FLOODING

DEFINITION – Flooding is the temporary condition of partial or complete inundation on normally dry land and it is the most frequent and costly of all hazards in Pennsylvania. Flooding events are generally the result of excessive precipitation. General flooding is typically experienced when precipitation occurs over a given river basin for an extended period of time. Flash flooding is usually a result of heavy localized precipitation falling in a short time period over a given location, often along mountain streams and in urban areas where much of the ground is covered by impervious surfaces. The severity of a flood event is dependent upon a combination of stream and river basin topography and physiography, hydrology, precipitation and weather patterns, present soil moisture conditions, the degree of vegetative clearing as well as the presence of impervious surfaces in and around flood-prone areas. (NOAA, 2009). Winter flooding can include ice jams which occur when warm temperatures and heavy rain cause snow to melt rapidly. Snow melt combined with heavy rains can cause frozen rivers to swell, which breaks the ice layer on top of a river. The ice layer often breaks into large chunks, which float downstream, piling up in narrow passages and near other obstructions such as bridges and dams. All forms of flooding can damage infrastructure (USACE, 2007).

MITIGATION ACTIONS FOR RESIDENTS

- **Personal Preparedness** – It is important to plan for disasters. Families may not be together or at home. Consider completing the following to be prepared.

  - **Family Emergency Communication Plan** (FEMA) serves as a comprehensive checklist for household disaster preparedness. FEMA Family Emergency Communication Plan Checklist

  - **Family Disaster Plan** (American Red Cross) – Communication networks and electricity could be disrupted. Planning in advance will help ensure that all the members of your household know how to reach each other and where to meet up in an emergency.
    American Red Cross Family Disaster Plan Template

  - **Emergency Kits** – It is always a good idea to have an emergency kit on hand. Consider basic items as well as special needs.
    Build a Kit (Ready.gov) ready.gov Build-a-Kit
    Survival Kit Supplies (American Red Cross) American Red Cross Survival Kit Supplies Checklist

- **Emergency Alerts and Warnings** – To receive emergency alerts and warnings, refer to the following websites, mobile apps, and other resources.

  - **American Red Cross Mobile Apps** (Apple App Store, Google Play, or text to "90999"
    Mobile Apps - The American Red Cross

  - **South Central Alert** – This service allows residents and businesses in an eight county area to be notified of an emergency situation and important alert messages in a variety of ways, including on their cell phones, home and work phones, by text messaging and e-mail.
    South Central Alert - Sign Up

FLOODING

- Monitor police news feeds, weather, and news on social media or websites. Receiving periodic updates is vital.

- **Flood Insurance** – Purchasing flood insurance does not prevent a flood from occurring, but it does mitigate a property owner's financial exposure to loss from flood damage. The National Flood Insurance Program (NFIP) policies are only available in communities that participate in the program, which is administered by FEMA.

- **Acquisition** – Land with structures may be purchased by and titled in the name of a local governing body that can remove structures and enforce permanent restrictions on development. Acquisition is voluntary action that must be agreed upon by property owner and local government.

- **Structure and infrastructure Relocation** – A structure may be moved to a less hazardous location.

- **Structure and infrastructure Elevation** – A structure may be mechanically lifted so that the lowest floor, including the basement, is raised above the base flood elevation. Utilities or other mechanical devices should also be raised above expected flood levels.

- **Structure and infrastructure Dry-Floodproofing** – It may be possible to keep water out by strengthening walls, sealing openings, or using waterproof compounds or plastic sheeting on walls. Dry-floodproofing is not recommended for residential construction but may be a reasonable alternative for non-residential structures-either in new construction, while making a substantial improvement, or while repairing a substantially damaged structure.

- **Structure and infrastructure Wet-Floodproofing** – Using water resistant paints or other materials can allow for easy cleanup after floodwater exposure in accessory structures or in a garage area below an elevated residential structure. In a basement, wet-floodproofing may be preferable to attempting to keep water out completely, because it allows for controlled flooding to balance exterior and interior water forces and discourage structural collapse. Wet-floodproofing may not be used for basements in cases of new construction, substantial improvement, or substantial damage.

- **Manufactured Homes** – Manufactured or mobile homes should be elevated above the base flood elevation and anchored, or more preferably, kept out of the floodplain.

- **Debris Control** – Community members can participate in debris control by securing debris, yard items, or stored objects that may otherwise be swept away, damaged, or pose a hazard if floodwaters would pick them up and carry them away. Additionally, a community can pass and enforce an ordinance that regulates dumping.

- **Hazardous and Buoyant Material Protection** – Containers of hazardous materials such as petroleum or chemicals should not be located in a flood hazard area. If such a location is necessary, hazardous material containers need to be anchored, because the contents can contaminate water and multiply the damaging effects of flooding by causing fires or explosions, or by otherwise making structures unusable. Also, buoyant materials should be anchored, because if they float

downstream, they may cause additional damage to buildings or bridges or may plug a stream resulting in higher flood heights.

MITIGATION ACTIONS FOR MUNICIPALITIES

- **Adopt the York County Hazard Mitigation Plan** by resolution or develop and implement a municipal hazard mitigation plan. York County Hazard Mitigation Plan

- **Prepare a Continuity of Operations Plan** to ensure that essential functions continue to be performed under a broad range of circumstances, protecting residents and minimizing business interruption. Consider what capital improvements are needed to adequately protect business or properties. FEMA Continuity of Operations Brochure

- **Prepare an Emergency Operations Plan** which describe who will do what, as well as when, with what resources, and by what authority – before, during, and immediately after an emergency. FEMA Guide for All Hazards Emergency Operations Planning Guide

- **Coordination** – Develop pre-disaster Memorandums of Agreements or Memorandum of Understanding with adjacent jurisdictions. Build partnerships (neighborhoods, emergency management/first responders, businesses, utility service providers, and local government agencies to strengthen response and recovery.

- **Public Education and Outreach** – Educate residents regarding risk and impact of hazards, how to prepare and protect themselves and their property. Facilitate funding for mitigation measures and technical assistance programs that address measures that citizens can take. Driver safety strategies for flooded areas can be addressed through driver safety/education classes and by the media. Local officials can be trained on flood fighting, floodplain management, flood proofing, and traffic control during flooding, and other measures.

- **Structure and infrastructure Floodplain Management** – Determining and enforcing acceptable land uses through planning and regulation may not prevent inevitable flooding in flood-prone areas, but planning and regulation can alleviate the risk of damage by limiting exposure in Local plans and regulations.

- **Capital Improvement Plans** – Infrastructure planning decisions can affect flood hazard mitigation. For example, decisions to extend roads or utilities to an area may increase exposure. Some communities may consider structural flood protection such as levees or floodwalls.

- **Zoning Ordinance Adoption or Amendments** – Examples of zoning methods that affect flood hazard mitigation include: I) adopting ordinances that limit development in the floodplain; 2) limiting the density of developments in the floodplain; and 3) requiring that floodplains be kept as open space.

FLOODING

- **Subdivision Ordinances or Amendments** – Subdivision design standards can require elevation data collection during the platting process. Lots may be required to have buildable space above the base flood elevation.

- **Building Code Adoption or Amendments** – Requirements for building design standards and enforcement include the following possibilities: I) that a residential structure be elevated; and 2) that a nonresidential structure be elevated or floodproofed.

- **Conservation Easements** – Conservation easements may be used to protect environmentally significant portions of parcels from development. They do not restrict all use of the land. Rather, they direct development to areas of land that are not environmentally significant.

- **Transfer of Development Rights** – In return for keeping floodplain areas in open space, a community may agree to allow a developer to increase densities on another parcel that is not at risk. This allows a developer to recoup potential losses from non-use of a floodplain site with gains from development of a non-floodplain site.

- **Purchase of Easement/Development Rights** – Compensating an owner for partial rights, such as easement or development rights, can prevent a property from being developed contrary to a community's plan to maintain open space. This may apply to undeveloped land generally or to farmland in particular.

- **Stormwater Management Ordinances or Amendments** – Stormwater ordinances may regulate development in upland areas in order to reduce stormwater run-off. Examples of erosion control techniques that may be employed within a watershed area include proper bank stabilization with sloping or grading techniques, planting vegetation on slopes, terracing hillsides, or installing riprap boulders or geotextile fabric.

- **Multi-Jurisdiction Cooperation Within Watershed** – Forming a regional watershed council helps bring together resources for comprehensive analysis, planning, decision making, and cooperation.

- **Comprehensive Watershed Tax** – A tax can be used as a mitigation action in several ways: 1) tax funds may be used to finance maintenance of drainage systems or to construct reservoirs; 2) tax assessments may discourage builders from constructing in a given area; or 3) taxes may be used to support a regulatory system.

- **Post-Disaster Recovery Ordinance** – A post-disaster recovery ordinance regulates repair activity, generally depending on property location. It prepares a community to respond to a disaster event in an orderly fashion by requiring citizens to: I) obtain permits for repairs, 2) refrain from making repairs, or 3) make repairs using standard methods.

- **Floodplain Ordinances or Amendments** – Communities that choose to participate in the NFIP Amendments must adopt ordinances that meet minimum federal and state requirements. Communities may pass more stringent ordinances to reduce risk even further.

FLOODING

- **Community Rating System** – Also administered by FEMA, the Community Rating System (CRS) is a companion program to the NFIP. It rewards a community for taking actions over and above minimum NFIP requirements with the goal of further reducing flood damages in the community. The more actions a community takes, the lower the premiums for flood insurance within that community.
- **Updated Floodplain Mapping** – By taking the initiative locally to more accurately map problem areas with information not already on FEMA maps, a community can warn residents about potential risks that may not have been anticipated. Upgrading maps provides a truer measure of risks to a community.

- **Storm Drainage Systems/Maintenance** – Flood mitigation can involve installing, re-routing, or increasing the capacity of a storm drainage system that may involve detention and retention ponds, drainage easements, or creeks and streams. It can 'include separation of storm' and sanitary sewerage systems as well as higher engineering standards for drain and sewer capacity. Most times, a drainage system will do its job and move water to intended areas. However, if a system is not maintained, erosion, material dumping, or deterioration of human-made reinforcement materials may reduce the carrying capacity of a stream. Therefore, regular maintenance, such as sediment and debris clearance, is needed so that the stream may carry out its design function. Also important is detection and prevention/discouragement of discharges into stormwater/ sewer systems from home footing drains, downspouts or sump pumps.

- **Drainage Easements** – Communities may consider obtaining easements for planned and regulated public use of privately owned land for temporary water retention and drainage.

- **Wetland Protection** – With special soils and hydrology, wetlands serve as natural collection basins for floodwaters. Acting like sponges, wetlands collect water, filter it, and release it slowly into rivers and streams. Protecting and preserving wetlands can go a long way toward preventing flooding in other areas.

- **Roads** – Roads are needed to get people and goods from place to place. In addition to planning for traffic control during floods, there are various construction and placement factors to consider when building roads. To maintain dry access, roads should be elevated above the base flood elevation. However, if a road creates a barrier it can cause water to pond. Where ponding is problematic, drainage and flow may be addressed by making changes to culvert size and placement. In situations where flood waters tend to wash roads out, construction, reconstruction, or repair can include not only attention to drainage but also stabilization or armoring of vulnerable shoulders or embankments.

- **Structural Flood Control Measures** – Structural flood control measures (e.g., levees, dams, or floodwalls) channel water away from people and property. Structural measures may also increase drainage or absorption capacities (e.g., detention and retention basins, relief drains, spillways, drain widening/dredging or rerouting, logjam and debris removal, extra culverts, bridge modification, dike setbacks, flood gates and pumps, or channel redirection). However, structural measures may cause an increase in the base flood elevation. History has shown that structures that channel water may create a false sense of security and result in greater damage to nearby properties if the structures fail.

FLOODING

- **Minor Structural Projects** – A minor structural project is similar to, but smaller and more localized than a structural project, in that the measures used to reduce flooding may include levees, floodwalls, dams or other activities that channel water away from people or property. However, a minor structural project should only be constructed in areas that cannot be mitigated through nonstructural activities, or where structural activities are not feasible due to low densities.

- **Dam and Levee Maintenance** – Although dams and levees may have been constructed properly, failure to maintain them can lead to significant loss of life and property if they are stressed and broken or breached during a flood event. An inspection, maintenance and enforcement program helps to ensure continued structural integrity. Dams or levees need to be kept in good repair. Unnecessary or old and structurally unsound dams should be removed. Planning for dam breaks can include constructing emergency access roads as well as automating pump and flood gate operation. It also never hurts to regulate development in a dam's hydraulic shadow, where flooding would occur if there were a severe dam failure.

- **Flood Warning** – In addition to a communication strategy, a flood warning system may consist of people or machines monitoring water level with stream gauges. Although a flood warning system generally does not provide long-term damage reduction, it can alleviate health and safety risk by providing citizens time to escape and possibly remove belongings that could be damaged. NOAA weather radio and EAS broadcasts can be incorporated into a community's flood warning system.