RECOMMENDATIONS OF THE

FLOODPLAIN REGULATIONS EVALUATION SUBCOMMITTEE (FRES)

OF THE DRBC FLOOD ADVISORY COMMITTEE (FAC)

May 19, 2009

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INTRODUCTION:

Background: Between September 2004 and June 2006, three major floods occurred along the main stem Delaware River.

In July 2007, the Delaware River Basin Interstate Flood Mitigation Task Force issued a report to the four basin governors identifying a total of 45 consensus recommendations for a proactive, sustainable, and systematic approach to flood damage reduction in the basin. One of the priority management areas identified in the report was floodplain regulations.

The Delaware River Basin Commission (DBRC) is a federal-interstate compact government agency whose members are the governors of the four basin states (New York, Delaware, Pennsylvania, and New Jersey) and a federal representative appointed by the President of the United States.

The Flood Advisory Committee (FAC) of the DRBC provides a forum for coordination of flood warning and flood loss reduction activities and the efficient use of technical and financial resources for the benefit of the Delaware River Basin community.

In November 2008, at the request of New Jersey and Pennsylvania commissioners, the Flood Advisory Committee formed the Floodplain Regulations Evaluation Subcommittee to address Recommendation FR-1 of the Interstate Task Mitigation Task Force Report.

Excerpt from Recommendation FR-1: *"There is no consistent set of floodplain regulations basinwide to uniformly manage development within the floodplain areas of the basin. Currently, floodplain regulations vary widely from State to State and often from community to community. As a result, development may be occurring in the floodplain of one State or community that may be adversely affecting other States and communities. Development in the floodplain individually and cumulatively results in adverse impacts somewhere in the watershed. These adverse impacts can include increased flood stages, increased velocities, erosion and sedimentation, water quality degradation and habitat loss. In addition to these negative effects, development in the floodplain disturbs naturally vegetated riparian corridors and often threatens the safety of both residents and emergency personnel in the event of a flood." (Delaware River Interstate Flood Mitigation Task Force Action Agenda, July 2007)*

Subcommittee Charge: To review and evaluate the similarities and differences in floodplain regulations throughout the Delaware River Basin, and to develop and present recommendations on the potential for more effective floodplain management throughout the Basin to the FAC.

Subcommittee Organization: The Floodplain Regulation Evaluation Subcommittee (FRES) is composed of twenty (20) representatives who represent the interests of the basin states, federal government, environment, citizens, builders, agriculture, commerce, floodplain mapping and local officials. Representatives were appointed by their representative interest group when possible.

Subcommittee Facilitation Guidelines: At the first meeting of FRES, representatives were presented with general facilitation guidelines to govern their deliberative process. This governing procedure stated that the decision-making of the FRES would be done by "consensus". Consensus is usually defined meaning both general agreement with the resolution or mitigation of minority objections and the process of getting to such agreement. Essentially this meant that there may not be unanimous agreement on every issue but each member of the FRES would be able to live with the final recommendation under each subject heading. There was no particular consensus model identified or used during deliberations but instead the process was a general guide to the deliberations of the FRES. In most consensus decision-making processes, a group (usually at least four) of dissenters can block a decision of the group. It is important to note that the FRES process did not include the ability for individual or group of members to block a recommendation of the FRES. Instead the FRES worked out a compromise individual to this process.

The FRES encountered a few instances where consensus could not be reached for an individual subject heading and compromised in two ways. First, for some subjects the FRES identified two to three options for recommendations. In general when this occurred, the FRES members all agreed with at least one of the options but were not unanimous for any one option. Also, these options were targeted for specific areas or conditions in the basin. For example, the regulatory floodplain definition heading

options were developed for mapped and unmapped areas of the basin as the FRES identified that options needed to be provided for both of these conditions. In cases where a member of the FRES was adamantly opposed to a recommendation, majority rule not consensus was employed and the members' dissention was noted under the heading and refers to an explanation of their reasoning included in the appendix.

Emphasis by Subcommittee Representatives: Included in an appendix to this report are letters from subcommittee representatives that provide emphasis, opposition, or expand upon the position of their interest group as it relates directly to the recommendations contained in this report. As the comments pertain to specific recommendation headers, they will be referenced throughout the report.

Timeline: The subcommittee met eight (8) times over the course of seven months. The first meeting convened on November 12, 2008. Meeting agendas noting speakers when applicable are included as Appendix I to this report.

Review Materials: The following list of regulations and guidance was reviewed by the subcommittee to inform their deliberations:

- National Flood Insurance Program (NFIP) minimum requirements (44 CFR 60.3)
- Delaware River Basin Commission Floodplain Regulations
- New Jersey - NJDEP Flood Hazard Area Control Act Rules (N.J.A.C. 7:13)
- Pennsylvania – Pennsylvania Flood Plain Management Act (Act 166-1978)
- Guidance from PADCED on how municipalities can meet the minimum National Flood Insurance Program (NFIP) requirements
- New York - Floodplain Management Criteria for State Projects (6NYCRR Part 502)
- NYS Residential Building Code (Chapter III, Section R323)
- Guidance by NYSDEC; Optional Additional Language to Model Local Law for Flood Damage Prevention
- New Castle County, DE (Unified Development Code Section 40.10.310 – Floodplains and Floodways)
- National Flood Programs and Policies in Review, Association of State Floodplain Managers, 2007
- Effective State Floodplain Management Programs, Association of State Floodplain Managers, 2003

PREAMBLE:

In developing recommendations on the potential for more effective floodplain management throughout the Basin to the FAC, the following considerations were recognized and discussed by the subcommittee:

- Diversity of Stream Character across the Basin
  - Main stem vs. tributary
  - Urban vs. Rural
  - Tidal vs. Non-tidal
  - Agricultural Lands
- Floodplain Restoration
- Floodplain Mapping
- Implementation
- Socio/economic Impacts
- Permitting/Enforcement
- Education

Diversity of Stream Character across the Basin: The sub-committee recognizes that the character of stream reaches in the Delaware River Basin vary tremendously. The main stem Delaware River stretches roughly 360 miles from it's headwaters in New York State to its mouth at the Delaware Bay, and its tributaries extend many hundreds of miles more. Over its course the river and its tributaries run through a variety of landscapes, all which affect the risk to life and property from flood events differently.

Many geomorphic, geologic, climatological, and anthropogenic factors influence the flood risk on a particular stream reach, including location in the watershed (mainstem vs. tributary), land use and population distribution (urban vs. rural), and the effect of tidal action (tidal vs. non-tidal). This subcommittee found that comprehensive floodplain regulations beyond minimum NFIP standards need to be implemented across the entire Delaware River Basin, which responsibly reflect the conditions and needs of the various watershed regions within the basin.

Given the diversity across the Basin in watershed and stream corridor character, and development patterns, it is essential that management prescriptions be suited to the stream reach where they are applied. Good stream management on a lightly populated headwater reach is going to look very different from good stream management on a lower estuarine reach adjacent to a major metropolitan area. While adopting consistent goals throughout the Basin is critical, the methods for attaining those goals are going to vary on particular stream reaches. Stream regulators and managers must be wary of over-generalizing the Basin when prescribing management solutions. To proceed otherwise risks harming communities, either by not requiring enough safety precautions, or by over-regulation.

A major consideration resulting from the difference in flood risk across the Basin is how to allocate resources to the areas where they are most needed. Members of the sub-committee expressed the importance of evaluating the flood risk across the basin based on population density, development trends, and history of flood damage.

Main stem vs. tributary: The character of flood risk varies considerably between the main stem Delaware River and its tributaries, and changes continuously as one moves downriver. As an example of two extremes, many headwater tributaries in the upper watershed are characterized by flash flooding in narrow canyons. These floods come on with very little warning, are brief in duration, and transport a relatively small amount of water compared to floods on the lower main stem. Floods on the lower main stem generally come on more gradually, cover a large extent, convey a large amount of water, and persist for longer periods of time. Each kind of flood requires different methods of preparation and response in order to avoid loss of life and property. When developing a management prescription for a particular stream reach, its location in the watershed should be considered.

Urban vs. rural: Anthropogenic factors, development patterns in particular, are a key determinant of the risk a flood poses to life and property. In the event of a flood, more people and property will be in harm's way in densely populated areas. Current and future population distribution in flood hazard areas should be taken into account when creating management prescriptions for particular stream reaches.

Tidal/Non-tidal: Storm surge can affect all of the tidal portions of the Delaware River and tributaries and can extend well beyond the normal head of tide in

severe surge events. The head of tide for the main stem of the Delaware River is at Trenton, New Jersey.

Storm surge associated with major hurricanes can far exceed the 100-year flood elevations. For example, at Wilmington, Delaware the 100 year flood level is +10 NAVD 88 yet the storm surge elevation associated with a category 3 hurricane is over 16 feet NAVD 88. Although the return frequency of a major hurricane may be rare, and may not be appropriate for normal floodplain construction standards, for certain critical facilities and emergency operations functions, it may be appropriate to use hurricane surge levels, in location and design considerations.

Hurricane evacuation scenario planning often relies on surge modeling and mapping. Where surge areas have been mapped using outdated topography, they are likely not very accurately delineated.

- Surge inundation areas should be delineated using best available topography.

Existing DRBC floodplain regulations are applicable only to non-tidal areas of the Delaware River Basin. NFIP regulations allow fill in tidal areas because it is assumed that encroachment in tidal areas will not cause increase in the 100-year flood stage. It is known, though, that filling may cause increases in regional flooding and exacerbate drainage problems during rainfall events in which flood stages do not approach 100-year levels.

- Consideration of restriction of fill, such as through DRBC's floodplain regulations, should be given to tidal areas.

Agricultural Lands:

Agricultural use has historically occurred in the floodplains because of their fertile soils and generally flat topography. The effect of agriculture in the floodplain should be taken into account when creating management prescriptions for particular stream reaches. It is not the goal of these recommendations to create regulations on agriculture that may impede their ability to remain competitive against other regional farm operations. Instead, agriculture in the floodplain should be encouraged to be compatible with responsible floodplain management including, but not limited to, existing programs that provide incentives to farmers to provide buffers along watercourses.

Floodplain Restoration: As articulated by the Congressional Task Force on Natural and Beneficial Functions of the Floodplain, June 2002, floodplains "reduce flooding and limit flood-related damages through their floodwater conveyance and storage functions."

As a result, protecting and restoring floodplain functions "will reduce flood losses" in addition to providing groundwater recharge, filtering sediment and contaminants, transporting nutrients, supporting habitats for a variety of sensitive living resources, and enhancing community quality of life.

The regulations currently in place for addressing development in the floodplain have not successfully reduced flood damages, in fact they have allowed new development, redevelopment, and expansion of existing development to continue and the result has been a continued increase in flood damages.

Communities subject to increasing flood damages include both historic communities (those over 100 years old) as well as recent development (those built within the past 5 years). Historic communities play an important role in the history of our region and nation. New development has contributed to increasing flood damages by both placing new homes in harms way as well as increasing flood flows and peaks for pre-existing communities. If we are to reduce flood damages in the future it will be important to undertake a floodplain protection and restoration strategy.

Floodplains vegetated with trees and shrubs can be four times as effective at retarding flood flows as grassy areas. Naturally vegetated floodplains are generally layered with leaf and organic matter that result in organic soils with high porosity and a greater capacity for holding water. More than just being an area that can help address flooding issues in a community, the floodplain, in this natural state, is a riparian ecosystem that needs the overbank flows that the natural watershed's hydrology provides in order to remain healthy and in balance.

The protection and restoration of forested floodplains reduces the harm and threat of flooding to homes, businesses and communities (1) by ensuring they are not located in these most hazardous of areas that are known to flood and (2) by reducing the peak and breadth of flooding thereby protecting homes that historically have not been located in the path of

floods. Protection and restoration of the floodplain also removes the need for emergency services, the costs of rebuilding, and all of the other financial, physical and psychological costs associated with flood damaged communities located in the floodplain.

A floodplain protection and restoration program focused on reducing present and future flood damages does not mandate the removal of every structure – for example there are numerous community reasons for maintaining and protecting historic structures and vistas despite their location in the floodplain as these structures and areas have other cultural, historic and social values to the community. A floodplain protection and restoration strategy can and should leave room for honoring these and other values of the community.

- The Basin States and the DRBC should provide funding and programs for acquisition, protection and restoration of developed and undeveloped property in the flood plain on both tributary streams and the main stem Delaware River. DRBC's authority to engage in acquisition and restoration of floodplain lands is provided under Article 6, section 6.3 of the Delaware River Basin Compact.

- States should craft and carry forward a program to identify and purchase for fair value structures located in the floodplain that property owners are interested and willing to sell – this program would be focused on identifying and pursuing structures/properties that the home owner/property owner has, by their own volition, initiation, choice and action, put on the market for sale. This program should include a mechanism whereby homeowners could reach out to state, federal and/or regional agencies to first offer them the home for sale at fair market value plus an additional financial incentive- thereby providing the homeowner an economic incentive to offer the home first to government programs focused on purchase and removal of structures at risk of flooding prior to the homes entering the public market for sale.

- DRBC should develop a prioritization of areas, communities and structures for acquisition and floodplain restoration and reforestation activities. This prioritization should include identification of historic communities and structures that should be targeted for alternative flood damage solutions including floodproofing and elevation.

- The Basin states must get out ahead of efforts of FEMA regarding repetitive loss properties and put together a repetitive loss reduction strategy. This strategy should include well-rounded programs that encourage the offer and acceptance of buyouts for repetitive loss properties including creating and funding programs that provide funds needed to give fair market value for purchased properties as well as creation of programs to assist flood victims in their relocation programs to assist in securing new, affordable mortgage rates, and affordable housing within their community if they so chose.

- States should also create and implement programs to remove highly vulnerable public works structures from the floodplain with a special emphasis on waste water treatment plants which are routinely overwhelmed by floodwaters and discharge untreated or partially treated sewage into receiving streams and rivers. As part of this program, all public works without an NHR listing that have experienced repetitive loss should be phased out by requiring removal from the flood hazard area upon substantial change. For instance, a wastewater treatment plant should be required to move out of the flood hazard area if the footprint of the physical plant is expanded.

Floodplain Mapping: FEMA develops and produces flood hazard data and maps in order to administer the National Flood Insurance Program (NFIP). The Delaware River Basin is comprised of two FEMA Regions, FEMA Region II and FEMA Region III. This requires the states and FEMA Regions to coordinate and confer on methodology and mapping specifics so that a seamless map can be created across state boundaries.

Having accurate maps of flood hazard areas is critical to the ability to properly identify and manage flood hazard areas. There are many areas, particularly in the upper portions or other undeveloped areas of the Basin, where flood hazard maps do not exist or if they do exist are inaccurate. New regulations based on inaccurate maps will be ineffective. Furthermore, any regulation based on a flood hazard map is only applicable on streams where flood hazard areas are defined. While the expense inherent in creating detailed flood hazard maps is great, it is an inescapable fact that this information is necessary to plan for flood damage prevention and the enforcement of regulations regarding development in

stream corridors. Also critical is the ability of the appropriate people to access and use those maps.

- Fund further detailed studies and flood hazard mapping throughout the basin: Available resources should be directed at creating new, more accurate flood hazard maps in the areas that are lacking this information. This is essential to proper planning for flood damage prevention and the enforcement of any new regulation.

- Fund training in the use of flood hazard maps for individuals tasked with enforcing existing and any potential new regulations: Individuals who will be encountering potentially non-compliant projects the most should be familiar with flood hazard maps for their community and their use. This includes but is not limited to code enforcement officers, planning board members, and realtors.

- Make maps accessible and easy to use: Maps should be widely accessible and easy to use, so that any person concerned with the flood risk to a particular property can access and understand that information. Making maps available in an interactive form on the internet would be a good way to provide access to many people at low cost.

- Lobby to help basin communities receive preference when applying for federal funding to do floodplain mapping.

Implementation: This subcommittee did not recommend means of implementation for the recommendations contained within this report. The subcommittee realized that there may be many different means of implementing any one recommendation. When possible, proposed regulations should be implemented within existing regulatory frameworks either at the local, county, state or regional level recognizing that adequate implementation of any one recommendation is strongly dependant on education, permitting and enforcement.

Socio/economic Impacts: The subcommittee did not analyze social, economic or environmental impacts of the recommendations contained in this report. This issue of considering impacts was raised as an important factor that should be considered as recommendations were formulated. The DRBC Flood Advisory Committee informed the subcommittee that it was not their charge to consider the possible socioeconomic or environmental impacts of any recommendations; that would be done by the adopting party, whether the DRBC or the States themselves. However it is important to make mention that this was a significant point of concern for several FRES members.

It is the belief of subcommittee members that prior to implementation of the recommendations contained in this report, a social, economic and environmental analysis and discussion be undertaken to determine the full impact of any floodplain management recommendation. This type of analysis is often required as any rule making process and should be performed by the entity proposing any higher regulatory standard.

The analysis is recommended to consider both the costs and benefits of compliance with floodplain regulations. Some considerations to be analyzed include building and construction costs, land value, flood insurance, reduced annual flood damage, environmental benefits, issues of health and safety, infrastructure and community service issues, enhancement to living environments, and water quality.

The higher standards for floodplain development recommended by the Subcommittee are primarily intended to specifically reduce flood damage to new and existing property and generally to reduce the impacts of flood events on both the built and natural environment. Nearly all of recommendations will have economic impacts, often both economic benefits and economic costs. Social impacts are also likely and also may be positive or negative. The economic and social effects of higher floodplain regulations should be considered before implementing new standards. Similarly, leaving insufficient floodplain regulations intact in areas subject to flooding will perpetuate existing social and economic impacts and should be considered as well.

Permitting/Enforcement: Permitting and enforcement of floodplain regulations often occurs at the local level by local officials. Floodplain managers come from a variety of curricula and backgrounds. In small communities, floodplain managers are sometimes part-time employees. The role of these floodplain managers is expanding due to increases in disaster losses and the emphasis being placed upon mitigation to alleviate the cycle of damage-rebuild-damage. Many of these localities do not have the necessary resources to provide consistent and

comprehensive administration and enforcement of floodplain regulations. An integral part of improving the floodplain management in the Basin is the allocation of more resources to this function.

A review of the enforcement methods throughout the Basin found that there was consistency in the structure of the regulations as many were based on State models that were subsequently adopted by the local communities. However: effective administration of existing regulations and the potential adoption of new standards will not be successful unless the overall administration and enforcement of floodplain regulation improves. The following components need to be included in any proposed floodplain regulation:

1. Due process for applicants
3. The ability to issue stop work orders with the owner having the option to fully mitigate or remove a structure
4. A variance procedure and no certificate of occupancy issued without completion of an as-built elevation certificate
5. Monitoring and investigative staff
6. The ability to levy fines
7. Training for inspection/enforcement personnel

Education: There is a need for a coordinated education, outreach and training program in the basin for floodplain managers, local planning and zoning boards, professionals and the public. Communities need to be armed with the proper knowledge to properly evaluate whether development is reasonably safe from flooding or will exacerbate local flooding conditions, will result in increased flood damages and flood response costs, and result in other issues of community concern.

The Certified Floodplain Managers (CFM) certification should be promoted for all local floodplain managers and professionals. This national certification was established by the Association of State Floodplain Managers (ASFPM) to improve the knowledge and abilities of floodplain managers in the United States. CFMs are professionals that:

- understand the rules and regulations of floodplain management;
- understand natural and beneficial functions of the floodplain;
- understand risk analysis and map interpretation;
- understand the impacts of building in the floodplain;
- stay current with floodplain management trends and activities by taking continuing education classes;
- provide guidance on local conditions and development;
- provide guidance to officials and citizens on floodplain management and describe the risks involved in building in the floodplain as well as the beneficial uses of the floodplain; and
- have attained a level of knowledge of floodplain management that allows them to perform a variety of flood preventive activities in the community.

The local State chapters of ASFPM, the New Jersey Association of Floodplain Managers (NJAFM) and the New York State Floodplain and Stormwater Managers Association (NYSFSMA) currently provide CFM training and exam opportunities.

RECOMMENDATIONS

A. Regulatory Floodplain Definition

Background: A naturally functioning floodplain is a hydrologically important and dynamic component of a watershed. In addition to being environmentally sensitive and ecologically diverse, floodplains provide flood storage and conveyance, protection of water quality and recharge of groundwater.

A regulatory floodplain may, or may not, encompass the natural floodplain, the area needed for a watercourse to maintain its natural biologic, geomorphic and hydrologic functions. Instead, regulatory floodplains are adopted standards designed to guide floodplain development and lessen the effects of floods on the built environment.

In order for property owners to be able to purchase flood insurance through the National Flood Insurance Program (NFIP), their municipality is required to enforce certain minimum regulations on development in the floodplain. FEMA defines its regulatory floodplain, the Special Flood Hazard Area (SFHA), as any area inundated by the base flood. The base flood is the national standard used by the NFIP and Federal agencies for the purposes of requiring the purchase of flood insurance and regulating new development.

The base flood is defined as having a one-percent chance of being equaled or exceeded in any single year. It is also informally referred to as the 100-year flood, which incorrectly leads to the assumption that a base flood is expected to occur once in 100 years. Instead, the base flood has a one-percent (1 out of a 100) chance of being equaled or exceeded in any single year. Therefore, a base flood could occur two times in the same year, two years in a row, or four times over the course of 100 years. The terms "base flood," "100-year flood," and "one-percent annual chance flood" are often used interchangeably with the 1% annual chance of flood deemed the most accurate description.

It is important to acknowledge that floods do not stop at regulatory floodplains, nor does the regulatory floodplain define the limit of potential flood damage or losses. Nationally, FEMA reports that 25 percent of total flood insurance claims are made by property owners located outside of the 1% annual chance floodplain. In the Delaware River Basin, 35 percent of repetitive loss property owners are located outside of the 1% annual chance floodplain.

In addition, an uncontrolled release of water during either a non-storm or storm event, like the catastrophic dam failure or the breach of a levee, could result in significant flooding impacts beyond the 1% annual chance floodplain.

States and local municipalities are encouraged by FEMA to adopt "more than the minimum" requirements. In fact, the Community Rating System (CRS), a FEMA program, rewards such communities by issuing credit points based on the adoption of standards higher than the NFIP's minimum requirements. Policyholders in these communities receive discounts on their flood insurance premiums because their communities are implementing floodplain management programs that go beyond the minimum requirements of the NFIP.

Future development is not taken into account during the development of FEMA flood hazard area mapping. As future development or other land use changes within a watershed area occur, runoff may increase flows to flood-prone areas downstream.

In NJ, for State land use regulatory permits, the NJ Flood Hazard Area is defined by the 1% annual chance peak flow (or 100-year peak flow rate) plus 25%. This regulatory floodplain definition is more restrictive than the national standard and was adopted by NJ as a means to consider the effects of future development.

DE, PA and NY currently use the 1% annual chance peak flow to define the regulatory floodplain without any considerations for future build out.

As mentioned in the Preamble under the heading "Floodplain Mapping", substantial portions of the Basin have inaccurate maps, or in some cases no maps at all. In these areas map-based regulations are currently not an option. Members of the sub-committee expressed the importance of evaluating the flood risk in these areas based on population density, development trends, and history of flood damage.

Recommendations: The regulatory floodplain for waterways in the Delaware River Basin should be greater than the 1% annual chance floodplain.

A) The subcommittee proposes one of the following two comparable approaches:

Option 1

The regulatory floodplain for the Delaware River Basin should be defined by the 1% annual chance peak flow (also know as the 100-year flow) plus 25% along the main stem of the Delaware River and all other streams and rivers within the basin. Flood hazard area maps should include a residual risk factor of 25%; 1) to consider current and future planned development, 2) to recognize variability in hydrologic modeling, 3) to consider temporary blockages to culverts and other hydraulic impediments, and 4) to more accurately define flood risk.

Option 2

The regulatory floodplain for the Delaware River Basin should be defined by the 0.2% annual chance floodplain (also known as the 500-year floodplain) along the main stem of the Delaware River and all other streams and rivers within the basin. Any change in the regulatory floodplain for the Delaware River Basin would require a remapping effort. As the 0.2% annual chance floodplain is already mapped in a large part of the basin, implementation of this regulatory floodplain definition may be able to occur more quickly.

B) Unmapped waterways of the Basin need a mechanism for identifying the regulatory floodplain. Whether this mapping is prepared by 1) DRBC, 2) the developer, or 3) States and Communities, all maps prepared along previously unmapped waterways should be prepared using consistent methodology.

In order to prioritize mapping preparation, unmapped or inadequately mapped areas should be evaluated based on population density, development trends, and history of flood damage. Areas at high risk of flood damage based on this evaluation can be prioritized for future mapping and possibly more stringent regulations.

*Comments in Appendix III: Riverfront Property Owner Representative, NJ Farm Bureau, Delaware County, NY.

B. Floodway definition

Background: Existing flood hazard area maps greatly underestimate the limit of floodways along the main stem Delaware River and other waterways within the Delaware River Basin. The flood hazard area, or floodplain, is the area along a waterway that is expected to be or has been inundated by floodwaters. The floodway, which is the inner portion of the flood hazard area nearest the stream or river, is the most dangerous area that carries deeper flows and higher velocities during a flood. New construction of structures is generally prohibited in floodways because it is unsafe and obstructs the passage of floodwaters, although removal of vegetation and construction of parking or other nonstructural activities while having an impact are often allowed. The flood fringe, or areas immediately adjacent to floodways where development is commonly allowed are often subject to flood depths and velocities similar to those of the floodway.

A regulatory floodway is defined as the channel of a river or other watercourse and portions of the floodplain adjoining the channel that must be reserved in order to carry and discharge the base (or 1% annual chance) flood without cumulatively increasing the water surface elevation more than a designated height. The Floodway drawn on floodplain maps is based on a technique of compressing the wetted cross section in the hydraulic model, until a desired surcharge is achieved. This surcharge is the floodway standard, of which the minimum FEMA floodway standard allows for a 1.0-ft rise. The current New Jersey State floodway standard, allows for a more conservative 0.2-ft. rise in flood depths. This more stringent, lower rise determination results in a larger regulatory floodway allowing the same base floodwaters to be carried downstream over a larger area. Even though NJ has adopted this more stringent standard on its in-state waterways, the less stringent FEMA standard was used to delimit the floodway for the main stem of the Delaware River to avoid inconsistencies between different floodway criteria on the New Jersey and Pennsylvania sides of the river. Both Pennsylvania and New York allow a 1.0-ft rise floodway standard throughout the Delaware River Basin. Communities must regulate development in these floodways to ensure that there is no increase in the base flood elevation at any location.

Due to the inherent challenges of hydrologic and hydraulic modeling, limitations of topographic accuracy, and general cartographic limitations, the exact placement of a floodway is open for discussion, debate and change. An experienced land development engineer, working for a developer with enough resources, will likely be able to relocate the

floodway boundary using the FEMA Letter of Map Revision (LOMR) process. Therefore, while the floodway concept is a strong floodplain management tool, it is only as strong as the mapping it is based on. Any regulation tied to the floodway could be avoided entirely if the floodway is amended via the LOMR process. Savvy developers will review the modeling and determine if it is cheaper to comply with stricter regulation, or simply attempt to adjust the floodway limits and thereby remove themselves from regulatory authority. In these cases, a 0.2-ft rise floodway standard would make it more difficult to play these types of games.

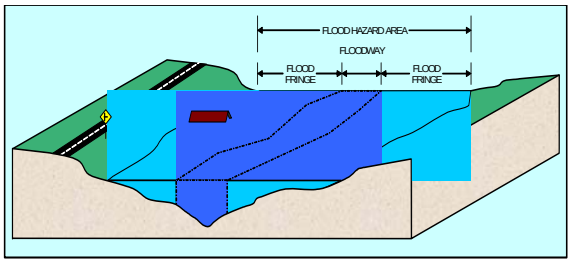
Currently designated 1-ft rise floodways are extremely narrow and new construction is sometimes improperly permitted in close proximity to streams and rivers simply because they are not currently demarcated as floodways. Greater portions of the floodplain would lie within mapped floodways if the 0.2-ft floodway standard were to be used. Adequately defining the floodway and regulating development in these floodways is one way to ensure future flood loss reduction.

Recommendation: The floodway in the Delaware River Basin should be defined by a 0.2-foot rise standard for the main stem Delaware River and all other streams and rivers within the basin. Such a change would help to deter risky, new development in close proximity to streams and rivers.

*Comments in Appendix III: Riverfront Property Owner Representative, NJ Farm Bureau, Delaware County, NY.

C. Development/ Fill in the Flood Fringe

Background: The Flood Hazard Area, as defined by FEMA, is composed of a floodway and a flood fringe. The flood fringe is the portion of the floodplain that lies outside the floodway.



Floodwaters generally move more slowly in the flood fringe as compared with the floodway, and the flood fringe serves to temporarily store large volumes of floodwater during a flood. The space that floodwaters occupy on a given site during a flood is referred to as the "flood storage volume" of that site.

When structures or fills are placed in a flood fringe, it occupies a space that would otherwise be filled with floodwaters during a flood, thus reducing the flood storage volume on the site. If a significant volume of floodwater is prevented from occupying a given area, excess floodwater will instead occupy neighboring and downstream properties, thus worsening flood conditions on those sites.

Unless properly managed, development within floodplains can exacerbate the intensity and frequency of flooding by increasing stormwater runoff, reducing flood storage, and obstructing the flow of floodwaters. Structures constructed in the flood fringe are subject to flood damage and threaten the health, safety and welfare of both the people who occupy them and emergency responders who respond in times of flood emergency.

Historically, the earliest settlements along the eastern seaboard were established along navigable waters. As a result, many of the Delaware River basin's older communities lie partially or completely within floodplains. As development has continued within the basin over the years, increased impervious cover in the form of roads, buildings and parking lots combined with the destruction of forest and wetlands for development and agriculture has increased peak rates and the volume of runoff flowing to the streams and rivers within the basin.

Development within the floodplain obstructs flood flows and compromises the flood storage and peak attenuation contributions of a natural floodplain. In addition, it knowingly places structures, infrastructure and people in the very locations that are known and expected to be subject to flooding and flood damages. As a result, flooding that naturally occurs along waterways has become progressively more threatening and damaging to people, buildings and infrastructure as a combination of increased runoff, decreased vegetation and storage absorption capacity and additional development in floodplains occurs. It is expected that these negative trends will continue so long as buildings and structures continue

to be placed in the floodplains of the streams and rivers of the Delaware River basin.

<u>Recommendation:</u> Protect the flood fringe in a naturally vegetated state and limit development including, but not limited to, structures, infrastructure, impervious surfaces, fill, grading and removal of vegetation.

The goal of managing development in the floodplain shall be to prohibit, except in extraordinary cases, new development in the flood fringe and to reduce risk to people and structures currently located in the floodplain. Development, for purposes of this document, is defined to include structures, infrastructure, impervious surfaces, fill, grading, storage of materials and equipment, and removal of vegetation.

Furthermore, the overall goal shall be to preserve existing floodplains and enhance the ability and function of floodplains by removing unnatural obstructions and reconnecting streams to their floodplains.

All communities in the basin should be encouraged to develop comprehensive plans that establish no build and no disturbance zones within environmentally sensitive and high storm hazard areas such as riverine floodplains and coastal storm surge areas.

Development shall be based on avoiding construction in the flood fringe and maintaining the floodplains in a natural state. Strong standards shall be established for siting, construction and protection of all structures in the flood fringe.

As governments face the costs of maintaining an aging infrastructure, it is wise to focus on flood solutions that do not depend on active maintenance. Non-structural solutions to flooding problems should be considered before structural solutions. Non-structural solutions include, but are not limited to, physical relocation or elevation of structures in the floodplain and floodplain or stream restoration projects. Some structural solutions include dams, levees and backflow prevention devices. Structural solutions should be reserved only to address existing development.

The subcommittee recommends establishing regulations and policies throughout the basin that:

- Promote standards that protect floodplains from alteration and promote enhancement.
- Permit only passive uses in the flood fringe. Passive uses are defined as uses that do not require grading or placement of habitable structures. Examples include agriculture, pasture, orchards and natural areas.
- In the flood fringe, prohibit creation of new lots without sufficient buildable area outside of the flood hazard area.
- Limit new structures within the flood fringe to the maximum extent possible.
- Prohibit the placement of fill as a means to make a previously undevelopable parcel buildable.
- Require any development in the flood fringe to be designed so that it does not unnecessarily displace existing flood storage or increase flood heights. Where flood storage displacement does occur, an equal volume of flood storage shall be created offsite, but within the same watershed and as near to the fill as possible.
- Require critical facilities including, but not limited to, hospitals, fire and police stations, transportation facilities to be kept outside of the 0.2% (500 year floodplain) to protect life, health and the local economy.
- Provide incentives to existing property owners in the flood fringe to: 1) relocate homes and businesses outside the flood hazard area where possible; 2) make improvements to structures below substantial improvement levels to reduce flood damage potential and increase flood storage (reference K. Substantial Damage/Improvement to Structures); and 3) make improvements to properties in the flood fringe to increase flood storage.
- Design new bridges and crossings to ensure that flooding to existing buildings or facilities is not exacerbated upstream or downstream.
- Design new agricultural structures in a manner that results in minimal damage to the structure and its contents, and will create no

additional threats to public safety or environmental degradation.

- Establish urban floodplain reclamation programs. These should establish incentives for projects that include floodplain reclamation, such as a "density bonus" for building outside of the floodplain.
- Coordinate with existing programs that preserve agricultural lands, forests, wildlife habitat and others, which help guide encroaching development areas outside of floodplains.

*Comments in Appendix III: NJ Farm Bureau.

D. Development/ Fill in the Floodway

Background: The floodway is the portion of the floodplain that is required to carry the design flood with a pre-defined rise. The depth and velocity of flow in the floodway is much greater than flow within the flood fringe. Therefore, development in floodways is subject to greater flood damage potential from the depth and velocity of flow. It is recommended that policies prohibit new development in the floodway and encourage relocation of people who have chosen to live in floodways.

People living within floodways are subject to devastating flood events that impact public heath, safety and welfare, and often result in loss of life and severe damage to property. Emergency response systems are often overextended during floods as they attempt to rescue people from dangerous flood prone areas.

Since the floodway is the portion of the floodplain that is reasonably required to carry floodwaters, the dynamics of flooding are much different in the floodway than within the flood fringe. Whereas the flood fringe temporarily stores floodwaters, the floodway quickly conveys floodwaters.

Placing structures or fill within a floodway can also cause serious obstructions to flow, which increases the depth of flooding and exacerbates erosion, therefore adversely impacting people situated outside the floodway as well as within the floodway. Furthermore, placing fill in one portion of a floodway can not easily be offset by an equal cut in another portion of the floodway because floodwater conveyance within floodways can be quite complicated and is often sensitive to a number of factors, such as the size, shape, skew, cross-sectional area and friction of the channel and adjacent floodway, as well as the presence of manmade structures and natural topographic features.

Structures situated in floodways are often subject to greater depth and velocity of flooding than those in the flood fringe, placing the people who use and rely on these structures at great risk during a flood.

Recommendation: New development in floodways should be prohibited. Development, for purposes of this document, is defined to include structures, infrastructure, impervious surfaces, fill, grading, storage of materials and equipment, and removal of vegetation.

The subcommittee recommends establishing regulations and policies throughout the basin that:

- Prohibit the placement of fill or new structures within floodways.
- Eliminate/redesign existing obstructions to flow where possible.
- Provide existing floodway property owners with opportunity to make improvements below substantial improvement levels to properties and structures to reduce flood damage potential.
- Provide incentives to relocate homes and businesses outside the floodway, where possible.
- Design and construct all bridges and crossings to ensure that flooding to existing buildings or facilities is not exacerbated upstream or downstream.

E. Stream/riparian Corridors and Vegetation Disturbance

Background: A stream corridor is composed of several essential elements including the stream channel itself, associated wetlands, floodplains and vegetation. The literature reviewed by the sub-committee indicates that stream buffers, particularly those dominated by woody vegetation, are instrumental in providing numerous ecological and socioeconomic benefits. Simply put, riparian

corridors protect and restore the functionality and integrity of streams.

While the focus of riparian buffer research has often been on the water quality and habitat benefits of buffers, there is expert support for the ability of buffers to attenuate flooding. Research has demonstrated that because of the hydrologic and hydraulic impacts of vegetated buffers, buffered streams experience a less dramatic spike in stream flow from storm events, and do a better job of storing floodwaters and releasing them gradually, thus reducing flood crest height downstream .

While there is no question that riparian buffers can help to prevent flood damage, there was debate among the sub-committee over the most effective way to protect and restore them in the Basin. The general consensus among the literature reviewed by the sub-committee is that the desirable width and character of a riparian buffer varies according to the purpose of the buffer (flood damage prevention, water quality, bank stability, aquatic habitat, terrestrial habitat, etc.), and the characteristics of the stream and the riparian area (stream width, stream discharge, drainage area, topography, soil type, land use, population density, existing and traditional riparian vegetation, etc.). Several formulas exist to determine buffer design based on desired function and site characteristics.

While designing buffers based on site and watershed characteristics is ideal, it requires scientific analysis that can be time consuming and expensive. Regulations based on science can also be more complex and thus more difficult to enforce. For these reasons, many regulators advocate a fixed-width buffer mandate.

Subcommittee members were divided over these two approaches so they included options addressing each methodology

Recommendations: Incorporate the buffer concept as part of a comprehensive floodplain management program to protect communities from flood damage.

The subcommittee proposes one of the following two comparable approaches:

Option 1

A) Adopt a minimum 100' vegetated buffer along all waterways of the basin; and

B) Communities who have crafted an approved fixed or variable-width riparian buffer program can implement that program in lieu of the 100' minimum buffer mandate.

Option 2

A) DRBC should establish and require a riparian variable-design buffer program. The program should include a minimum buffer recommendation based on an evaluation of buffer widths as they relate to flood damage prevention. This model program should be informed by an evaluation of existing programs in the basin and elsewhere.

B) If a community already has a buffer program in place judged by DRBC or the relevant state agency to be effective, that program should be considered adequate for compliance.

C) The resulting buffer program should include an element that requires restoration/creation of vegetated buffers in new development and redevelopment circumstances.

*Comments in Appendix III: Delaware Riverkeeper Network, NJ Farm Bureau, Delaware County, NY.

F. Adopted Building Code

Background: The International Building Code (IBC) is a model building code developed by the International Code Council (ICC). It has been adopted throughout most of the United States.

Pennsylvania, New York, New Jersey and New Castle County, DE have adopted the 2006 International Codes issued by the ICC. Section 1612.4 of the ICC states the design and construction of buildings and structures located in flood hazard areas shall be in accordance with American Society of Civil Engineers known as the ASCE 24 – 05 Flood Resistant Design and Construction. Highlights of the ASCE 24 are as follows:

Freeboard:

- Dwellings: 1-foot freeboard.
- Essential/Emergency Facilities: 2-3 feet freeboard
- Agricultural/Temporary Facilities: Lowest Floors at Base Flood Elevation (BFE)

Fill: Required to be stable under conditions of flooding, including rapid rise and rapid drawdown,

prolonged inundation, and erosion and scour; structural fill compaction is specified or an engineering report is required; side slopes are required to be no steeper than 1:1.5.

Soil considerations: Soil characteristics and underlying strata, including soil consolidation, expansion or movement, erosion and scour, liquefaction, and subsidence must be considered.

Flood-Damage Resistant Materials: Flood-damage resistant materials shall be used below the lowest floor elevations, including freeboard. Requires structural steel exposed to salt water, salt spray, or other corrosive agents to be hot-dipped galvanized after fabrication; other metal components shall be stainless steel or hot-dipped galvanized.

Utilities and Service Equipment: Utilities and attendant equipment that is elevated shall not be located below the lowest floor elevations, including freeboard.

Siting Considerations: Structures shall not be built in:

- Areas subject to flash flooding (floodwaters rise to 3 feet or more above banks in less than 2 hours).
- Erosion-prone areas (determined by analyses) unless protected.
- High velocity flow areas (faster than 10 ft/sec) unless protected.

Buildings in proximity to flood protective works (dams, levees, floodwalls, diversions, channels) shall not have adverse effects on, or conflict with, maintenance and repairs of those protective works.

Recommendation: Continue the use of ICC standards in the floodplain, except in cases where the recommendations proposed by FRES are more restrictive. Examples of more restrictive regulations proposed by FRES, include but are not limited to, freeboard (lowest habitable floor of structures) and siting considerations.

G. Standards for the Lowest Floor of Structures (Freeboard)

Background: Freeboard is a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, bridge openings, and the hydrological effect of urbanization of a watershed.

Freeboard is not required by minimum NFIP standards, which require that the lowest habitable floor (including basements) be at or above the FEMA base flood elevation. The base flood elevation is the computed elevation to which floodwater is anticipated to rise during the base flood. Base Flood Elevations (BFEs) are shown on Flood Insurance Rate Maps (FIRMs) and on the flood profiles.

The BFE is the regulatory requirement for the elevation or floodproofing of structures. The relationship between the BFE and a structure's elevation determines the flood insurance premium.

In NJ, the lowest floor of all residential and commercial structures must be set at least one (1) foot above the NJ flood hazard area design flood elevation, or two (2) feet above the FEMA base flood elevation. In NY, the lowest floor of all one or two family buildings must be constructed two (2) feet above the FEMA base flood elevation. PA and DE currently adhere to the NFIP minimum which permits the lowest floor of all residential and commercial structures to be at or above the BFE.

There are two benefits to freeboard. One is damages avoided, the other is insurance savings. Freeboard results in significantly lower flood insurance rates due to the lower flood risk.

Recommendation: All new or substantially improved residential, institutional and commercial structures within the Delaware River Basin should be constructed two (2) feet above the 1% annual chance base flood elevation within the flood fringe.

H. Enclosed Areas below Flood Elevation

Background: History tells us that what was at the time of construction, compliant space before the lowest floor, over time transitions to living space. Vigilance on the part of local officials is needed to prevent this from occurring.

Recommendations:

A) At time of construction, a deed restriction should be required for enclosures. This deed restriction would need to be filed with the recorder of

deed. It is recommended that a copy of the deed restriction be filed with floodplain administrator to aid in proper floodplain management and enforcement at the community level.

B) Structural requirement: If the enclosure below the flood elevation is greater than 6 feet in height measured from floor to floor, at least 25 percent of the surface area of the outer wall of enclosures should be left permanently open. This allows floodwaters to freely enter the building to balance hydrostatic pressure during a flood and prevents conversion of enclosures built below the flood hazard design elevation from conversion to living space.

I. Substantial Damage/Improvement to Structures

Background: The primary advantage to adding the cumulative provision for substantial damage is to increase the availability of Increased Cost of Compliance (ICC) flood insurance coverage. ICC will pay up to thirty thousand dollars beyond the flood insurance claim payment for compliance with local flood damage reduction regulations. Structures that have been declared substantially damaged and are required to meet flood damage reduction regulations because of cumulative losses can only obtain ICC coverage if the community has adopted the cumulative provisions in their ordinance.

Unless records are kept very well and up to date, there can be difficulty in implementing cumulative provisions for substantial improvement and substantial damage. This issue needs to be well covered by educational training programs.

"Substantial improvement" means any reconstruction, rehabilitation, addition or other improvement to a structure, the total cost of which equals or exceeds 50 percent of the market value of the structure before the start of construction of the improvement.

"Substantial damage" means damage sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Recommendation(s):

1. **Cumulative Substantial Damage Declaration:** A cumulative loss determination should be applied in the basin following the ICC definition of cumulative loss, 2 or more events greater than 25%.

It is recommended that once the cumulative loss figure goes above should go on a high priority list for purchase and have greater access to funds for elevation and/or purchase with homes willing to accept a purchase being given a higher priority.

2. **Tracking of Cumulative Substantial Damage/ Improvements:** Track cumulative substantial improvements or damages to structures in special flood hazard areas to ensure that flood protection measures are incorporated.

J. Dams and Flood Damage Risk

Background: When considering dam construction, dam removal, spillway modification and potential dam failure, the most significant issue related to flood damage prevention is the change in floodwater distribution that will result. FEMA generally doesn't include small impoundments as being influential to the 100 year floodplain. More common flood events (1yr, 10yr, 25yr, 50yr), however, can be greatly affected by smaller impoundments. The creation/removal/failure of a dam has the potential to dramatically change the magnitude of these flood events, and their failure during larger flood events can result in increased damage and loss of life immediately downstream.

There are a large number of small dams in the Delaware River basin. Many of these dams are very old, and present a wide range of structural integrity. Failure of these dams can create a flood hazard that is not predicted by existing maps, especially in areas directly downstream. Failure of dams of this nature has resulted in fatalities in Delaware County, NY. Better monitoring of dams and their effects on flood damage is necessary to fully safeguard life and property in the basin.

Recommendations:

1. Monitoring of all dams, and small, possibly-overlooked dams in particular, should be increased, and dams that present a clear and present danger of failure should be removed or their hazard sufficiently mitigated.

2. States should seek to increase funding and technical assistance to small dam owners for evaluation and removal, where necessary.

3. Hydraulic studies in the vicinity of high and medium hazard dams should be revisited to evaluate the change in flood hazard areas above and below the dam in the event of failure. Consideration should be given to the possibility of the failure of multiple small dams in a major flood event. Such studies should also occur prior to any non-emergency dam breach.

4. A safety plan that includes inundation maps for flood hazard areas should be created for all dams, and used as a basis for emergency planning. A mechanism should be developed to communicate the location of mapped hazard zones to the public.

5. Before a dam is removed, hydraulics must be revisited to evaluate the adequacy of downstream drainage structures, and the accuracy of upstream floodplain maps.

6. Require the evaluation of downstream flooding impacts as part of the permit application process for either a dam decommissioning or dam repair which increases spillway capacity. This evaluation must verify that flooding conditions downstream of the dam will not be increased during the 10-, 50- and 100-year storm event.

K. Bridge/Culvert Construction or Reconstruction and Flood Damage Risk

Background: The Delaware River watershed is very large. Over its course the river runs through a variety of landscapes, all which affect the risk to life and property from flood events differently. Particularly important to bridge and culvert design is the geomorphology of the stream channel, valley, and adjacent uplands, and population distribution and density where the structure occurs. While all of the states in the basin should be aware of the policies and standards of the others, and all should work together where appropriate to mitigate flooding, it is important for each state in the watershed to develop standards and details that are appropriate for their topography, population densities and development. One standard design procedure for the entire basin is inappropriate.

The central concerns of designing highway drainage structures are the duration of their useful life, the costs they will incur over the course of that lifespan, and risk assessment. While it is possible to design and build structures that would withstand extremely large events, it is likely that the benefit will not be worth the cost given that the structure will reach the end of its useful life long before the design event affects it.

Recommendation(s):

1. Design new bridges and culverts to ensure that flooding to existing buildings or facilities is not exacerbated upstream or downstream. Design should be based on the results of updated flood models using recent climate data that incorporates changing precipitation trends. It is likely that old models for determining the probability of occurrence of a particular event are no longer appropriate, given the pace of climate change in the Basin. These models should be re-evaluated using USGS stream gage data.

2. Maps should be updated for new crossings; the applicant should submit Letter of Map Revision (LOMR) as part of the application process should there be any change in the base flood elevation or extent.

L. Stormwater Regulations –New and Redevelopment

Background: Managing the impacts of stormwater runoff and the flooding that often results is becoming as challenging as ever. Impacts caused by urbanization and impervious land cover include increased runoff volumes, diminished stream base flow, increased frequency of bank full flooding, stream bank erosion, loss of riparian forest cover, floodplain disconnection, decline in aquatic and plant diversity and changes in sediment yield and transport. Facing many of same the challenges experienced by stormwater managers nationwide , such as impaired watercourses listed on the EPA 303d stream inventory, antiquated drainage infrastructure and an increase in flooding frequency and severity, stormwater managers and regulators have been forced to move away from traditional stormwater management methods which have been proven to be ineffective.

To that end, ordinances have been promulgated that focus on a runoff volume based method of stormwater management; rather than traditional store and release stormwater designs. These new designs emphasize the importance of maintaining a healthy

hydrologic balance between recharging groundwater supplies, the use of infiltration to maintain stream health and filtering stormwater runoff using natural, non-structural practices by the implementation of Green Technology Best Management Practices (GTBMPs). Stormwater managers in the Mid-Atlantic region recognize that approximately 90% of the annual rainfall comes from rain events of 2 inches or less.

The challenges to successfully managing stormwater runoff are not limited to the physical boundaries of hydrology and hydraulics. Runoff is a natural occurring process respective of land uses and the associated land covers. A successful stormwater program must address the range of land uses from residential to commercial and Greenfield development to Brownfield development and redevelopment.

<u>Recommendation:</u> The goal of stormwater design within the Delaware River Basin should mimic pre-development hydrology at a minimum by the following:

- Require post development infiltration to achieve 100% of the pre-development infiltration condition.
- Mandate no net increase in the volume of runoff post development as compared to pre-development.
- Mandate use of stormwater best management practices to address runoff volume management, pre-development infiltration goals, re-use and reduction of stormwater. Include peak rate control for the 2, 10 and 100 year design storm if not already addressed by the series of strategies already used to address volume, infiltration and quality issues.
- Establish corridors for the conveyance event (typically the 10 year frequency. storm event) and verify that no hazards or life-safety issues exist for storm events up to the 100 year flood event through the creation of easements or right of ways.
- Require minimum vegetated buffers on riparian buffers to all watercourses in the basin.
- Provide 100% water quality treatment for the 2.0” rainfall event in 24-hours.

*Comments in Appendix III: NJ Farm Bureau.

APPENDIX I – Meeting Agendas

Delaware River Basin Commission
DELAWARE · NEW JERSEY
PENNSYLVANIA · NEW YORK
UNITED STATES OF AMERICA

Delaware River Basin Commission

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Deputy Executive Director

AGENDA

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the DRBC Flood Advisory Committee (FAC)

Meeting 1
Wednesday, November 12, 2008, 9:30am
DRBC – Goddard Room

Topics proposed for discussion are as follows:

A. Introductions

B. Background, including Brief Overview of the Interstate Task Force Report
Dan Fitzpatrick, PA DCED

C. Subcommittee Charge, Organization, Deliverables and Timeframe
Joseph Ruggeri, NJDEP

D. Review and Basics of Floodplain Management & Planning (definitions, concepts, etc.)
Vince Mazzei, NJDEP

E. Discuss Proposed Subcommittee Considerations and Present Comparison Matrix
Laura Tessieri, DRBC

F. Review Current Levels of Floodplain Regulations in the Basin and Reach Consensus on Key Regulations for Subcommittee Review
Joseph Ruggeri, NJDEP

G. Review Critical Path Schedule, Decision Making Process and Next Steps
Dan Fitzpatrick, PA DCED

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

January 13, 2009, 10:00 am
Agenda – Meeting #2

1. Introductions

2. Concurrence on Future Meeting Dates

3. Presentation: National Flood Insurance Program
   Joseph Zagone, CFM - FEMA RIII

4. Presentation: Delaware River Basin Commission Floodplain Regulations
   William Muszynski P.E. – DRBC

5. Matrix Review/Discussion

6. Presentation: No Adverse Impact Approach to Floodplain and Watershed Management
   Kimberly Bitters, CFM - co-chair of the ASFPM NAI Policy Committee

7. Wrap-up/Ideas for Future Consideration

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Monday February 2, 2009, 10:00 am
Agenda – Meeting #3

1. Introduction

2. Presentation: Pennsylvania Floodplain Regulations
   Dan Fitzpatrick, CFM - PADCED

4. Presentation: New Jersey Flood Hazard Area Control Act Rules
   Vincent Mazzei, P.E. - NJDEP

5. Review/ Discussion of Matrix

6. Discussion of Final Comparison Document and Recommendations – structure, development process, etc.

7. Future Meetings/ Upcoming Speakers

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Thursday February 26, 2009, 10:00 am
Agenda – Meeting #4

Morning

1. Introductions

2. Presentation: New York Floodplain Regulations
   Bill Nechamen, CFM, NYSDEC and Nicole Franzese, Delaware County Planning Department

3. Presentation: New Castle County, Delaware Floodplain Regulations
   John Gysling, P.E., New Castle County Department of Land Use

Afternoon

4. Development of Draft Recommendations
   (Representatives will be split into groups and will tackle a subset of the matrix considerations. A suite of recommendations will begin to be developed.)

5. Brief Presentation of Initial Draft Recommendations
   (Development of draft recommendations by representatives expected to continue following the meeting to prepare a document for use at the March 17th meeting.)

6. Future Meetings/ Upcoming Speakers

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Tuesday March 17, 2009, 10:00 am
Agenda – Meeting #5

Morning

1. Introductions

2. Presentation: "The Importance and Benefits of Forested Buffers"
   Bob Wendelgass, PA Campaign for Clean Water and Bern Sweeney, Ph.D., Stroud Water Research Center

3. Subcommittee Discussion (Final development of consideration list, remaining big picture issues)

Afternoon

4. Further Development of Draft Recommendations
   (Representatives will split into the two groups formed at the last meeting and consider the alternate subset of the matrix considerations.*)*

5. Reconvene Subcommittee for Discussion

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Tuesday March 31, 2009, 10:00 am
Agenda – Meeting #6

1. Introductions

2. Subcommittee Deliberations

3. 2pm - Presentation: “No Adverse Impact Floodplain Management- Legal Implications, Protecting the Rights of All” Ed Thomas, Esq., Michael Baker

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Tuesday April 14, 2009, 10:00 am
Agenda – Meeting #7

1. Introductions

2. Subcommittee Deliberations

DRBC Floodplain Regulations Evaluation Subcommittee (FRES)
of the
DRBC Flood Advisory Committee (FAC)

Friday, May 8, 2009, 9:30am – 3:30pm
Agenda – Meeting #8

1. Introductions
2. Review of Recommendation Document
3. Reach Consensus
4. Discussion of Preamble & Appendix (for letters from subcommittee members emphasizing any additional points they feel necessary)
5. 5/19 FAC Presentation

APPENDIX II – Matrix of Regulations

	National Flood Insurance Program (FEMA)	DRBC	New Jersey	Pennsylvania	New York	Delaware	Delaware County, New York (NYSDEC 1990 Model Law)	New Castle County, Delaware
Regulatory floodplain definition	Area of special flood hazard is the land in the flood plain within a community subject to a 1 percent or greater chance of flooding in any given year. The area may be designated as Zone A on the FHBM. After detailed ratemaking has been completed in preparation for publication of the flood insurance rate map, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, or V1-30, VE, or V. For purposes of these regulations, the term ``special flood hazard area'' is synonymous in meaning with the phrase ``area of special flood hazard''.	Section 6 of the DRBC Flood Plain Regulations(FPR). Similar to FEMA definition.	NJ Flood Hazard Area equal to 100-year flood in tidal area and 100-year flood plus an added factor of safety in non-tidal areas (NJ flood hazard area design flood = 125% of 100-year discharge in non-tidal areas)	NFIP Minimum	NFIP Minimum	NFIP Minimum	Meets NFIP minimum Meets DRBC minimum	NFIP minimum
Floodway definition	Regulatory Floodway is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. The NFIP maximum height allowed is 1.00 foot.	Section 6 of the DRBC Flood Plain Regulations(FPR). Similar to FEMA definition.	Since 1974 defined by 0.2 foot rise in water levels. Interstate waterways defined by 1 foot rise in water level.	NFIP Minimum	NFIP Minimum	NFIP Minimum	NFIP minimum	NFIP minimum
Development in the floodplain	Allowed in floodway fringe with restrictions (lowest floor elevation, venting, etc.)	Authorities provided under Section 6 of the Compact, the Commission's Practice and Procedures (section 2.3.5.B 9 & 16 and FPR)	Regulated by Flood Hazard Area Control Act Rules N.J.A.C. 7:13	PA Act 166 - Structures for produaction/storage of hazardous chemicals elevated to BFE+1/12 ft. & designed to prevent pollution	NFIP Minimum plus 2-feet freeboard in Residential Building Code of NYS	NFIP Minimum	Meets NFIP minimum Not as stringent as DRBC (permits increase of base flood)	Only for permitted uses in Table 10.210 of the Unified Development Code
Development in the floodway	Must demonstrate no rise (0.00 foot)	Development is restricted as specified in Section 6.3.2, e.g. no residential development, stock piling or disposal of pesticides, domestic or industrial waste, radioactive materials, etc	Prohibited	PA Act 166 - Structures for produaction/storage of hazardous chemicals prohibited	NFIP Minimum	NFIP Minimum	Meets NFIP minimum Not as stringent as DRBC (allows the placing of fill so long as affect on base flood is mitigated elsewhere)	Only for permitted uses in Table 10.210 of the Unified Development Code, essentially none
Fill in floodplain	Allowed in floodway fringe	Section 6.3.3 Not to adversely affect the capacity of the floodway.	0% net fill restriction in non-tidal flood fringe statewide - therefore may only be allowed with compensatory storage onsite or nearby in same floodplain	NFIP Minimum	NFIP Minimum	NFIP Minimum	Meets NFIP minimum Not as stringent as DRBC (allows the placing of fill as long as it does not raise base flood more than one foot)	No net fill
Fill in floodway	Must demonstrate no rise (0.00 foot)	Section 6.3.2 Prohibited	Prohibited	NFIP Minimum	NFIP Minimum	NFIP Minimum	Meets NFIP minimum Not as stringent as DRBC (allows the placing of fill so long as affect on base flood is mitigated elsewhere)	No disturbance or net fill
Stream/riparian corridors and vegetation disturbance	Not specifically addressed	Not addressed	Depends on type of stream. Riparian zone is 50 ft, 150 ft, or 300 ft from top of bank.	Not addressed	No required buffer or riparian zone. State DEC stream encroachement permit required for regulated streams for work in or below stream banks.	Not addressed	Not addressed	100 foot riparian buffer from top of bank and 50 foot buffer from wetlands and floodplain
Adopted building code	N/A	Section 6.2.1 requires approval of State and Local standards of flood Plain regulation. Section 6.4.1. provides that duly empowered state or local approvals can be in lieu of Commission approval, However Sections 6.2.1 and 6.4.3.A provide that such standards must be equivalent of the Commission	Through the NJDCA, the NJ Construction Code identifies the model codes as sub-codes including 2006 IBC, 2006 IRC, 2006 National Standard Plumbing, 2005 National Standard Electrical Code, 2006 IFC, State-developed rehabilitation code (existing buildings).	PA Uniform Construction (UCC)	2007 Building Code of NYS and Residential Code of NYS, based on IBC.		Most recent is NYS 2007 Residential Code, based on IBC, NFIP	IBC, 2006
Standards for the lowest habitable floor of structures (freeboard)	Lowest floor must be at or above the base flood elevation (no freeboard required)	Section 6.3.2.A.1 No erection of structures in floodway for occupancy by humans or animals at any time. Section 6.3.3.B.2 In flood fringe, lowest floor to beabove the Flood Protection Elevation (equivalent to one foot above base flood elevation).	Lowest floor to be constructed must be set at least one (1) foot above the NJ flood hazard area design flood elevation. (or two (2) feet above base flood elevation)	NFIP Minimum	2' above the base flood elevation for one or two family buildings.	NFIP Minimum	Meets NFIP minimum Not as stringent as DRBC (Requires 1 foot) Not as stringent as NYS Residential Code 2007 (requires 2 feet)	18 inches

	National Flood Insurance Program (FEMA)	DRBC	New Jersey	Pennsylvania	New York	Delaware	Delaware County, New York (NYSDEC 1990 Model Law)	New Castle County, Delaware
Enclosed Areas below Flood Elevation	60.3 (c)(5) Require, for all new construction and substantial improvements, that fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. A minimum of two openings having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding. The bottom of all openings shall be no higher than one foot above grade. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.	Not addressed	1. 1 square inch of net vent opening per square foot of floor area; 2. Crawl spaces must be less than 6 feet high or 25% of wall space must remain permanantly open; 3. Deed of property must state habitation of crawl space prohibited	NFIP Minimum	NFIP Minimum	NFIP Minimum	Meets NFIP minimum	Meets NFIP minimum
Substantial Damage/Improvement to Structures	Entire structure treated as new construction and must be brought into compliance with the current ordinance.	Section 6.5.2 Prior non conforming Structures: Non-confroming structures in the floodway cannot be expanded. Non-conforming structures in floodway that are damaged or destroyed by any means to the extent of 50% or more cannot be restored, repaired or improved except in comformity with these regs.	All new construction, additions, improvements must meet current rules. If more than 50% of a structure is replaced, entire structure must meet new rules.	NFIP Minimum	NFIP Minimum	NFIP Minimum	Meets NFIP standards Meets DRBC standards	Improvements of 50% of value or more must full comply
Dam removal requirements pertaining to flooding		N/A	NJ Dam Safety Standards (N.J.A.C. 7:20-1.7(h)) requires the submission of computations that demonstarte that the proposed dam removal will not adversely affect flooding conditions downstream during the 10-, 50- and 100-year storm events.	A permit is required to remove a dam and it must be determined if there would be a substantial adverse impact to the public health and safety both upstream and ddownstream of the dam. This would include the effect on flood elevations.				
Bridge/Culvert construction or reconstruction		N/A	N.J.A.C. 7:13-11.7 requires that the structure does not cause any offsite flooding of buildings, railroads, roadways or parking areas during any rain event and no more than a 0.2 foot rise in the NJ Flood Hazard Area Design Flood elevation within 500 feet of the structure.	Bridges and culverts should be designed to pass flood flows without loss of stability, may not create hazard to life or property, may not significantly alter the natural regimen of the stream, may not increase velocities which results in erosion, may not significantly increase water surface elevations and shall be consistent with local flood plain programs. No increase in the 100 year flood elevation where detailed FEMA mapping exists and a maximum of 1 foot increase if no FEMA study exists.				
Stormwater Regulations	None	Not addressed	Stormwater Management Rules N.J.A.C. 7:8		DEC permit required for disturbance of over 1 acre. More detailed requirements in MS4 areas.		DEC filing required for disturbance of over 1 acre as per EPA NPDES standards. Projects in NYC watershed are subject to additional restrictions under NYCDEP's Watershed Rules and Regulations including a prohibition on building impervious surface within 100 feet of a watercourse or 300 feet of a reservoir outside of hamlets and villages, and the completion of an additional Stormwater Pollution Prevention Plan for most projects.	DE Sediment and Stormwater Regulations and New Castle County Drainage Code. Requirement is to manage peak rate and goal is to mimic pre development hydrology to the maximum extent practicable with regard to rate, volume and duration of flow.

APPENDIX III – Comments from Representatives

Floodplain Definition

This letter is to express strong opposition to the recommendation to redefine the floodplain from inundation at the 1.0 % flood event (100 year flood) to inundation at the 0.2% flood event (500 year flood).

Expanding the floodplain to include the 500 year flood event more than doubles the area of the floodplain, adding thousands of people who, in the history of the Delaware River, have never been flooded. What's more, most are not required to even have flood insurance. That makes no sense. Who are we protecting?

The expressed purpose of this sub-committee was to make recommendations that made floodplain management more effective; meaning reduced damage cost for FEMA and/or NFIP. Since 1978, excluding the Katrina year, NFIP, nationally, has had a surplus of about $8B. And the current average NFIP annual damage payment is on the order of $650M, with a commensurate premium input of around $2.5B. Clearly, those who live in the flood danger areas are more than paying for their flood damage and not the American tax payer. We appear to be managing our river risks well. You cannot regulate all these risk away. It accomplishes nothing but friction to add significantly more and unnecessary regulations when the system is working well.

Some in our sub-committee have expressed the radical notion that we need to set regulations in place that will eventually drive all residents from the floodplain. This is a fool's errand. Energies would be better spent focusing on achievable river improvements such as cleaner water, river ecology education of our youth and island clean-up. We have been on this river, in the floodplain, for over 400 years and we are taking pretty good care of her. In the last few decades the river has gotten much cleaner and the environment more stabilized. The beauty of the Delaware River is, as seen by the folks who are near her and love her. Without them there is no beauty. Please use common sense when laying on rules and do not approve this unnecessary and overly burdensome definition change.

Mick Drustrup,

Riverfront Property Owner's Representative

Floodway Definition

This letter expresses strong opposition to the recommendation to redefine the floodway from a 1.0 rise to 0.2 feet rise.

The essence of floodway has always been defined as the area of a flooded river that carries the highest currents and where structures are much more susceptible to damage. Floodway rules, for this reason, are much more restrictive. Extending the floodway into the area of low current and still waters of the floodplain diminishes the heightened awareness and greater sensitivity necessary for the true floodway.

This draconian change mirrors New Jersey's strident floodplain regulations and significantly extends the area within the floodway, adding heavy and unnecessary regulations to thousands. During our deliberation it was neither shown that the one foot definition was ineffective nor that the 0.2 feet definition was much more effective.

This definition change will have significant adverse impact on the thousands of people who currently live in the floodplain near the floodway. They will be prevented from adding a garage and mother-in-law suite or that planned addition to the back porch. Property values will go down and the local tax bases reduced. This rule change is unnecessarily restrictive to property owner's freedoms and accomplishes very little.

The cost to government, of implementing this change was not discussed during our deliberations, but probably will be large. The cost of mapping and promulgation, as well as the cost of enforcement and legal administration will run into the millions. And for what? Making it harder for people to live in the floodplain so as to influence them to leave? Lower risk? Sometimes when people deliberate an issue such as we have done, the hardest thing to do is to say no change is the best course. This is one of those times. **Please do not approve this definition change recommendation.**

Mick Drustrup,

Riverfront Property Owner's Representative

DRN Comment 1

May 13, 2009

Flood Advisory Committee
Delaware River Basin Commission
West Trenton, NJ

Dear Members of the Flood Advisory Committee,

I had the honor of serving as a member of the Floodplain Regulations Evaluation Subcommittee over the past several months. I wanted to take this opportunity to speak to the recommendation for a mandatory 100-foot buffers requirement.

I believe it is critical that not only does the FAC elevate forward the recommendation of a vegetated buffer requirement, but that it retain the 100-foot mandatory width as a cornerstone part of that recommendation and that the recommendation be modified to mandate the buffer be forested as opposed to simply vegetated.

The 100-foot mandatory forested buffer should be pressed forward for the following reasons:

- ✓ It will provide needed flood storage, absorption and peak attenuation for our watershed communities;
- ✓ It will help preserve the carrying capacity of streams;
- ✓ It will ensure a zone where there are no homes or structures to be damaged thereby strengthening the flood damage reduction goals of floodplain protection programs;
- ✓ It will give communities the baseline width they need to secure the array of benefits that forested buffers provide;
- ✓ It will ensure that every community can benefit equally from a buffer protection program regardless of their level of engineering, legal and political resources, (or that of their upstream neighbors) while providing an opportunity to justify another buffer protection strategy based on community specific conditions if the community is willing to invest the resources, time and talent needed to ensure an effective buffers protection program;
- ✓ The science continues to emerge to demonstrate that 100-foot forested buffers ensures the best array of community protections.

Failing to articulate the specific 100-foot buffer width and simply relegating it to further and future study dooms the recommendation of a mandatory buffer requirement to failure. Setting a specific figure of 100 feet, a figure that even if you disagree with it has a firm footing in science ensures that the

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recommendation and benefits of a buffer requirement moves forward. Concerns about whether 100-foot is the appropriate width can be debated and vetted through the regulatory process where it will be subject to scientific debate as well as political scrutiny. Failing to provide a figure ensures that before there can be that scrutiny and debate there needs to be another stakeholder committee whose efforts would lag well behind the floodplain regulatory initiative at hand and as a result either the recommended floodplain regulation enhancements would be held up until the new committee has done its work, or the outcome of that committee effort would come too late to be of service.

Why have a buffer requirement as part of a flood damage reduction strategy?
Development in the floodplain and/or stream side cumulatively has affects on flooding and damages -- removal of vegetation, introduction of fill and structures, and the compaction of soils all increase the volume of water that is passed into the streams, reduces the ability of streamside lands and floodplains to absorb floodwaters; it reduces the space available for floodwaters to spread out and slow; and it knowingly places structures, infrastructure and emergency response personnel in the path of floods when they do occur.

Mandating forested buffers along all natural water courses ensures a vegetated buffer that is able to provide all of the quantity, quality, erosion and ecosystem benefits that are helpful in protecting streams and communities from the adverse impacts of floods. Vegetated buffers reduce downstream flooding by reducing velocity and volume through storage, infiltration, uptake, increased travel time and a resulting reduction in flood peaks.[i] Vegetated buffers help ensure that there are not structures placed in such close proximity to streams and rivers that they are there to be subject to damage when there is a flood (i.e. vegetated buffers are another useful tool for flood zone management[ii] – they keep development back from waterways thereby reducing the quantity of structures present and subject to damage).

While the focus of riparian buffer research has often been on the water quality and habitat benefits of buffers, there is expert support for the benefits of buffers for addressing non-natural flood flows and peaks. At a presentation by Dr. Bern Sweeney to the FRES on March 31, 2009, it was presented that streams without buffers have higher peak and volume rates during periods of high flows. In addition he described how 100-foot forested buffers protect streams from unnatural narrowing which otherwise compromises their carrying capacity. An Army Corp technical document regarding riparian buffers affirmatively states the "widely recognized" value of buffers for, among other things, "reducing flood peaks".[iiiiv]

It has been found that meander bends are five times less likely to be significantly eroded from a major flood than nonvegetated bends[v]-- this is important in light of the fact that erosion of public and private lands is one of the adverse impacts from flooding.

Experts have noted that buffer systems in conjunction with LID practices work by utilizing natural processes to provide significant detention through depression storage and infiltration. As a result, peak rate and volume of post-construction runoff can often be reduced dramatically.[vi] Research has consistently concluded that because of the hydrological impacts of buffers, those areas which preserve and restore such systems may require less or smaller sized stormwater infrastructure, such as detention basins.[vii] This fact is widely recognized and many state and local stormwater management programs allow for the "crediting" of stormwater that is discharged to intact buffer systems. This is all of tremendous benefit to those that live downstream.

And in at least one study it was concluded that "adjacent forest vegetation and litter lowered stream water elevations from 9.9 m (32.3 ft) to 5.3 m (17.3 ft) for a 100-year flood."[viii]

Why forested buffers versus vegetated?
The FRES recommendation is simply for vegetated buffers. I would like to urge a modification that would require forested buffers.

The root systems associated with vegetated buffers protect and support the banks and other critical parts of a stream's morphology, allowing it to resist erosive forces and remain stable. The vegetation's roots hold the riparian lands in place, maintaining the hydraulic roughness of the bank, slowing flow velocities in the stream near the bank. Root systems of woody shrubs and trees do a better job of anchoring soils— a function turf grass cannot do effectively.[ix] Streams reaches that are forested "exhibit 20 – 33% slower channel migration and lower floodplain accretion rates of sediment and thereby provide more stability than deforested channels."[x] In light of the amount of erosion that results from flooding, this enhanced level of benefit provided by forested buffers advocates for a forested buffers requirement as opposed to simply vegetation.

Research has concluded that forested buffer systems, as opposed to grassed systems, provide enhanced *in situ* (instream) contaminant sequestration and degradation primarily due to increased biological activity -- increased nitrogen attenuation and pesticide degradation are particularly associated with forested stream buffers.[xi] Forested buffers have been shown to be 2 to 3 times wider than non-forested streams[xii], thereby enhancing their ability to process point and nonpoint source pollution inputs.[xiii]

Forested buffers help protect waterway carrying capacity. It has been shown that forested streams in the Piedmont region "were wider and had lower average water velocity and higher bed roughness than adjacent deforested channels."[xiv] Streamside trees are well recognized for their ability to reduce flooding and flood damages [xv] and are generally more effective at providing flood protection than either grass or shrubs.[xvi]

Why 100 feet?
It is widely acknowledged that vegetated buffers provide a broad array of critical community and ecosystem protections and benefits. Likewise, buffers are not generally installed or mandated in order to accomplish one single goal – they are widely recognized as of tremendous benefit for multiple reasons. In setting a buffer requirement it is essential that we set it at a width that best accomplishes all of the goals of a buffer requirement, including flood control, damage reduction, erosion prevention, as well as pollution prevention, habitat and ecosystems creation and support, community quality of life, ecotourism, recreation, tax benefits and jobs. Therefore, when considering what width to mandate, it is important to identify that minimum width which is needed to secure the greatest variety of benefits at a reasonable and beneficial level. Buffers greater than 30 meters (approximately 100 feet) are able to support most of the functions communities seek in setting a vegetated buffers requirement – widths below this figure do not adequately maintain most of the beneficial functions of vegetated buffers.[xvii]

From a practical perspective, setting a uniform minimum buffer width that would apply in the absence of special community planning and enforcement makes practical sense. Uniform widths are easier to enforce, allow for greater predictability within the development community, and require less specialized knowledge, time and resources to create and administer.[xviii] On a basinwide perspective, it makes more practical sense to have a uniform minimum standard, allowing for an alternative approach in those communities willing to invest the specialized resources needed to develop, implement and enforce an alternative, whether wider or more narrow. But for those who do not want to make this investment, a minimum uniform width is a cost and resource saver that is of benefit.

One literature review found that for flood attenuation the science pointed to a range of widths from 65 feet to 492 feet (20 to 150 meters).[xix] This review demonstrates that for flood attenuation it is generally

accepted that wider buffers are what is needed and that a mandatory 100-foot minimum is actually on the smaller side of the range – a more conservative approach would actually mandate a larger buffer requirement closer to 250 feet. And most notable, while the recommendation of the FRES and this letter is to put in place a minimum 100-foot buffer requirement, the recommendation does provide for communities to undertake a science and community based review that would allow recommendation and adoption of alternative buffer widths on a community specific basis. The recommendation does not say no other size is acceptable – it simply states that in the absence of a community specific and science based alternative the minimum should be the figure of 100, which does not appear to be all that conservative in light of emerging science on recommended buffer widths for flood attenuation, erosion control, stream narrowing and other flood related issues.

Unnatural levels of erosion is one significant outcome of streamside/riverside development and increased flooding. One report has identified 50 meters (164 feet) as the minimum for providing detrital input and bank stabilization to a waterway. [xx]

Numerous studies have concluded that buffers, particularly forested varieties, provide significant removal of aquatic contaminants, including toxics. While site specific conditions dictate the effectiveness of such systems, many researchers have concluded that buffers can remove upwards of 80 to 90% of such contaminants when equal or greater to 100 feet in width. [xxi] And study has shown that forested streams can process "two to 10 times the ammonia per unit length that a deforested stream can."[xxii]

Buffers also regulate stream temperature through shading, important for healthy habitat. Studies have concluded that removal of streamside vegetation can result in a temperature increase of 6 to 9 degrees Centigrade.[xxiii] Also, riparian vegetation moderates stream temperature reducing the daily and seasonal fluctuations in stream temperature. It has been found that not only the presence but also the size of forested stream buffers have a profound impact on a streams ability to support trout populations. Researchers found that when forested buffer widths were reduced from 100 feet to 50 feet, stream temperatures increased 2.9 °F to 4.2 °F while fine sediments increased 11%. Although these changes may appear small numerically, they resulted in an 81-88% reduction in young trout populations.[xxiv]

The range for wildlife, aquatic and bird benefits is large but generally well exceeds the 100-foot range.[xxv]

Literature reviews repeatedly document that 100-foot widths, and often greater, are critical for achieving these discussed functions as well as many others.[xxvi]

The Army Corps states, "that establishing or maintaining existing vegetated buffers to open waters is critical to overall protection of the nation's aquatic ecosystems".[xxvii] The Army Corps points out that the wider the buffer, the more protective of ecological functions they will be, which the Army Corps considers to be a mandated goal of the Clean Water Act.[xxviii] The Natural Resources Conservation Service Planning & Design Manual recognizes that while there may be a range of buffers to choose from, "a minimum buffer of 100 ft (30 m) on both sides of the stream is recommended for sufficient protection of the stream. This usually amounts to a buffer that is 3 to 5 mature trees wide on each side of the stream."[xxix]

There is ample science to demonstrate that buffers are a benefit for many reasons including flood protection and flood damage reduction, and that at a 100-foot width the wide array of benefits that a vegetated buffer can provide is provided to a meaningful degree.

Currently, floodplain regulations do not focus on the cumulative and community impacts of floodplain and streamside development. They primarily look to protect the individual homeowner from structural damage. Mandating 100-foot forested buffers, of course with appropriate exceptions when justified, can help change that flawed focus and perspective. It is a step towards ensuring that we are making decisions regarding development and communities that are fair and beneficial to the streamside landowner as well as the rest of the community that is either benefitted or harmed from the floodplain actions that are allowed.

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[i] Vegetated riparian buffers and buffer ordinances, NOAA and South Carolina Dept of Health and Environmental Control; Fischer & Fischenich, Design Recommendations for Riparian Corridors and Vegetated Buffer Strips, emrrp, April 2000.

[ii] Vegetated riparian buffers and buffer ordinances, NOAA and South Carolina Dept of Health and Environmental Control.

[iii] Army Corps of Engineers WRAP, "Technical and Scientific Considerations for Upland and Riparian Buffers Strips in the Section 404 Permit Process", ERDC-WRAP-01-6, May 2002, citing DeBano and Schmidt 1990; O'Laughlin and Belt 1995".

[iv] Miller, A.E. and A. Sutherland. 1999. "Reducing the Impacts of Storm Water Runoff through Alternative Development Practices." Office of Public Service & Outreach, Institute of Ecology, University of Georgia, Athens, GA.

[v] Center for Watershed Protection, "Impacts of Impervious Cover on Aquatic Systems", Watershed Protection Research Monograph No. 1, March 2003. See also Vegetated riparian buffers and buffer ordinances, NOAA and South Carolina Dept of Health and Environmental Control, recognizing the benefits of vegetated buffers for erosion control.

[vi] Tourbier, J.T. 1994. Open space through stormwater management: Helping to structure growth on the urban fringe. J. Soil Water Conservation. 1994. vol. 49, no. 1, pp. 14-21.

[vii] Miller, A.E. and A. Sutherland. 1999. Reducing the Impacts of Storm Water Runoff through Alternative Development Practices. Office of Public Service & Outreach, Institute of Ecology, University of Georgia, Athens, GA.

[viii] Castelle, Johnson, Conolly, "Wetland and Stream Buffer Size Requirements – A Review", J. Environ. Qual. 23:878-882 (1994);

[ix] National Research Council. 2002. Riparian Areas: Functions and Strategies for Management. Water, Science, and Technology Board, Board of Environmental Studies and Technology, National Academy Press, Washington, DC. Also see Stroud Water Research Center, Protecting Headwaters: The Scientific Basis for Safeguarding Stream and River Ecosystems, 2008.

[x] Sweeney, et al, Riparian deforestation, stream narrowing, and loss of stream ecosystem services. 2003.

[xi] Sweeney, B. W., et al. 2004. Riparian deforestation, stream narrowing, and loss of stream ecosystem services. PNAS, September 2004; 101: 14132–14137.

[xii] PA CREP Fact Sheet: Streamside Magicians, How Trees Help Streams, 2006, citing Stroud Water Research Center research.

[xiii] Sweeney, et al, Riparian deforestation, stream narrowing, and loss of stream ecosystem services. 2003.

[xiv] Sweeney, et al, Riparian deforestation, stream narrowing, and loss of stream ecosystem services. 2003.

[xv] See for example PA CREP Fact Sheet: Streamside Magicians, How Trees Help Streams, 2006, in which this powerful benefit of trees is affirmatively stated by the State program's fact sheet.

[xvi] Riparian Buffer Zone. NRCS Planning & Design Manual, NRCS.

[xvii] Johnson, A.W. and D. M. Ryba. 1992. A literature review of recommended buffer widths to maintain various functions of stream riparian areas. Prepared for King County Surface Water Management Division, as cited in Buffer Strip Function and Design, An Annotated Bibliography, Compiled for Region III Forest Practices Riparian Management Committee. Aquatic Resource Consultants, Renton, WA. While this citation is of only one literature review, if desirable I could provide a wide variety of citations to back this conclusion – the literature time and time again documents that bigger buffers are needed to provide the valuable functions that healthy vegetated buffers can deliver; smaller widths are able to accomplish a much more limited goal set and therefore are of much more limited value.

[xviii] Environmental Law Institute. Conservation Thresholds for Land Use Planners. 2003. Pges 20-21.

[xix] Fischer & Fischenich, Design Recommendations for Riparian Corridors and Vegetated Buffer Strips, emrrp, April 2000.

[xx] Environmental Law Institute. Conservation Thresholds for Land Use Planners. 2003. Pges 20-21.

[xxi] Summary of Select Studies Reporting Percentage of Pollutant Reductions Based on Buffer Size

		% Reduction based on Buffer Size:											
		~15 ft (4.6 m)			~35 ft (10.7 m)			~100 ft (30.5 m)			> 100 ft (> 30.5 m)		
Study	**Year**	**N**	**P**	**S**	**N**	**P**	**S**	**N**	**P**	**S**	**N**	**P**	**S**
Lowrance *et al.*	2001	5%	62%	60%	50%	65%	80%	80%	80%	90%	95%	90%	90%
Lowrance *et al.*	1995	4%	29%	61%	23%	24%	75%	80%	77%	97%			
Schwer & Clausen	1989							76%	78%	89%			
Magette *et al.*	1987	17%	41%	72%	51%	53%	86%						
Barker & Young	1984										99%		
Young *et al.*	1980							87%	88%				

[xxii] Stroud Water Research Center, Protecting Headwaters: The Scientific Basis for Safeguarding Stream and River Ecosystems, 2008.

[xxiii] Leavitt, J. 1998. The Functions of Riparian Buffers in Urban Watersheds", page 4, Master of Science Degree Report, University of Washington, Seattle, WA.

[xxiv] Meyer, J. M., et al. 2005. Implications of Changes in Riparian Buffer Protection for Georgia's Trout Streams. Institute of Ecology, The University of Georgia, Athens, GA.

[xxv] Fischer & Fischenich, Design Recommendations for Riparian Corridors and Vegetated Buffer Strips, emrrp, April 2000; see Delaware Riverkeeper Network Wide Riparian Buffers Fact Sheet for a wealth of citations regarding this fact.

[xxvi] For example Buffer Strip Function and Design, An Annotated Bibliography, Compiled for Region III Forest Practices Riparian Management Committee; A Review of the Scientific Literature on Riparian Buffer Width, Extent and Vegetation, Office of Public Service and Outreach, Institute of Ecology, Univ of Georgia, March 1999; Stroud Water Research Center paper discussed during presentation before the FRES and expected to be released Summer 1009.

[xxvii] Army Corps of Engineers WRAP, "Technical and Scientific Considerations for Upland and Riparian Buffers Strips in the Section 404 Permit Process", ERDC-WRAP-01-6, May 2002 citing the Federal Register 67(10), p. 2065.

[xxviii] Army Corps of Engineers WRAP, "Technical and Scientific Considerations for Upland and Riparian Buffers Strips in the Section 404 Permit Process", ERDC-WRAP-01-6, May 2002.

[xxix] Riparian Buffer Zone. NRCS Planning & Design Manual, NRCS.

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May 15, 2009

The New Jersey Farm Bureau, in order to best represent the agricultural interests of farmers in the Delaware River Basin, officially dissents to several of the recommendations set forth by the Floodplain Regulations Evaluation Subcommittee. Furthermore, we have concerns in regard to the process that has been used to develop these recommendations. Below is a description of our concerns, issues, and, where appropriate, support.

Description of our concerns with the recommendations:

Socio/economic Impacts:

- Despite concerns raised by several subcommittee members, the subcommittee was denied the opportunity to investigate the socioeconomic effects of more restrictive floodplain regulations on communities. It cannot be stressed enough that a socioeconomic analysis should be performed to determine the impact that any floodplain management recommendations will have on private property owners in the floodplain of the Delaware River Basin. We cannot view floodplain management in a vacuum, absent from social and economic thought without consideration for the collective needs of local communities. To approach floodplain management from a singular perspective and not consider social and economic benefits and costs of these recommendations would not be fair and balanced. Additionally, social and economic analyses are routinely performed (even mandated) by other regulatory bodies when regulations are proposed, therefore, performing a social and economic analysis for the recommendations herein would be in keeping with these other rule-making bodies. Therefore, both short-term and long-term socioeconomic analysis of floodplain management recommendations should be performed.

Regulatory Floodplain Definition:

- The FRES recommends either one of two approaches for the definition of the regulatory floodplain: 1) 1% annual chance peak flow plus 25% along the main stem of the Delaware River and all other streams and rivers within the basin, or 2) the 0.2% annual chance floodplain along the main stem of the Delaware River and all other streams and rivers within the basin. We are opposed to either approach for defining the floodplain. While NJ already established regulations for the 1% annual chance peak flow plus 25%, this approach does not use data that corresponds to real-life flood events. The 25% additional flow is an arbitrary number created in a NJDEP resolution from 1974. The NJFB cannot support this approach in the recommendation as it is not based on sound science. Additionally, the recommended alternative approach to use the 0.2% annual chance floodplain as the regulatory floodplain definition is unnecessarily restrictive. While a 500-year floodplain may be appropriate for areas at high-risk of flooding, other areas that have never flooded before would be adversely affected by the implementation of such a recommendation.

Floodway Definition:

- The more restrictive floodway definition of a 0.2 foot rise would place greater portions of communities in the floodway. The economic impacts of this change could be great, in regard to costs associated with new mapping, loss of land use and land value, and other financial hardships. We believe that it has not been sufficiently demonstrated throughout the course of these deliberations that the 0.2 foot rise would be a much more effective floodway definition than that currently in place throughout the basin. Is there experience that demonstrates this recommendation will be better? How much more land will this take?

Development/Fill in the Flood Fringe:

- In order for the agricultural industry that is located in the floodplain to remain competitive against other regional farm operations, agricultural producers must be afforded special consideration for agricultural activities and agricultural development within these areas. Excessive agricultural development restrictions on farms located in floodplains would increase their costs beyond their regional competition and detract from overall farm viability. We support the use of the floodplain for agricultural activities, the coordination with existing programs that preserve agricultural lands, and the development of new agricultural structures designed in a manner that results in minimal damage to the structure and its contents and that creates no additional threats to public safety.

Stream/riparian Corridors and Vegetation Disturbance:

- We support the incorporation of the buffer concept as part of floodplain management and we agree that vegetated buffers provide benefits of floodwater storage however we do not support an arbitrarily prescribed 100-foot minimum riparian buffer requirement for flood protection purposes. Fixed-width buffers present a one-size-fits-all approach that does not take into account site-specific conditions such as land use, stream characteristics, hydrology, and topography, among many other variables. We support the use of variable-width buffers that are established based on science and site-specific characteristics.

Stormwater Regulations – Redevelopment:

- Stormwater runoff is a complex and challenging issue. As such, we encourage the FAC to form a stormwater evaluation subcommittee to properly address this issue as it relates to flood management, throughout the basin.

<u>Description of our concerns with the process for developing recommendations:</u>

- The FRES was charged to develop recommendations on the "potential for more effective floodplain management" yet used a process that permitted only a cursory examination of the most and least stringent regulations already in place in the basin states. There was no time allowed for us to determine whether the most and least stringent regulations in these states have been effective in reducing flooding or flood-caused damage to human life and property or whether they are based on a firm scientific foundation. What works in one community may not work effectively in another due to the hugely variable physical conditions and historic land uses that characterize the Delaware River Basin.

- The pace at which these recommendations were developed was much too rapid. A total of eight meetings took place since November 2008 for the development of these recommendations. The brevity of these meeting dates did not sufficiently allow for enough discussion or a proper consensus process whereby minority objections could be appropriately addressed.

DELAWARE COUNTY PLANNING DEPARTMENT

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To: Delaware River Basin Commission
Flood Advisory Committee (FAC)
From: Nicole Franzese, Planning Director
Date: May 19, 2009
Re: FRES Recommendations Comments

Delaware County Planning Department (DCPD) submits the following paper as comments on the Floodplain Regulation Evaluation Subcommittee (FRES) recommendations to the Flood Advisory Committee (FAC). Delaware County was pleased to support the effort of the FRES and provide input and comment on the recommendations as they were developed and drafted. However; we are not in support of all of the recommendations in the final paper. Our paper details the main areas of dissension between our conclusions and the FRES recommendations.

We do not agree with the FRES recommendation regarding the changes in the regulatory definition of floodplain and floodway. DCPD has provided an alternative process for identifying flood hazards and using this process to inform any potential change in the regulatory definitions of floodplain or floodway. This process is outlined in numbers one (1), two (2) and three (3). A version of this process was included in the paper as a method for identifying risk areas in unmapped areas of the Delaware River Basin (DRB). Number four (4) is DCPDs' conclusion and recommendation for how the FAC should address the Task Force Recommendation FR-5: Standardized Riparian Corridors, included in the FRES paper under the heading Streams/Riparian Corridors and Vegetation Disturbance. We offer the following general comments for consideration.

Findings - DCPD has some general concerns regarding the FRES findings. After the presentations were concluded the majority of the FRES members felt that the floodplain regulations in the DRB were not adequate and implementation of the most stringent regulation would lead to more effective floodplain management. The analysis of the regulations showed that the regulations in all four states met minimum NFIP standards with New Jersey's standards being more restrictive than the NFIP minimum. Information from the Task Force showed distribution by county of repetitive losses throughout the basin, 60% in Pennsylvania and 30% in New Jersey.

Were these losses in or out of the floodplain? Are these historic communities or is this new construction? If New Jersey's more stringent standard for regulatory floodplains and floodways has been in effect since 1975 why are these losses still occurring? Is this because Pennsylvania uses a different regulatory standard along the mainstem? The conclusion that changes in the regulatory definition of floodway and floodplain will improve this situation was premature and may greatly underestimate the problem. More specific analysis of why, where and how these losses occur needs to be conducted before these recommendations are implemented. Also, this conclusion relies on the content of the regulations being the problem while this may not be the case.

Education, Training, Administration and Enforcement - The training and education of the local officials involved in floodplain and land-use management are essential components to the success of the administration and enforcement of any regulation. Members of the FRES indicated that existing floodplain regulations are not being administered effectively in the DRB. Making regulations more stringent will not address or fix this problem. This must be done by providing more education and resources to local communities so that they can adequately administer their existing regulations. Until and unless this issue is addressed this situation will not improve. We have found through the adoption and implementation of our county watershed management plan, DCAP that when communities have access to technical resources for planning, floodplain management, stream corridor management, highway management, etc., they will make better decisions on the ground that protect their natural and manmade environment. Education and training must be provided to DRB communities for administration and enforcement of the floodplain regulation to improve; this needs to occur independent of the adoption of these recommendations.

It may be the eventual conclusion of the DCPD that these regulatory changes are warranted; but at this time we cannot endorse this recommendation for Delaware County without more information and a more detailed analysis.

Adoption and Implementation Process - Prior to implementation of any of the recommendations contained in this report, a socioeconomic and environmental analysis must be performed to determine the full impact of any floodplain management recommendation. This type of analysis is required as part of any rule making process and would recognize that effective floodplain regulations often need to balance community sustainability, implementation strategies, economic

development, property rights, environmental quality, and health/safety issues. (FRES Report Socio-economic Impacts)

DCPD concurs with this recommendation and also encourages the FAC and DRBC to follow the guidance given in the basin states to how these analyses are conducted. For example, New York required a comprehensive State Environmental Quality Review Act (SEQRA) review and SAPA process be followed that involves the public, solicits comments and balances all the factors. The SAPA process also allows for a specific 'Rural Flexibility Analysis" that considers the impact of potential regulations on rural communities. This process should not be circumvented by the adoption of any of these recommendations at the DRBC level; the recommendations should be considered and adopted state by state using these processes.

DRBC should lobby that the states/counties/towns/villages/residents in the Basin receive additional points for all federal grants related to flood recovery programs/efforts supported by the FAC. This is an essential general recommendation that the DRBC should implement immediately. During the months the FRES was meeting, the Town of Hancock in Delaware County, NY applied for Federal funds to institute a buffer program. They were given some general feedback that they were unlikely to get the grant because the Midwest states were being given higher priority for this funding. In general, Delaware County has been able to access funding for watershed management in part due to the presence of the NYC Watershed and our watershed partners at the Upper Susquehanna Coalition. However; other areas of the DRB may not be as fortunate. The DRBC can take a more active role to facilitate funding for the DRB communities.

1) **Flood Risk Characterization of Stream Reaches within the Basin (Urban vs. Rural, Mainstem vs. Tributary, Headwaters vs. Piedmont vs. Estuary)**

Background:

The mainstem Delaware River stretches roughly 360 miles from it's headwaters in New York State to its mouth at the Delaware Bay, and its tributaries extend many hundreds of miles more. Over its course the river runs through a variety of landscapes, all which affect the risk to life and property from flood events differently. Many geomorphic, geologic, climatological, and anthropogenic factors influence the flood risk on a particular stream reach. It is important to note that anthropogenic factors, development patterns in particular, are a key determinant of the risk a flood poses to life and property. In the event of a flood, more people and property will be in harm's way in densely populated areas. Given the diversity across the Basin in watershed and stream corridor character, and development patterns, it is essential that management prescriptions be suited to the stream reach where they are applied. Good stream management on a lightly populated headwater reach is going to look very different from good stream management on a lower estuarine reach adjacent to a major metropolitan area. While adopting consistent goals throughout the Basin is critical, the methods for attaining those goals are going to vary on particular stream reaches. Stream regulators and managers must be wary of over-generalizing the Basin when prescribing management solutions. To proceed otherwise risks harming communities, either by not requiring enough safety precautions, or by over-regulation. We feel that a characterization of this nature is a critical pre-requisite to creating any kind of new regulation or program. This analysis could result in something similar to the hydro-physiographic regions created by the USGS[1], but going a step further to incorporate anthropogenic factors like population density and land use.

Recommendation:

Conduct a basin-wide geo-spatial analysis to create a stream reach risk taxonomy:

Before moving forward with any new regulation, it is essential that DRBC create a measure of flood risk for every point along the mainstem and tributaries of the Delaware River, using input from current science and development patterns. A basin-wide first stroke of this analysis should include population density, development trends, and history of flood damage. It stands to reason that sparsely populated areas, that are not likely to become more densely populated in the future

[1] USGS Scientific Investigations Report 2006-5112. 2006. Magnitude and Frequency of Floods in New York. http://pubs.usgs.gov/sir/2006/5112/, accessed 5/2/2009.

given current trends, and that have not experienced significant damage from flooding in recent history, can be considered to have a lower risk of loss of life and property in the event of a flood. Once these areas are isolated attention can be focused on areas where more people are in danger. The metrics listed above would be relatively cheap to assess, and would give an initial feel for areas that would benefit from additional analysis using other geomorphic, geologic, and climatological factors, and possibly more stringent regulation. This information would be used in conjunction with flood hazard mapping, creating another layer of classification based on additional watershed characteristics and development patterns. This "risk rating" could then be used to determine the appropriate flood damage prevention prescription for a particular stream reach. DRBC should lobby that states/counties/towns/villages/residents receive additional preference when seeking federal funding for efforts of this nature.

2) Regulatory Floodplain Definition

Background:

The flood hazard area, or floodplain, is the area along a waterway that is expected to be or has been inundated by floodwaters. As future development or other land use changes within a watershed area occur, runoff may increase flows to flood-prone areas downstream. In NJ, for state land use regulatory permits, the NJ Flood Hazard Area is defined as the area inundated by the one percent annual chance flood (often called the 100-year flood) plus an added flow of 25%. DE, PA and NY currently use the 1% annual chance flood without any considerations for future build out. The 1% annual chance flood, as defined by FEMA as the "base flood" assumes that when the flood fringe (floodplain outside of the floodway) is fully developed, an increase of up to one foot in the base flood elevation may occur.

Adding 25% to the peak flow rate will result in a more conservative definition of the floodplain. Using this approach, however, creates a situation where the floodplain for a given sub-basin does not correspond to a particular flood event, and floodplain extents will be inconsistent between sub-basins. An arbitrary 25% increase in one basin might result in a flood extent equivalent to a 150 year event. Using the same 25% in another basis might result in a flood extent equivalent to a 250 year event. This inconsistency is a result of the physical features of the land contributing runoff to the system.

It is also important to consider that although an area may be located outside of the 1% annual chance floodplain, it does not completely rule out the possibility that the area may be susceptible to potential flooding impacts. Nationally about 25 percent of flood insurance claims are made by property owners that are located outside of the 1% annual chance floodplain.

Additionally, an uncontrolled release of water during either a non-storm or storm event, like the catastrophic dam failure or the breach of a levee, could result in significant flooding impacts beyond anticipated 1% annual chance floods.

It is important to recognize areas where the risk of flooding beyond 1% annual chance flood is greatest based on watershed characteristics, and expand the regulatory floodplain accordingly in these areas.

Recommendation:

Regulatory floodplain should be more extensive than the 1% annual chance of inundation for higher risk areas where appropriate.

The extent of the regulatory floodplain in areas that are at a greater risk of flooding beyond the 1% annual chance should be expanded. A method for this that is based on science and development patterns could be to use the .2% annual chance floodplain (500-year floodplain) for high risk areas and for critical facilities that if flooded could result in serious danger to life and health, or widespread social or economic dislocation. The 1% floodplain could be used for low risk areas. The measure of risk should be based on a basin-wide stream corridor flood-risk evaluation, as described above in (1). In both cases, basing the regulatory floodplain extent on a design storm as opposed to an arbitrary percentage increase over the BFE will result in a consistent flood extent between sub-basins that face similar risks of flood damage.

3) Regulatory Floodway Definition

Background:

Existing flood hazard area maps greatly underestimate the limit of floodways along the main stem Delaware River and in many cases do not exist for other waterways within the Delaware River Basin. The flood hazard area, or floodplain, is the area along a waterway that is expected to be or has been inundated by floodwaters. The floodway, which is the inner portion of the flood hazard area nearest the stream or river, is the most dangerous area that

carries deeper flows and higher velocities during a flood. New construction is generally prohibited in floodways because it is unsafe and obstructs the passage of floodwaters. However, the flood fringe, or areas immediately adjacent to floodways where development is commonly allowed are often subject to flood depths and velocities similar to those of the floodway.

A regulatory floodway is defined as the channel of a river or other watercourse and portions of the floodplain adjoining the channel that must be reserved in order to carry and discharge the base (or 1% annual chance) flood without cumulatively increasing the water surface elevation more than a designated height. The minimum FEMA floodway determination allows for a 1.0-ft rise. The current New Jersey State floodway standard, allows for a more conservative 0.2-ft. rise in flood depths. This more stringent, lower rise determination results in a larger regulatory floodway allowing the same base floodwaters to be carried downstream over a larger area. Even though NJ has adopted this more stringent standard on its in-state waterways, the less stringent FEMA standard was used to delimit the floodway for the main stem of the Delaware River to avoid inconsistencies between different floodway criteria on the New Jersey and Pennsylvania sides of the river. Both Pennsylvania and New York allow a 1.0-ft rise floodway standard throughout the Delaware River Basin. Communities must regulate development in these floodways to ensure that there are no increases in upstream flood elevations.

As a result, regulatory defined floodways are extremely narrow and new construction is sometimes improperly permitted in close proximity to streams and rivers simply because they are not currently demarcated as floodways. Greater portions of communities would likely lie within mapped floodways if the 0.2-ft floodway standard were to be used. Adequately defining the floodway and regulating development in these floodways is one way to ensure flood loss reduction.

The Floodway drawn on FEMA FIRMs is based on a technique of compressing the wetted cross section in the hydraulic model, until a desired surcharge is achieved. This surcharge is typically 1 foot; however some other entities use a smaller surcharge, which is considered to be more restrictive. The limits of compression are then translated spatially onto the FIRM, where boundaries between measured cross sections are interpolated. The limit of a floodway is defined by the boundary on the FIRM, and is not based on elevation.

Do to the inherent challenges of hydrologic and hydraulic modeling, limitations of topographic accuracy, and general cartographic limitations, to a certain extent the exact placement of a floodway is open for discussion, debate and change. A FEMA Letter of Map Revision has to be done according to accepted engineering principles. It also has to be approved by the local community. If the map revision results in any increase in BFE or flood hazard area boundaries, the developer must have control of that land. Within these parameters, though, there exists the possibility that by adjusting the parameters within the modeling, such as discharges and cross sections, or improving the delineation with

topography, it may be possible for an individual to make changes in the floodway following affected property owner notification and due process.
Therefore, while the floodway concept is a strong floodplain management tool, it is only as strong as the mapping it is based on. A floodway based regulation is only applicable on streams where a floodway is defined. Many streams in the Delaware basin do not have a defined floodway.

Recommendation:

Base any change in regulatory floodway definition on a comprehensive risk analysis of the entire basin
as detailed above in (1) Flood Risk Characterization of Stream Reaches within the Basin.
Any change to the floodway definition should be based on:

1. The population and development density, growth pressures, and history of flood damage in the affected communities;

2. Additional flood risk characterization of the stream reach as detailed in (1) above, in areas where population and development density, growth pressures, and history of flood damage suggest it is necessary.

Such an analysis should be done in conjunction with floodplain remapping scoping efforts, which must include input from local communities. DRBC should lobby that states/counties/towns/villages/residents receive additional preference when seeking federal funding for efforts of this nature.

4) Community-based variable-design riparian buffer program

Researchers and practitioners from academia, government, and the private sector are in nearly unanimous agreement that a variable-design buffer system, with buffers tailored specifically for particular stream reaches, is the most effective strategy for accomplishing flood damage prevention on a watershed scale[i]. Simply put, a well-designed buffer responds to all the parameters of the site to accomplish its defined purpose.

The Delaware River Basin Interstate Flood Mitigation Task Force agreed in their Final Report/Action Agenda presented to the DRBC in July of 2007. Under

Recommendation FR-5, the Task Force recommends "Standardized riparian corridors should be considered along all Basin streams, rivers and estuary waters, **the size of which appropriately reflects the relative gradient and natural resources of the watershed[2]."** The Task Force goes on to state that a challenge to implementing this recommendation will be **"determining the appropriate width of the riparian corridor in various portions of the watershed[3]."** Clearly, the Task Force did not intend for the entire basin to have a protected riparian corridor of the same design. With the opinions of the Interstate Flood Mitigation Task Force and experts aligned in favor of a variable-design buffer program, it is hard to comprehend what would motivate sub-committee members to argue for anything different. But argue they did.

Much of the debate amongst the FRES surrounding this issue centered on the merits of a mandatory fixed-width buffer program vs. a community-based variable-design buffer program. The arguments in favor of a mandated fixed-width program raised by sub-committee members, and our rebuttals to them, are listed below:

Argument 1*: A one-size-fits-all program saves the time and effort required to perform site-by-site analysis.*

A variable-design riparian buffer program by necessity requires a detailed investigation of the site where the buffer is to be created, in order for the design to properly respond to the characteristics of the stream reach where it will be located. It is important to note, however, that in order for any program administered on the scale of the DRB to be successful, priority areas must be addressed first[4]. This would be true of a fixed-width buffer program, a water quality program, a program to conserve habitat for an endangered species, and any other hypothetical program one considers. Given limited resources, developing a strategy to address the stream reaches where buffers would be most effective in reducing flood risk first is critical. GIS technology and spatial analysis applications can be used to establish priority buffer locations, as well as site-specific designs, based on parameters including stream width, stream discharge, drainage area, topography, soil type, adjacent land use, population density, history of flood damage, and existing and traditional riparian vegetation to create an order of work that maximizes effectiveness. A

[2] Delaware River Basin Interstate Flood Mitigation Task Force. 2007. Final Report to DRBC Commissioners/Action Agenda, pg. 72.

[3] Ibid.

[4] USDA, 2008;
Hawes and Smith 2005;
Wenger, 1999.

significant amount of the data required for designing buffers suited to particular stream reaches would be assembled during the process of prioritization.

A basin-wide program that doesn't start with a prioritization process will lead to misallocation of resources, and ultimately a buffer program that is not effective in preventing flood damage. Given the necessity of prioritization to a successful program, and the overlap in the work required for prioritization and for creating variable-design buffers, the argument that a fixed-width buffer program will save time and effort over a variable-design buffer program loses validity.

Furthermore, a design not tailored specifically to the site runs the risk of not being adequate to accomplish the desired goal, or being over-designed to the point of consuming more land and other resources than necessary. A good example of the weakness of a fixed-width buffer design involves the variability of the effective width of a buffer for flood damage prevention. Many of the authors reviewed recommend a buffer of at least 75' feet, or the width of the floodplain, whichever is greater, as most effective for flood mitigation[5]. It is important to note that on many streams in the Basin, particularly in the headwaters, the floodplain will be considerably narrower than 75', while on the mainstem the floodplain could be much wider, on the order of many hundreds of feet. Prescribing a buffer of a fixed width for flood damage prevention, even of the minimum of 75', or 100' as Option (1) above calls for, will be inadequate across much of the Basin. In many cases on smaller streams with narrow floodplains a 100' buffer will be larger than necessary, if its purpose is flood damage prevention. The same principle is true for buffers designed for other purposes. Time and money saved in instituting a fixed-width program is not really saved if the program creates ineffective designs that do not prevent flood damage.

Argument 2: *Simplified requirements for compliance make monitoring and enforcement easier.*

It is true that it does not require a high level of sophistication to judge whether a landowner is in compliance with a fixed-width buffer requirement. Compliance monitoring of fixed-width buffers could be performed swiftly by unskilled personnel. But mandating minimum buffer design parameters virtually guarantees that landowners and communities will construct buffers to those

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[5] Hawes and Smith 2005
PADEP 1998
CRJC 2005
USDA 2003
Tjaden and Weber 2005
USDA 2008

specifications and nothing more. In many situations this might not be adequate. As mentioned above, the recommended effective buffer width for flood damage prevention varies widely depending on the stream, and is in many cases much wider than the minimum 100' advocated in Option (1). Without educating people on the ways that buffers will benefit them and providing support for them to install the best design for the intended purpose, it is unlikely that any landowner will preserve or construct a buffer that is any larger than the mandatory minimum. Proper compliance monitoring should judge whether or not the buffer is performing its intended function, not that it is a particular width and composition.

Another issue is that the bulk of the work of compliance monitoring for any buffer program on the scale of the DRB will be done by local people. Top-down mandates have a tendency to alienate local communities and landowners, including the people responsible for enforcement. This is particularly true in rural areas. Without the support of the local enforcement community for a buffer program, enforcement will be, to put it mildly, lax. On the other hand, working with communities to develop buffer requirements that make sense for their particular situation creates a sense of ownership of the program, and an incentive to make sure it is successful.

Argument 3: *Given the number and diversity of landowners and municipalities in the Basin, cultivating the local buy-in required for a community-based program creates an outreach and education challenge. It was asserted by some members that in the face of that challenge, it makes more sense to regulate than to educate.*

A buffer initiative on the scale of the Delaware River Basin will require the cooperation and support of individuals at the local level in order to be successful. Throughout the basin, land-use decisions are made at the municipal or county level. Regulations are also often enforced by local entities. Without the support of all 838 municipalities in the basin, any buffer program is bound to experience problems with administration, enforcement, and maintenance on the ground. While the number and diversity of municipalities in the Basin does indeed present a challenge, it is by no means insurmountable. The Delaware County Action Plan (DCAP) presents a model for collaborative watershed planning that continues to be successful. This mission of DCAP is to assist Delaware County, New York's residents, farmers, businesses, and communities in meeting New York City's stringent water quality standards without a loss of economic vitality. The planning process involved city and state agencies, county agencies, and communities. The result is a plan and a program that has the support of everybody involved, including the communities where water quality management happens. At the time DCAP was initiated Delaware

County was the fourth poorest county in the state. If it can happen in Delaware County, it can happen anywhere, including across the DRB.

While it is possible to force communities and landowners to protect or install riparian buffers through regulation, this approach will not motivate them to be good stewards. An individual who is forced to preserve or plant a buffer on their property will rightly feel that their ability to make decisions about how their land is managed has been taken away. This person can't be expected to consider proper maintenance of the buffer on their property a high priority if they feel as if their ownership of that piece of their property has been compromised.

The right way to create community and landowner ownership of their buffers is to teach people why buffers are important, involve them in the design process and the creation of management plans, and provide financial and technical support for buffer installation, monitoring, and maintenance. A program that successfully engages Basin communities will require staff dedicated solely to education, outreach, and technical support. It will also need to be properly funded, with incentives provided for preserving or creating buffers. If done properly, outreach, education and funding can create the support at the local level that is necessary for the long term success of a buffer program of this scale.

There is no question that a community-based, variable-design buffer program is more resource intensive than a mandatory fixed-width buffer program. However, **the time and money saved by implementing a mandated fixed-width buffer program is not an adequate justification for disregarding scientific consensus that a community-based, variable-design buffer system is more effective.** To act in such a manner risks undermining the program's success due to the failure of poor designs, misallocation of limited resources, and most importantly from the chilling effect that top-down mandates have on community participation.

The following are recommendations aimed at creating a program that allocates resources effectively, installs buffers designed in response to site parameters, includes communities and landowners in the design process, emphasizes education, and cultivates community and landowner buy-in.

1) Conduct baseline assessment and target buffers in the watershed:

The FAC should consider prioritization criteria based on current science for implementation of a buffer program, and use these to conduct a comprehensive geospatial evaluation of the entire basin to prioritize areas where buffers will provide the most benefit to the system. These criteria should be based on drainage area

characteristics, including the existence of buffer programs/regulations, potential to accomplish multiple goals, potential to contribute contaminants, stream sizes, population density of watershed area, potential to contribute high volumes of water rapidly to the watershed, (such as areas with a high percentage of impervious surface cover, like urban areas, and headwater streams with a high level of upland area interface), and other factors based on scientific evaluation. A baseline assessment and geographic prioritization of this nature is essential to the effective use of limited resources.

2) Evaluate existing buffer programs in the watershed:

Due to the complexity of the basin and the variety of buffer programs available, the FAC should conduct a separate review and analysis of the buffer programs in the basin similar to their evaluation of the basin's floodplain regulations. This analysis should include programs from other watershed areas that have been effective. In preparing this paper Delaware County conducted a cursory review of the buffer programs in the DRB and has listed them at the end of this report for your information.

3) Require all communities in the basin to be covered by a variable-design riparian buffer program.

Communities found to contain high priority stream reaches within their boundaries should be targeted first. If a community already has a program in place judged by DRBC to be effective, that program should be considered adequate for compliance.

4) *Communities found not to have an adequate buffer program in place should be given support in developing one that complies with DRBC policy and suits their needs*.

Communities found to contain high priority stream reaches within their boundaries should be targeted first. The resulting program should be designed in large part by the community, with DRBC and other appropriate agencies serving in an advisory capacity.

5) DRBC should assign staff specifically to conduct outreach and provide technical support to communities to assist in developing buffer programs, or coordinate with other agencies to provide such support.

The outreach challenge presented by ensuring every community is covered by a program that it supports will require staff dedicated solely to that purpose.

6) Riparian buffer designs should be determined on a site-specific basis using the recommendations of experts.

There is consensus in the scientific literature that buffer designs should vary according to a variety of factors, including the purpose of the buffer (flood damage prevention, water quality, bank stability, aquatic habitat, terrestrial habitat, etc.), and the characteristics of the stream and the riparian area (stream width, floodplain width, stream discharge, drainage area, slope, soil type, land use, riparian vegetation, etc.). Any program or regulation that mandates a set buffer design throughout a watershed runs the risk of prescribing an intervention that does not accomplish program goals and/or asks for unfair concessions from the landowner. It is recommended that additional buffer protections be established for headwater streams, waters designated as high quality (including special protection waters, exceptional value waters, high quality waters, category 1 waters, trout producing and maintaining waters, and waterways that are habitat to endangered or threatened species).

7) Buffer programs should seek to accomplish other goals beyond flood damage prevention, wherever possible.

These include but are not limited to water quality protection, protection and restoration of habitat for species of concern creation of recreational assets, and natural resource based economic opportunities.

8) The resulting buffer program should include an element that requires restoration/creation of riparian buffers in new development and redevelopment circumstances.

The project review process should trigger a buffer design process that responds to the project site in order to most effectively prevent flood damage. The resulting buffer design should be a requirement of the project.

9) Coordinate any riparian buffer programs and regulations with others in the basin, to avoid redundancy and use resources efficiently.

Many programs and regulations already exist in the basin to encourage or regulate the preservation of riparian buffers. Steps should be taken to avoid overlap between programs and regulations, as well as to facilitate different programs and regulations working in concert when appropriate. Areas with existing buffer regulations or programs should be exempt from any new regulation. In some areas of the basin, stream setbacks and buffers already exist. While most of these do not directly

address the character of riparian vegetation, they already exist on the books, and modifying them to provide for the preservation and restoration of riparian vegetation may be easier than passing new regulations.

10) Where possible, re-vegetate to the edge of the floodplain and include adjacent wetlands in riparian buffers.

Vegetated floodplains and adjacent wetlands slow floodwaters and increase the storage capacity of the floodplain. This reduces peak flows and the severity of floods downstream. Re-vegetating as much of the floodplain as possible should be a priority where it is feasible.

11) Minimize buffer gaps.

Gaps in riparian buffers provide a place for runoff to concentrate and enter the channel, as well as obstructing the movement of many wildlife species. Emphasis should be given to creating uninterrupted buffers, even if they may not be as wide as desired. Priority areas should be addressed first as described in (2) above.

12) *DRBC should lobby to help states/counties/towns/villages/residents receiver preference when applying for federal funding to do riparian buffer work, at programmatic or project levels.*

13) Build responsible buffer management into riparian buffer programs.

Landowners need to be able to manage their buffers to serve a variety of purposes, including economic benefit and aesthetic quality. Good buffer management can accomplish multiple goals, and provide benefits to the landowner while protecting the watershed. Many designers advocate a 3-zone approach, in which the zone closest to the river is undisturbed forest, the next closest is managed forest, and the furthest zone from the channel is maintained as meadow or prairie type of landscape. The outer two zones should be managed (within a set of criteria) at the landowner's discretion.

Existing programs and regulations in the Basin:

USDA and FSA Programs:

The Natural Resource Conservation Service (USDA) and Farm Service Agency (FSA) offer numerous programs for farmers and landowners interested in improving soil, water, and air quality. Conservation programs that prevent soil erosion, reduce damages caused by floods and other natural events, and improve and enhance water quality provide incentives for landowners interested in voluntarily subscribing to conservation practices with cost-share benefits. Additionally, the NRCS Field Office Technical Guide (FOTG) provides landowners guidance in implementation of best management practices that conserve natural resources. There are numerous programs available that offer assistance to farmers and landowners interested in voluntarily enhancing natural resources which can be found at http://www.nrcs.usda.gov/programs/.

One example of a USDA administered program is the Conservation Reserve Enhanced Program (CREP)[6]. CREP is a voluntary USDA program that protects environmentally sensitive land by placing it in an approved vegetative cover for a period of 10 to 15 years. In return, farmers are compensated with an annual payment and reimbursement for establishing recognized Best Management Practices (BMPs).

When a state or city identifies a specific resource issue such as drinking water, which can be addressed through CRP, they can develop an "enhanced" program to address that issue. The USDA then agrees to enhance the annual payment to farmers and the city or state provides additional cost share opportunities for the implementation of these best management practices.

CREP has a continuous enrollment open year round. To be eligible for CREP, cropland must have been planted to a commodity crop in four of the six years between 1996 and 2001 and be physically and legally capable of being cropped. Marginal pastureland may also be enrolled, provided it is suitable for use as a riparian, wildlife, or wetland buffer.

CRP/CREP improves water quality, enhances fish and wildlife habitat and helps farmers recover some of the costs to do this for the benefit of all.

CREP Best Management Practices (BMPs) that are eligible for cost share assistance on a farm may include:

- riparian buffers
- tree planting
- fencing
- wetland buffers
- filter strips
- wildlife habitat buffers

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[6] Delaware County Soil and Water Conservation District (DCSWCD). 2009. http://www.dcswcd.org/Programs.htm, accessed 3/25/2009.

- alternative water sources
- grassed waterways

These BMPs work hand in hand to protect water quality. The benefits of CRP/CREP include improved water quality, reduced erosion, decreased fertilizer/pesticide runoff, removal of animals from streams, improved aquatic habitat, reduced thermal stress, establishing wildlife habitat, good farming practices and the protection of public drinking water supplies.

New Castle County, DE: This county requires at least a 100' buffer from the top of the bank of any watercourse.

New Jersey Flood Hazard Area Regulations: The new Flood Hazard Area Regulations, adopted November 5, 2007, provide more protection for stream buffers through new riparian zone protections. The regulations establish maximum disturbance and include vegetation replacement and mitigation for various activities. The NJDEP program, also known as Stream Encroachment Program issues, permits if a proposal meets the regulations.

The regulations establish the following new regulated riparian zones:

- 300 feet on both sides of a NJ Category One water body (trout production) and upstream tributaries within the same HUC-14 watershed; (Hydrologic Unit Codes for 970 sub-watersheds)
- 150 feet on both sides of an upstream tributary to a trout production water not in the HUC-14 watershed;
- A trout maintenance water body and all upstream tributaries within one mile;
- Any segment of water flowing through an area containing documented habitat for a threatened or endangered species of plant or animal;
- Any segment of water flowing through an area containing acid producing soils.
- 50 feet along both sides of all other waters.

The riparian zone regulations limit the area of vegetation that can be disturbed for various regulated activities. An applicant can obtain a flood hazard area permit for disturbance of the riparian zone only if he/she meets very stringent conditions. They must establish that: The basic purpose of the project cannot be accomplished on site without disturbing vegetation in the riparian zone;

- Disturbance to the riparian zone is eliminated where possible and minimized where not possible by relocating the project, reducing the size of the project, or situating the project in portions of the riparian zone where previous development or disturbance has occurred;

- Any temporarily cleared area of vegetation must be replanted with indigenous, non-invasive vegetation;

NY municipal regulations[7]*:* Many communities in the NY portion of the Basin have laws within their zoning and subdivision regulations that provide for setbacks from streams, the reasonable preservation of vegetation, and prohibitions on clearing land within a floodplain. Levels of enforcement vary.

NYCDEP land acquisition and easements[8]*:* The NYCDEP has a well-funded land acquisition program in the Delaware Basin, with efforts to purchase land outright as well as purchase easement from willing sellers to benefit water quality. Acquired riparian land is maintained or restored to a fully vegetated condition. Conditions of easements provide for riparian buffers on a site-by-site basis.

NYCDEP Stream Buffer regulations in NYC watershed[9]*:* Projects in the NYC watershed are subject to additional restrictions under NYCDEP's Watershed Rules and Regulations. These include a prohibition on building impervious surface within 100 feet of a watercourse or 300 feet of a reservoir (outside of hamlets and villages), a prohibition on building individual residences within 100 feet of a watercourse or 300 feet of a reservoir, and the completion of an additional Stormwater Pollution Prevention Plan for most projects. These regulations do not directly address the character of riparian vegetation.

Streamside Assistance Program (SAP)[10]*:* SAP is a New York City Department of Environmental Protection program administered in the upper Delaware Basin by the Delaware and Ulster County's Soil and Water Conservation Districts. Recognizing that there was a need to provide non-farm riparian landowners with the same kind of support that farmers receive for good riparian zone management from programs like CREP, SAP was created to do just that. The overall goal of the SAP is to inform and assist landowners in better stewardship of their riparian land through protection, enhancement, or restoration. DEP and its partners (County Soil & Water Conservation Districts and Cornell Cooperative Extension) do this for private riparian landowners throughout the New York City West of Hudson watershed by providing:

1) Access to technical assistance, through their County Soil and Water Conservation Districts (SWCD).

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[7] Jastremski, Michael. 2009. Delaware County Community Laws Pertaining to Flood Safety. Delaware County Planning Department, Delhi, NY. Available upon request at michael.jastremski@co.delaware.ny.us

[8] Catskill Watershed Coalition. 1999. MOA Summary Guide. http://www.cwconline.org/pubs/moa/moaland.html, accessed 4/7/2009.

[9] New York City Watershed Rules and Regulations. 1997. Section 18-39 Stormwater Pollution Prevention Plans and Impervious Surfaces. http://www.nysefc.org/home/index.asp?page=287, accessed 4/7/2009.

[10] DCSWCD, 2009.

2) Best Management Practices (BMP) and prescriptive measures to improve landowner management of their riparian buffer in order to enhance the function and condition of the riparian buffer.
3) Development of RCMPs to enhance awareness and inform landowners about riparian management issues specific to their individual properties
4) Assistance, where needed, with installation of riparian buffer improvement measures, such as native plantings, and projects.
5) Educational materials and training opportunities to encourage positive riparian stewardship by landowners and to enhance understanding the critical role of their buffer and how to maintain it in optimal functioning condition.

The primary purpose for riparian planting projects conducted by the Streamside Assistance Program is to:

- Enhance the stability and effectiveness of stream restoration projects, and
- Restore natural streamside vegetation.

Buffers 100 (Pennsylvania Campaign for Clean Water)[11]*:*

Buffers 100 is a program that seeks to add minimum riparian buffer requirements to Pennsylvania's existing Chapter 102 regulations. Some communities in the basin have adopted this program. Their proposed minimum requirements are as follows:

- 100 foot forested buffers on either side of every stream from top of the bank or, if greater, a fully vegetated 100 year floodplain.
- An additional 50 foot forested buffer for first and second order streams.
- An additional 200 foot forested buffer for streams classified as Exceptional Value or High Quality.
- Additional forested buffer widths for steep slope riparian areas.
- Buffer restoration, with native trees and shrubs, in non-forested riparian areas where development is proposed.
- Buffers of a size and vegetation type necessary to protect state or federal threatened and endangered species and habitat, but in no instance less than the minimum 100 foot requirement.
- For impaired waters, either an additional 50 feet of forested buffer or implementation of specific buffer, land use and stormwater management requirements.

[11] www.pacleanwatercampaign.org/**buffer**.html, accessed 4/28/2009

- Some form of legally enforceable, permanent protection for all required buffer areas.
- All required buffers established and maintained as non-disturbance areas limiting disturbance of vegetation or soil to restoration activities or other minimally disruptive activities, requiring offset of disturbance by buffer improvements or an extended buffer area, and prohibiting new structures.
- Exemptions would apply for existing development and agricultural activities.

Stream Re-Leaf[12]*:*

Stream Releaf is a voluntary program created by the PADEP that provides various types of incentives to developers and landowners to preserve or restore riparian buffers. The program was spawned from an agreement between the states of PA, MD, VA, the DC, and the EPA to reforest 2010 miles of stream by 2010. PA's share is 600 miles of stream. In order for a project to count towards that goal, the following criteria must be met:

- Buffers must average 35 feet wide from the top of the streambank to the buffer's uphill edge. A width of 50 to 100 feet is strongly encouraged.
- Buffers must contain at least two species of trees or shrubs, or a combination of trees and shrubs.
- Natural regeneration is acceptable where nearby tress native to the area can provide a seed source.
- Conservation of existing forested streamside areas should occur within an area at least 100' wide.

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[i] Connecticut River Joint Commission. 2005. Riparian Buffers for the Connecticut River Watershed. http://www.crjc.org/riparianbuffers.htm, accessed 3/26/2009.

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[12] PADEP, 1998.

Pennsylvania DEP Stream Releaf program. 1998. Forest Buffer Toolkit. http://www.dep.state.pa.us/dep/deputate/watermgt/wc/Subjects/StreamReleaf/Forestbufftool/default.htm, accessed 3/25/2009.

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