal tide level.

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Remember that the arrival of a storm center is preceded by strong winds and rain several hours before landfall.

## Worldwide Tropical Cyclone Names

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### Atlantic Names

2004	2005	2006	2007	2008	2009
Alex	Arlene	Alberto	Andrea	Arthur	Ana
Bonnie	Bret	Beryl	Barry	Bertha	Bill
Charley	Cindy	Chris	Chantal	Cristobal	Claudette
Danielle	Dennis	Debby	Dean	Dolly	Danny
Earl	Emily	Ernesto	Erin	Edouard	Erika
Frances	Franklin	Florence	Felix	Fay	Fabian
Gaston	Gert	Gordon	Gabrielle	Gustav	Grace
Hermine	Harvey	Helene	Humberto	Hanna	Henri
Ivan	Irene	Isaac	Ingrid	Ike	Isabel
Jeanne	Jose	Joyce	Jerry	Josephine	Juan
Karl	Katrina	Kirk	Karen	Kyle	Kate
Lisa	Lee	Leslie	Lorenzo	Lili*	Larry
Matthew	Maria	Michael	Melissa	Marco	Mindy
Nicole	Nate	Nadine	Noel	Nana	Nicholas
Otto	Ophelia	Oscar	Olga	Omar	Odette
Paula	Philippe	Patty	Pablo	Paloma	Peter
Richard	Rita	Rafael	Rebekah	Rene	Rose
Shary	Stan	Sandy	Sebastien	Sally	Sam
Tomas	Tammy	Tony	Tanya	Teddy	Teresa
Virginia	Vince	Valerie	Van	Vicky	Victor
Walter	Wilma	William	Wendy	Wilfred	Wanda

\*Lili was retired after 2002 season, replacement name to be determined.

Experience shows that the use of short, distinctive given names in written as well as spoken communications is quicker and less subject to error than the older more cumbersome latitude-longitude identification methods. These advantages are especially important in exchanging detailed storm information between hundreds of widely scattered stations, coastal bases, and ships at sea.

Since 1953, Atlantic tropical storms have been named from lists originated by the National Hurricane Center and now maintained and updated by an international committee of the World Meteorological Organization. The lists featured only women's names until 1979, when men's and women's names were alternated. Six lists are used in rotation. Thus, the 2004 list will be used again in 2010. Here is more information on the history of naming hurricanes.

The only time that there is a change in the list is if a storm is so deadly or costly that the future use of its name on a different storm would be inappropriate for reasons of

sensitivity. If that occurs, then at an annual meeting by the WMO committee (called primarily to discuss many other issues) the offending name is stricken from the list and another name is selected to replace it.

Several names have been changed since the lists were last used. Four names from the 1995 list have been retired. On the 2001 list, Lorenzo has replaced Luis, Michelle has replaced Marilyn, Olga has replaced Opal, and Rebekah has replaced Roxanne. Three names from the 1996 list have been retired. On the 2002 list, Cristobal has replaced Cesar, Fay has replaced Fran, and Hanna has replaced Hortense. Two names from the 1998 list have been retired. On the 2004 list, Gaston has replaced Georges and Matthew has replaced Mitch. On the 2006 list, Kirk has replaced Keith.

## **Definitions**

### **CLOSEST POINT OF APPROACH**

Point where hurricane eye makes closest contact to shore without making landfall.

### **COASTAL FLOOD WARNING**

A warning that significant wind-forced flooding is to be expected along low-lying coastal areas if weather patterns develop as forecast.

### **COASTAL FLOOD WATCH**

An alert that significant wind-forced flooding is to be expected along low-lying coastal areas if weather patterns develop as forecast.

### **EMERGENCY OPERATIONS CENTER (EOC)**

The city facility that serves as a central location for the coordination and control of all emergency preparedness and response.

### **EL NINO**

A warming of Pacific Ocean waters near the Equator that typically occurs every 3 to 7 years. Such an event dictates a shift in "normal" weather patterns.

### **EMERGENCY BROADCAST SYSTEM**

A system designed to permit government officials to issue up-to-date and continuous emergency information and instructions to the public in a threatened or actual emergency.

### **EMERGENCY PUBLIC INFORMATION**

Information disseminated primarily, but not unconditionally, at the time of an emergency frequently includes actions, instructions and direct orders.

### **EMERGENCY PUBLIC SHELTER**

Generally a public school or other such structure designated by city officials as a place of refuge.

### **EVACUATION TIME**

The lead time that a populated coastal area must have to safely relocate all residents of vulnerable areas from an approaching hurricane. This time can also be perceived as the necessary amount of time between the local official evacuation order and the arrival of sustained gale force winds and/or flooding.

### **EXTENT OF EVACUATION**

The identification of vulnerable people to evacuate based on estimated damage and/or homes susceptible to hurricane force winds.

### **EXTRATROPICAL**

A term used in advisories and tropical summaries to indicate that a cyclone has lost its tropical characteristics. The term implies both poleward displacement of the cyclone and

the conversion of the cyclone's primary energy source from the release of latent heat of condensation to baroclinic (the temperature contrast between warm and cold air masses) processes. It is important to note that cyclones can become extratropical and still retain winds of hurricane or tropical storm force.

#### FLOOD WARNING

The expected severity of flooding (minor, moderate or major) as well as where and when the flooding will begin.

#### FORWARD SPEED

The rate of movement (propagation) of the hurricane eye in mph or knots

#### GALE WARNING

Sustained winds 39-54 miles an hour (34-47 knots) either predicted or occurring. Note: Gale warnings are not normally issued during tropical cyclones.

#### HURRICANE

A storm with winds at a constant speed of 74 mph or more. These winds blow in a large spiral around a relatively calm center of extremely low pressure known as the eye. Around the rim of the eye, winds may gust to more than 200 mph. The storm dominates the ocean surface and lower atmosphere over tens of thousands of square miles.

#### HURRICANE ADVISORIES

Notices numbered consecutively for each storm, describing the present and forecasted position and intensity. Advisories are issued at six-hour intervals at midnight, 6 a.m., noon, and 6 p.m., Eastern Daylight Time. Bulletins provide additional information. Each message gives the name, eye position, intensity and forecast movement of the storm.

#### HURRICANE EYE

The relatively calm area near the center of the storm. In this area, winds are light and the sky is often partly covered by clouds.

#### HURRICANE EYE LANDFALL

When the eye, or physical center of the hurricane, reaches the coastline from the hurricane's approach over water.

#### HURRICANE PATH OR TRACK

Line of movement (propagation) of the eye through an area.

#### HURRICANE SEASON

The portion of the year having relatively high incidence of hurricanes. In the Atlantic, Caribbean and Gulf of Mexico, it is usually June 1 through Nov. 30.

#### HURRICANE/STORM PROBABILITIES

The National Weather Service issues hurricane/tropical storm probabilities in public advisories to realistically assess the threat of a hurricane or tropical storm hitting your

community. The probabilities are defined as the chance in percent that the center of the storm will pass within approximately 65 miles of 44 selected locations from Brownsville, Texas, to Eastport, Maine.

#### HURRICANE WARNING

An alert added to an advisory when hurricane conditions are expected within 24 hours. Hurricane warnings identify coastal areas where winds of at least 74 mph are expected. A warning may also describe coastal areas where dangerously high water or exceptionally high waves are forecast, even though winds may be less than hurricane force.

#### HURRICANE WATCH

An alert added to a hurricane advisory covering a specified area and duration. A watch means that hurricane conditions are a real possibility; it does not mean they are imminent. When a watch is issued, everyone in the area covered by the watch should listen for further advisories and be prepared to act quickly if hurricane warnings are issued.

#### NOAA WEATHER RADIO

A 24-hour continuous broadcast of existing and forecasted weather conditions.

#### PRE-EYE LANDFALL TIME

The time before actual hurricane eye landfall within which evacuation cannot be carried out because of earlier effects, such as the inundation of evacuation routes from the storm surge or rainfall and the arrival of sustained gale force winds. It is composed of the time of arrival of sustained gale-force winds or the time roadway inundation from storm surge/rainfall begins, whichever comes first.

#### PUBLIC INFORMATION OFFICER

A person appointed by a City Emergency Operations Center to be responsible for the formulating and coordinating of the dissemination of emergency public information with both the electronic and written media, ensuring that accurate information is being released to the general public.

#### SAFFIR-SIMPSON SCALE

The scale system used by the National Weather Service to give public safety officials an assessment of the potential wind and storm surge damage from a hurricane. Scale numbers are available to public safety officials when a hurricane is within 72 hours of landfall. Scale assessments are revised regularly as new observations are made. Public safety organizations are kept informed of new estimates of the hurricane's disaster potential. Scale numbers range from 1 to 5.

#### SEVERE THUNDERSTORM WARNING

Indicates that severe thunderstorms have been sighted or indicated on radar.

#### SEVERE THUNDERSTORM WATCH

Indicates that conditions are favorable for lightning, damaging winds greater than 58 miles an hour and hail and/or heavy rainfall.

### SHELTER PERIOD

The period in which people are forced to evacuate their homes. This time may vary from several hours to a couple of days depending upon the severity of the hurricane.

### SLOSH (Sea, Lake and Overland Surges from Hurricanes)

A computerized model that is able to estimate the overland tidal surge heights and winds that result from hypothetical hurricanes with selected characteristics in pressure, size, forward speed, track and winds. The resultant tidal surge is then applied to a specific locale's shoreline, incorporating the unique bay and river configurations, water depths, bridges, roads and other physical features. The model estimates open coastline heights as well as surge heights over land, thus predicting the degree of propagation or run-up of the surge into inland areas.

### SMALL CRAFT ADVISORY

A warning of winds from 20 to 33 knots or for sea conditions either forecasted or occurring that are considered potentially hazardous to small boats in coastal waters.

### SPECIAL MARINE WARNING

A warning for hazardous weather conditions, usually short and not adequately covered by existing marine warnings. Such conditions include sustained winds or gusts of 35 knots or more for 2 hours or less.

### SQUALL

A sudden increase of wind speed by at least 18 mph and rising to 25 mph or more and lasting for at least one minute.

### STORM SURGE

The high and forceful dome of wind-driven waters sweeping along the coastline near where the eye makes landfall or passes close to the coast.

### TROPICAL DEPRESSION

A tropical cyclone with maximum sustained surface winds less than 38 mph.

### TROPICAL STORM

A cyclone with maximum sustained surface winds 39 mph to 73 mph.

### TROPICAL STORM WATCH

An announcement that a tropical storm or tropical storm conditions pose a threat to coastal areas generally within 36 hours. A watch should normally not be issued if the system is forecast to attain hurricane strength.

## Housing Statistics

DP-4: Profile of Selected Housing Characteristics: &nbsp;&nbsp; 2000

Data Set: Census 2000 Summary File 3 (SF 3) - Sample Data

"NOTE: Data based on a sample except in P3, P4, H3, and H4. For information on confidentiality protection, sampling error, nonsampling error, and definitions see <http://factfinder.census.gov/home/en/datanotes/expsf3.htm>.

Subject"	Number	Percent
Total housing units	41,605	100
UNITS IN STRUCTURE		
1-unit, detached	26,090	62.7
1-unit, attached	3,482	8.4
2 units	1,706	4.1
3 or 4 units	3,041	7.3
5 to 9 units	4,084	9.8
10 to 19 units	1,221	2.9
20 or more units	1,778	4.3
Mobile home	165	0.4
Boat, RV, van, etc.	38	0.1
YEAR STRUCTURE BUILT		
1999 to March 2000	383	0.9
1995 to 1998	1,411	3.4
1990 to 1994	1,148	2.8
1980 to 1989	4,910	11.8
1970 to 1979	6,364	15.3
1960 to 1969	7,021	16.9
1940 to 1959	15,041	36.2
1939 or earlier	5,327	12.8
ROOMS		
1 room	265	0.6
2 rooms	1,307	3.1
3 rooms	3,097	7.4
4 rooms	7,728	18.6
5 rooms	9,933	23.9
6 rooms	8,232	19.8
7 rooms	6,230	15
8 rooms	3,018	7.3
9 or more rooms	1,795	4.3
Median (rooms)	5.3	(X)
Occupied Housing Units	38,170	100

#### YEAR HOUSEHOLDER MOVED INTO UNIT

1999 to March 2000	7,845	20.6
1995 to 1998	10,596	27.8
1990 to 1994	5,266	13.8
1980 to 1989	5,404	14.2
1970 to 1979	3,399	8.9
1969 or earlier	5,660	14.8

#### VEHICLES AVAILABLE

None	5,538	14.5
1	14,711	38.5
2	12,685	33.2
3 or more	5,236	13.7

#### HOUSE HEATING FUEL

Utility gas	24,464	64.1
Bottled, tank, or LP gas	448	1.2
Electricity	10,702	28
Fuel oil, kerosene, etc.	2,186	5.7
Coal or coke	0	0
Wood	25	0.1
Solar energy	36	0.1
Other fuel	196	0.5
No fuel used	113	0.3

#### SELECTED CHARACTERISTICS

Lacking complete plumbing facilities	214	0.6
Lacking complete kitchen facilities	171	0.4
No telephone service	1,568	4.1

#### OCCUPANTS PER ROOM

Occupied housing units	38,170	100
1.00 or less	36,675	96.1
1.01 to 1.50	1,105	2.9
1.51 or more	390	1

Specified owner-occupied units 21,128 100

#### VALUE

Less than \$50,000	1,565	7.4
\$50,000 to \$99,999	13,820	65.4
\$100,000 to \$149,999	4,163	19.7
\$150,000 to \$199,999	923	4.4
\$200,000 to \$299,999	478	2.3
\$300,000 to \$499,999	146	0.7
\$500,000 to \$999,999	20	0.1
\$1,000,000 or more	13	0.1

Median (dollars)	81,300	(X)
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**MORTGAGE STATUS AND SELECTED MONTHLY OWNER COSTS**

With a mortgage	15,395	72.9
Less than \$300	68	0.3
\$300 to \$499	701	3.3
\$500 to \$699	2,635	12.5
\$700 to \$999	6,103	28.9
\$1,000 to \$1,499	4,531	21.4
\$1,500 to \$1,999	1,062	5
\$2,000 or more	295	1.4
Median (dollars)	899	(X)
Not mortgaged	5,733	27.1
Median (dollars)	308	(X)

**"SELECTED MONTHLY OWNER COSTS AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999"**

Less than 15 percent	6,204	29.4
15 to 19 percent	3,785	17.9
20 to 24 percent	2,966	14
25 to 29 percent	2,094	9.9
30 to 34 percent	1,621	7.7
35 percent or more	4,185	19.8
Not computed	273	1.3

Specified renter-occupied units	15,780	100
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**GROSS RENT**

Less than \$200	1,230	7.8
\$200 to \$299	811	5.1
\$300 to \$499	4,071	25.8
\$500 to \$749	6,954	44.1
\$750 to \$999	1,592	10.1
\$1,000 to \$1,499	528	3.3
\$1,500 or more	64	0.4
No cash rent	530	3.4
Median (dollars)	540	(X)

**GROSS RENT AS A PERCENTAGE OF HOUSEHOLD INCOME IN 1999**

Less than 15 percent	2,460	15.6
15 to 19 percent	2,137	13.5
20 to 24 percent	1,926	12.2
25 to 29 percent	1,847	11.7
30 to 34 percent	1,427	9
35 percent or more	5,216	33.1
Not computed	767	4.9

" (X) Not applicable.

**PUBLIC BUILDING INVENTORY  
FORTHCOMING**