

## **Going Forward: Floodwater Management or Floodplain Management A History of Decisions on the Main Stem Delaware River**

Between mid-September 2004 and late June 2006, three major floods caused severe and repeated damage to thousands of structures, and disrupted the lives of tens of thousands of people along the main stem Delaware River. The flooding was the worst since the record flood of 1955. This summary is intended to provide a background for the Task Force when considering the potential role that new large scale flood control projects, such as dams, levees or channel dredging, should have in future flood loss reduction along the main stem. The Corps of Engineers will be undertaking a study in the next year to evaluate flood vulnerability and develop flood mitigation options for the Delaware River Basin. The recommendations of the Task Force will provide important guidance for this work.

Large structural projects were the flood protection measure of choice in the early and mid 20<sup>th</sup> Century, and the first DRBC Comprehensive Plan included a large dam on the Delaware River at Tock's Island. Such a large dam and its dedicated flood storage capacity would have significantly reduced, though not eliminated, flooding on the middle and lower main stem. The 1975 decision by the DRBC to defer the Tocks Island Dam decision, the Scenic River designation of the main stem Delaware, and Congressional de-authorization of the Tock's Island project, left the middle and lower river without the flood control once envisioned in the original Comprehensive Plan of the DRBC.

Following the three floods, some suggestions for re-consideration of Tock's Island dam have been made. In addition, a conceptual proposal for a flood retention structure at Wallpack Bend has been received by the DRBC. Due to a host of economic, environmental and political reasons, flood management has been historically moving away from large scale flood control projects (or floodwater management) and instead towards floodplain management and mitigating measures such as acquisition, elevation, floodplain regulations, and stormwater management. In addition, while spill mitigation programs at water supply reservoirs may provide some reduction in flood crests along tributary streams, they cannot be depended upon to produce the major reductions in flood peaks sought by property owners along the middle and lower Delaware.

### **Level B Study**

The DRBC's 1981 Level B Study was a comprehensive water resources planning study funded by the U.S. Water Resources Council and the DRBC after the Tocks Island decision. In considering main stem flood potential, the study looked at the flood control provided by the four Corps of Engineer reservoirs upstream of Trenton, NJ. These reservoirs (F.E. Walter, Beltzville, Jadwin, and Prompton) provide 68 billion gallons of dedicated flood storage capacity and are designed and managed to maintain this capacity. They are located on tributaries and control less than 10 percent of the drainage area of the Delaware River above Trenton. The Level B Study noted that in a repetition of the 1955 flood, these facilities, which were built after 1955, would have reduced the flood level at Trenton by 1.3 feet. In other words, the crest at Trenton would have been reduced from 28.6 feet to 27.3 feet – still 7.3 feet above flood stage. In further addressing main stem

flood potential, the Level B Study cited an analysis performed by the National Weather Service after record flooding from Hurricane Agnes in the Susquehanna River Basin in 1972. This analysis modeled the Hurricane as if it had been centered over the Delaware River Basin, and calculated a flood crest of 31 ft at Trenton – 11 feet above flood stage and 2.4 feet higher than the record flood of 1955. The Preferred Plan of the Level B Study did not recommend any additional flood control dams other than those previously constructed in the Delaware River Basin. The study noted that non-structural flood mitigation measures such as flood warning and emergency preparedness, floodplain property acquisition, floodplain management, flood insurance, and stormwater management, should be given more consideration than in the past.

### **1984 Delaware River Basin Study by the Corps of Engineers.**

The 1984 Corps study was authorized by Congress through a recommendation from the House Committee on Public Works and Transportation, after the DRBC expressed interest in the development of a flood damage reduction program for main stem communities in the absence of the Tocks Island Dam. The study included a detailed analysis of flood damage potential along the main stem of the Delaware River below Tocks Island. The study reviewed existing flood control projects, developed updated flood hydrology, identified major damage centers, developed estimated annual flood damages based on a flood risk assessment, and evaluated both structural and non-structural flood protection measures. All forms of impoundments and impoundment sites were reviewed for controlling flood waters on the main stem. The impoundments were screened using a set of seven criteria listed on pages 63 and 70 of the study report. These criteria are summarized below:

- 1) Projects were to be located above the City of Trenton, New Jersey.
- 2) Projects were to have a minimum of 20,000 acre-ft (6.52 billion gallons) of available flood control storage – either run of river or pumped storage.
- 3) Projects could not be located on Federal or state-designated scenic rivers or protected areas, nor on the main stem of the Delaware River.
- 4) Projects which were Part of the Level B Comprehensive Plan, and are designated for water supply, were considered unavailable to provide flood protection unless they had additional capacity to add-on flood control.
- 5) Projects could not require “extensive” relocation of major roads, railways, or structures which made them “obviously” economically infeasible.
- 6) Sites previously eliminated or deferred for environmental, social or cultural reasons were automatically eliminated.
- 7) Projects could not be economically feasible as a single flood control project if they were already infeasible as a flood control component of a multipurpose project.

All but two of several hundred potential impoundments were eliminated from consideration using these criteria, and the two remaining sites were eliminated due to either high cost or their small impact on main stem flooding. The study presents, on pages 66-69, a complete list of the impoundment sites meeting the 20,000 acre-ft criterion. Also eliminated were 30 local levee/floodwall measures for riverside communities in Monroe, Northampton, Hunterdon, Warren, Mercer, Bucks, and

Burlington Counties. A three level screening process based on cost vs. annual average damages of the protected community was used and eliminated all the structures from further consideration. The study located 12 out of 58 riverside communities where local non-structural flood protection measures were economically justified. The individual structures identified for application of protection measures accounted for only 2 percent of the 12,000 total floodplain structures in the study area. At the time, interest at the local level in sponsoring further studies of non-structural protective measures was extremely limited. Nearly 30 years had passed without a major main stem flood.

### **2004 Water Resources Plan for the Delaware River Basin**

A resolution adopting a new Water Resources Plan for the Delaware River Basin was signed by the four basin governors and the federal commissioner in September of 2004. The purpose of the plan was to provide a uniform framework for addressing water resources issues in the basin. It stressed the interrelatedness of water resource issues and the need for considering all aspects of water resources in decision-making. The formulation of the plan was based on recommendations of a Watershed Advisory Council, representing a spectrum of private, public, and non-profit interests, and the recommendations of DRBC advisory committees. The plan is comprised of five Key Result Areas, the second of which is Waterway Corridor Management. Flood loss reduction is included primarily in this category, although Key Result Area No. 3 – Linking Land and Water Resource Management includes storm water management. Page 31 of the plan lists the three goals for Waterway Corridor Management. These are:

- 2.1 Prevent or minimize flood-induced loss of life and property, and protect floodplain ecology.
- 2.2 Enhance water-based recreation in the river and tributaries.
- 2.3 Protect and restore healthy and biologically diverse riparian and aquatic ecosystems.

In its description of the major components of flood loss reduction, the plan lists assessment of flood hazards, pre and post disaster mitigation strategies, linking flood control with storm water management, minimizing ecological impacts of floods, enhancement of flood forecasting, and public education on the natural functions of floodplains, risks of development in the floodplain, and the need for hazard mitigation plans. While the plan does not prescribe new dams, it recognizes the flood control benefits provided by existing structures. The plan includes a matrix of goals and objectives, and includes two objectives for Goal 2.1. These are:

- 2.1.A Upgrade and modernize flood warning and forecasting capabilities.
- 2.1.B Characterize flood damage risks; prioritize and implement actions to reduce risks and losses, and address human induced ecological impacts of hydromodification.

The plan lists on-line availability of Advanced Hydrologic Prediction Service products, compliance with the Disaster Mitigation Act of 2000 and restoration of hydrologically impaired waterways as desired outcomes for the two objectives. The recent flooding has resulted in the initiation of several studies aimed at characterizing flood damage risk and identifying actions to reduce flood losses. These studies, combined with the

recommendations of the Task Force provide an opportunity to complete the work plan to address Goal 2.1 and its two objectives, and determine the extent to which large new structural control measures on the main stem Delaware River will play a part.

### **New Jersey Governor's Task Force Report**

After the floods of September 2004 and April 2005, New Jersey Acting Governor Richard Codey established the Delaware River Flood Mitigation Task Force. On August 22, 2006, Governor Jon Corzine released the final report of the Flood Mitigation Task Force which includes 37 recommendations directed at flood loss reduction. The recommendations are detailed and consistent with Goal 2.1 of the Delaware River Basin Water Resources Plan. However, the report goes further than the basin plan in its implications for large main stem structural projects. The Executive Summary introduces the major findings of the report with the statement that "The floodplains should be expected to flood," and follows this with the finding that "No set of measures, alone or in combination, will stop or eliminate flooding in the Delaware River Floodplain." The report does not rule out structural solutions for flood control, and encourages studies of their viability, but states that "Any study should focus on local nonstructural and structural measures, and should not revisit the federal and state policy and funding decisions that terminated the proposed Tocks Island dam project."

### **Post Flood Direction by DRBC Commissioners**

Since the June 2006 flood, the DRBC commissioners have met twice in public sessions concerning flood issues. DRBC staff have also participated in hearings and briefings related to the causes of the flooding. The major concern voiced by riverside citizens has been the need for more flood control. Many riverside property owners believe that better management of existing reservoirs could significantly lower flood levels along the main stem, and that reservoir spills and upstream development are largely responsible for the spate of recent flooding. The commissioners have responded by establishing this Task Force, providing funding for the development of a flood analysis model for the basin's reservoirs, and approving a temporary spill mitigation program for the three New York City Delaware Basin reservoirs. Consensus among the commissioners is that spill mitigation will not achieve major flood control along the main stem, and that a comprehensive program is needed to address flood loss reduction.

There has been no position taken by the commissioners on new large main stem dams, levees, or dredging projects and whether they should be pursued or eliminated from consideration. Although de-authorized by Congress, and not spoken to in the new Basin Water Resources Plan, the Tocks Island project still remains in the DRBC Comprehensive Plan. A policy on main stem flood control projects would set a clear direction for future flood loss reduction measures – whether to control main stem flooding by large structures, or rely instead on spill mitigation at existing reservoirs, floodplain management, stormwater management, and adaptive measures to reduce flood damage.