Appendix L – Strategy To Reduce Damages To Existing Flood Prone Structures And Facilities

West Virginia is confronted with significant floodplain development issues and watershed growth that pours increasing amounts of runoff into the narrow stream channels. Before enactment of the first floodplain management ordinance in the State (Matewan, 1970), thousands of structures were constructed within the 100- year frequency floodplain. Census 2000 data shows that prior to 1970 at least 430,000 residential structures were constructed in the State. Upon adoption of the Flood Insurance Rate Maps and enactment of the required floodplain management ordinances, each county and municipality in the region was burdened with floodplain structures that had been "grandfathered" into the program in their flood prone location. These structures represent a significant amount of the damageable property affected in the State.

It is estimated that there are over 110,000 flood prone structures in the regulated floodplains of West Virginia. Commercial structures are frequently concentrated in municipal areas within the floodplain, while residential structures are scattered throughout the floodplain. A significant number of critical institutional facilities, including schools, Federal and State offices, post offices, public utilities, police and fire stations, are located within the floodplain. All of these structures and facilities will continue to be damaged by flooding unless some corrective action is taken by Federal or State programs.

1. Projected Floodplain Growth:

The State of West Virginia is not anticipating significant population growth by the year 2025. Current projections show the population remaining stable between 1.8 and 1.9 million people during the next 25 years. However, some areas of the State (Berkeley, Jefferson, and Monongalia counties) have been experiencing population growth due to immigration from adjacent states (Maryland, Virginia, and Pennsylvania) and sprawl from adjacent municipal areas (Putnam County). Berkeley County's population has grown 28.7% since 1990 (highest population growth in the State). The City of Martinsburg, WV (Berkeley County) has experienced the highest population growth rate (6.4%) of all cities in West Virginia since 1990. Jefferson County also has experienced population growth (17.4%) since 1990. Both Monongalia County (8.4%) and the City of Morgantown (3.6%) experienced growth since 1990 that was associated with commercial

development along the Interstate 79 corridor. These growth rates have generated increased housing construction accompanied by commercial (retail, office and manufacturing sectors) growth along interstate corridors. Increased stormwater flooding in these municipal and county areas was an issue raised by the participants in the Martinsburg, Winfield, Clarksburg and Parkersburg workshop meetings.

The Interstate 81 and 79 corridors have become catalysts for land development. The moderate to flat topography of the I-81 corridor in Berkeley County has supported higher densities of development than is common in much of West Virginia. Proposed highways (i.e. Corridor H linking interstates 81 and 79) will bring northern Virginia and West Virginia closer together. This connection will increase the likelihood that northern and eastern regions of the State will continue to be bedroom communities and second or vacation home locations for out-of-state workers. Due to the rugged topography of this region, pressures to develop the floodplains in these areas will increase in step with continued growth.

Similar population growth patterns are evident in the Teays Valley area (between Huntington and Charleston). The Interstate 64 corridor between the two largest cities within the State has been a significant factor in this growth. According to the 2000 Census, Putnam County had the second highest population growth rate (20.4%) in the State since 1990. Putnam County, as in the case of Berkeley County, has experienced growth in new housing and commercial development as well as stormwater flooding and development pressures in the floodplain. The current upgrading of portions of I-64 to handle increased traffic is an additional consequence of growth in the corridor.

This growth (coupled with higher disposable incomes) contributes to demands for new housing, development of new commercial centers along highways and at interchanges (replacing older commercial centers in municipal areas), and upgraded and/or expanded institutional facilities (schools, hospitals, and corrections) to support population growth. These growth areas are confronted daily with floodplain development pressures and increasing construction of impervious cover in their watersheds. Stormwater flooding has been identified as a significant issue in all of the growth areas in the State (See Appendix I).

Without appropriate stormwater runoff controls and strict enforcement of existing floodplain management ordinances, these areas will experience increasing flood damages, de-stabilized stream channels, and potential losses of life. Many of the recommended actions in Section 6 are formulated to reduce damages to new floodplain construction, assist floodplain managers in administering existing ordinances and to control stormwater runoff. However, new residential and commercial growth will represent only a fraction of the damageable property already located in the State's floodplains. The inventory of pre-FIRM floodplain structures will remain subject to damages by flooding unless deliberate actions are taken to reduce their losses. The individuals and families living and working in those structures will continue to live at risk while they remain in the floodplain.

2. Inventory of Floodplain Structures:
Before enactment of floodplain management ordinances in 1970, approximately 430,000 structures were constructed within the State. Upon adoption of the Flood Insurance Rate Maps (FIRM's) and enactment of the required floodplain management ordinances, each county and municipality in the State accepted floodplain structures that had been "grandfathered" into the National Flood Insurance Program in a flood-prone condition. These structures continue to represent a significant percentage of the damageable property affected by annual floods. Unfortunately, most of the pre-FIRM structures were not built according to any recognized building code and many are not covered by flood insurance. Thousands of manufactured homes were located within the State's floodplains prior to the advent of the national flood insurance program.

A. At-risk structures: As a part of the investigations undertaken for the Statewide Flood Protection Plan, a preliminary at-risk structure identification/count was undertaken by the Pittsburgh District of the USACE in 2002. A combination of FEMA's Q3 and DFIRM floodplain data (available for 37 of the 55 counties within West Virginia) was overlaid onto aerial photographs. Individual structures were identified and classified by use categories (residential, commercial, and institutional) within the designated floodplain and regulatory floodway. The institutional classification was identified using the Geographic Names Information System (GNIS) and was obtained from the West Virginia Geographic Information System (GIS) Data Catalog. It should also be noted that the numbers listed are conservative as only areas with a FEMA-designated floodplain and/or floodway were analyzed.

Results of the thirty-seven-county analysis identified 81,054 structures located within the 100- year frequency flood zone. Shown below is the distribution of structures within the known floodplains of the thirty-seven counties:

USE	NUMBER
Residential	66,071
Commercial	14,223
Institutional	760
Total	81,054

For structures located in the designated regulatory floodway, the following results were obtained:

USE	NUMBER
Residential	3,198
Commercial	746
Institutional	27
Total	3,971

To project the number of structures that are in the remainder of the State, the census data tracts were overlaid on the mapping generated. A match was then performed to indicate

the tracts with identified structures on them and those that did not. The population base of each category is:

Total State Population	1,808,344
Population with Q3 data Available	1,155,378

This table indicates that the available floodplain information accounts for 63.89% of the State's population. To estimate the structure count for the remainder of the State, this number was factored into the known count. The results of this computation, with the total column rounded, follow:

USE	NUMBER OF KNOWN STRUCTURES	ESTIMATED REMAINDER	TOTAL
Residential	66,071	23,857	90,000
Commercial	14,223	5,136	19,400
Institutional	760	274	1,000
Total	81,054	29,267	110,400

For the regulatory floodway, this analysis yields the following (again the totals are rounded):

USE	NUMBER OF KNOWN STRUCTURES	ESTIMATED REMAINDER	TOTAL
Residential	3,198	1,155	4,400
Commercial	746	269	1,000
Institutional	27	10	40
Total	3,971	1,434	5,400

However, this number is artificially low. Only 23 of the counties with Q3 data have the detailed studies where the floodway is delineated, and then only on those streams with an at-risk population deemed large enough at the time to justify the expense of delineating a floodway. In fact, an analysis of the available Q3 data indicates that floodways represent less than 1% of the land indicated in the floodplain, where a more realistic estimate based on HEC model computations ranges from 5 to 15 percent. In order to obtain a better estimate, Kanawha County was selected as a good example of floodway/floodplain determination since that county had a relatively large amount of floodway calculated. The comparison of this data indicates:

TOTAL STRUCTURES IN KANAWHA COUNTY FLOODPLAINS	NUMBER IN FLOODWAYS	PERCENTAGE IN FLOODWAY
11,166	1,714	15.35%

This number (15.35%) is likely closer to the actual value. For purposes of the Statewide Flood Protection Plan, 10% of the total number of structures in the floodplain would likely be in the floodway. Utilizing this factor gives the final result of (with the estimated totals rounded):

USE	ESTIMATED FLOODPLAIN TOTALS	ESTIMATED FLOODWAY TOTALS
Residential	90,000	9,000
Commercial	19,400	1,940
Institutional	1,000	100
Total	110,400	11,000

The at-risk structure identification process was unable to discern units within the floodplain whose first habitable floor was above the Base Flood Elevation (BFE), but generally speaking, most units constructed before the enactment of local floodplain management ordinances did not have first floors elevated above the BFE. Most structures constructed within the floodplain after enactment of the ordinances have a first floor elevation higher than the 100- year flood. Analysis of floodplain permit actions by the counties and municipalities following enactment of their ordinances would enable discernment of elevated versus non-elevated structures. The structure count data was geo-referenced so that the data can be incorporated into a GIS database format for display and planning purposes. The accuracy of the at-risk structure count is limited by the age and quality of the aerial mapping, the number of structures whose first floor is located above the BFE (Post-NFIP construction) and the ability of the "identifiers" to discern the various types of structures by map observation.

B. Floodway structures: Those structures identified within the FEMA designated floodway are at-risk from floodwaters whose velocity is more of a threat than water depth. Floodway water velocities can exceed 10 feet per second resulting in significant dynamic forces against un-reinforced basement walls and wood frame construction. Due to the high water velocities, scouring around structures is common leading to undermining of foundations, pillars, columns and walls. This process normally results in failure of buildings, retaining walls, and bridge piers. Figure No. 1 shows the effects of high velocity floodwaters on residential construction in the floodway. These hydrodynamic forces can result in severe damages or total destruction of standard residential construction.

Generally, the floodway zone also experiences the greatest flood depths. Significant water depths (>5 feet) and velocities result in buoyancy forces that will dislodge and float most unanchored manufactured homes, vehicles, and storage tanks. Excessive water depths (>10 feet) will cause buried storage tanks, utility vaults and caskets to rise above ground and float. The floodway also carries the greatest amount of floatable debris: debris that can act as a battering ram against other structures within the floodway zone. The majority of residential structures, especially manufactured homes, suffering total destruction in flood events are located within the floodway zone. The July 2001 flooding in southern West Virginia resulted in the total loss of hundreds of floodway zone structures including many manufactured homes. Figure No. 2 shows the affects of floodwaters on manufactured housing located in the floodway. Generally, floodproofing of structures of any type is not recommended in the floodway zone due to these extremely destructive forces.

Figure L-1: Residential structure damaged in floodway.

Figure L-2: Manufactured home damaged in floodway.

C. Commercial structures: The majority of commercial structures in the State are clustered within municipal centers. These centers contain the economic, financial, legal, security, social organizations and public infrastructure upon which much of the county population depends. The municipal areas of the State that are subject to flooding represent a significant challenge to damage reduction strategies. During regional flood events, protection of these critical social and public centers is a key to recovery of the local economy and social structure of the entire county. As concentrations of employment, public services, fire and police, and retail shopping, municipal areas contain commercial and institutional structures and infrastructure that should be considered for protection in place.

Due to their size, construction methods and materials, many commercial structures can be protected using measures that are not otherwise feasible for residential structures. Commercial protection measures can include dry floodproofing methods such as waterproofing, veneer walls, ring- walls, and ring levees. These methods have been widely used throughout the nation and are effective in reducing flood damages.

Improvements in the interstate highway system in West Virginia have resulted in the creation of new commercial centers at many highway interchanges. Interchanges on Interstates 64, 70, 79, 77 and 81 have provided significant opportunities for regional malls and institutional facilities. Several of those interchanges are located within or adjacent to developable floodplain land. County and municipal officials are confronted with retail development proposals surrounding these interchanges that offer significant employment and revenue opportunities, but require variances for construction in designated floodplain areas. Without feasible site alternatives, the promise of economic growth and jobs will prevail over potential floodplain violations. Providing feasible site

development alternatives at these interchange locations would lessen the potential for unwarranted and unwise decisions to grant floodplain variances.

D. Institutional structures: A number of institutional structures including schools, Federal and State offices, post offices, public utilities, police and fire stations, and other essential services are located within the State's floodplain. These structures provide a wide array of essential social and public services to the State's population. Most of these structures and facilities are not protected by flood insurance and due to requirements for unconstrained public access; most have been constructed with first floors at ground level with little consideration for flood protection. Some of these structures and facilities are located within protected municipal areas, but many of them have been constructed outside of municipal areas in the floodplain for lack of economically feasible flood-safe sites. Many institutional facilities have been located in the floodplain subsequent to the enactment of Executive Order 11988. All of these institutional structures and facilities will continue to be damaged by flooding unless they are addressed by one or more existing Federal or State programs.

E. Industrial facilities: Many of the State's largest single industries and industrial complexes are located within floodplain areas. Due to the massive footprint of their production facilities, spatial requirements for materials storage, and need for convenient access to truck, rail and waterway access, floodplain areas are the site of choice for large industries. Major industrial complexes along the Kanawha, Ohio, Little Kanawha, Big Sandy and Monongahela rivers constructed before the advent of the NFIP are located within the 100-year floodplain and are subject to flood damages. These major sources of employment and tax revenue in the State need to be protected from flood damages. Many industrial parks constructed in the State subsequent to the NFIP have been located out of the floodplain.

3. Historical Flood Damage Reduction Practices:

Past efforts to reduce damages have been reactionary in nature and targeted at primary damage centers in the State. Following one or more damaging floods, Congressional action authorized detailed studies of flood protection works for specific damage centers. In some cases, entire watersheds or basins (Kanawha River, Potomac River, Tug Fork, Cheat River, Greenbrier River) were evaluated for comprehensive flood protection. Other Federal and State programs applied funds to the acquisition of floodplain structures damaged by flooding. These floodplain acquisition programs are effective in reducing damages, but have only been applied following flooding events and are frequently funded at a level far below the identified need.

This tactical approach to flood damage reduction has been successful in reducing damages at specific locations within the State, but many other areas (including numerous municipal areas) remain unprotected. There are approximately 248 municipalities within the State. Fifty-five of those municipalities are the government centers for the counties. Table L-3 shows a listing of the county seats in the State with comparative population statistics. Table L-4 shows the relationship of each of these government centers to their respective county and the employment base they provide to the county.

Table L-3. Counties and County Seats (Population Statistics)

Counties – County Seats	2000 Census Populations County – County Seat	Percent county seat of county population
Barbour – Philippi	15557-2870	18%
Berkeley - Martinsburg	75905-14972	20%
Boone - Madison	25535-2677	10%
Braxton - Sutton	14702-1011	**7%**
Brooke - Wellsburg	25447-2891	11%
Cabell - Huntington	96784-51475	53%
Calhoun - Grantsville	7582-565	**7%**
Clay - Clay	10330-593	**6%**
Doddridge – West Union	7403-806	11%
Fayette - Fayetteville	47579-2754	**6%**
Gilmer – Glenville	7160-1544	22%
Grant – Petersburg	11299-2423	21%
Greenbrier - Lewisburg	34453-3624	11%
Hampshire - Romney	20203-1940	10%
Hancock - New Cumberland	32667-1099	**3%**
Hardy - Moorefield	12669-2375	19%
Harrison - Clarksburg	68652-16743	24%
Jackson - Ripley	28000-3263	12%
Jefferson - Charles Town	42190-2907	**7%**
Kanawha - Charleston	200073-53421	27%
Lewis - Weston	16919-4317	26%
Lincoln - Hamlin	22108-1119	**5%**
Logan - Logan	37710-1630	**4%**
Marion - Fairmont	27329-19097	70%
Marshall - Moundsville	56598-9998	18%
Mason - Point Pleasant	35519-4637	13%
McDowell - Welch	25957-2683	10%
Mercer - Princeton	62980-6347	10%
Mineral - Keyser	27078-5303	20%
Mingo - Williamson	28253-3414	12%
Monongalia- Morgantown	81866-26809	33%
Monroe - Union	14583-548	**4%**
Morgan - Berkeley Springs	14943-663	**4%**
Nicholas – Summersville	26562-3294	12%
Ohio - Wheeling	47427-31419	66%
Pendleton - Franklin	8196-797	10%
Pleasants - St. Marys	7514-2017	27%
Pocahontas - Marlinton	9131-2017	13%
Preston - Kingwood	29334-2944	10%
Putnam – Winfield	51589-1858	**4%**

County – County Seat	2000 Census Population County – County Seat	County Seat Population as Percentage of County
Raleigh – Beckley	79220-17254	22%
Randolph – Elkins	28262-7032	25%
Ritchie - Harrisville	10343-1842	18%
Roane - Spencer	15446-2352	15%
Summers – Hinton	12999-2880	22%
Taylor - Grafton	16089-5489	34%
Tucker - Parsons	7321-1463	20%
Tyler - Middlebourne	7592-870	11%
Upshur - Buckhannon	23404-5725	24%
Wayne - Wayne	42903-1105	**3%**
Webster - Webster Springs	9719-808	**8%**
Wetzel - New Martinsville	17693-5984	34%
Wirt - Elizabeth	5873-994	17%
Wood - Parkersburg	87986-33099	38%
Wyoming - Pineville	25708-715	**3%**

Other commercial centers, although not government centers, do provide employment, commerce, financial and real estate services, police and fire services and social and public services. Municipal areas (towns and cities) are generally the center of commercial development within the counties and provide employment and both public and social services to the surrounding county population. Municipal centers also provide substantial county population with potable water and sewerage service from centralized or regional treatment facilities. In some cases, these essential public facilities are subject to flood damages or total loss. Many rural county areas, beyond the reach of municipal infrastructure systems, rely on public service districts (PSD's) for these utility services.

As a result of multiple flood events, many affected municipal areas suffer deterioration of their housing stock, losses of commercial property and recurring damages to infrastructure and population losses. Without significant capital investments, these communities begin to lose their effectiveness as commercial and service centers of the county population. Historically, these unprotected municipal areas either were not sufficiently damaged to warrant detailed flood damage studies, proposed flood protection projects were not found to be economically justifiable or a financially capable project sponsor was not identified to share the project construction costs. In some cases, environmental issues restricted the alternatives that could be considered to protect these damaged areas. Many feasible plans for protecting both municipal and county damage areas remain on office shelves today.

4. Impediments to the Implementation of Flood Damage Reduction Measures

A. Well conceived, soundly formulated and technically feasible flood protection plans have been prepared for several flood damaged areas of the State. Unfortunately, these plans were never implemented for a variety of reasons. A review of those plans shows

that there are three primary reasons that proposed flood protection plans were never implemented: 1) lack of economic justification to implement the project, 2) lack of an eligible and financially capable non-Federal sponsor to support the project, and 3) environmental compliance issues under NEPA. These three issues have prevented implementation of a variety of flood damage reduction measures throughout the State. A discussion of those three impediments and potential solutions follows.

B. Economic Justification: The Flood Control Act of 1936 (see Figure L-3) required that the benefits of any flood control project, to whomever they accrue, must exceed the costs. Since that enactment, Federal agencies formulating water resources development projects have been required to justify the economic efficiency of flood control projects.

In 1983, the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies (known as the Principles and Guidelines or the P&G) were enacted by then President Reagan. The Corps of Engineers, Bureau of Land Reclamation, Tennessee Valley Authority and the Natural Resources Conservation Service must all adhere to the economic and environmental requirements of the P&G for developing and recommending flood control projects. The economic justification requirements for project feasibility were further defined in the P&G.

DECLARATION OF POLICY

Section 1. It is hereby recognized that destructive floods upon the rivers of the United States, upsetting orderly processes and causing loss of life and property, including the erosion of lands and impairing and obstructing navigation, highways, railroads, and other channels of commerce between the States, constitute a menace to national welfare; that it is the sense of Congress that flood control on navigational waters or their tributaries is a proper activity of the Federal Government in cooperation with States, their political sub-divisions and localities thereof; that investigations and improvements of rivers and other waterways, including watersheds thereof, for flood-control purposes are in the interest of the general welfare***; that the Federal Government should improve or participate in the improvement of navigable waters or their tributaries including watersheds thereof, for flood-control purposes if the benefits to whomsoever they may accrue are in excess of the estimated costs,*** and if the lives and social security of people are otherwise adversely affected.

Figure L-3: 1936 Flood Control Act Language

In all cases, unless specifically authorized otherwise (such as the case of Section 202 authority for the Tug Fork Basin and the Section 581 authority for the Cheat River Basin), the Federal agency must determine by rigorous economic analysis that the average annual benefits attributable to the project exceed the average annual costs of the project or program to justify its construction or implementation. For flood damage reduction projects or programs, project benefits are determined to be reductions in the costs of flood damages to residential, commercial, institutional, industrial, transportation

and emergency and recovery costs attributable to the construction and operation of some flood damage reduction measure or combination of measures. Those measures are described below.

Generating economic benefits in small communities in West Virginia can be a daunting task. Normally, economic analysis requires estimations of flood damages both with and without projects in place as well as considerations for streams of benefits and costs accumulated through the economic life of the project with application of appropriate interest rates. The final economic analysis results in a benefits-to-costs ratio known as the BCR. Projects with a BCR of 1:1 or greater are considered for implementation. In simplified terms, economically justified projects are generating more than 1 dollar of flood damage benefits (reductions in damage costs) for each dollar of project development and operating costs spent. The comparison of cumulative project benefits and costs over the projects economic life determines the economic feasibility of the project.

In West Virginia, as in many parts of Appalachia, there are only a handful of municipalities that contain the population density and development values that can generate sufficient flood damage benefits to justify construction of major flood protection measures. Communities such as Huntington, Parkersburg, Point Pleasant, and Moorefield have high densities of residential, commercial, industrial and institutional development that have experienced significant flooding damages over a number of years. The combination of dense development and significant, recurring flood events has resulted in economic justification of local protection projects to protect those areas.

In addition, the accumulation of significant and recurring flood damages at numerous communities within larger basins and watersheds have generated sufficient flood damage benefits to justify flood control reservoirs such as Bluestone Lake, Summersville Lake, Sutton Lake, Burnsville Lake, Tygart Lake, R.D. Bailey Lake and others in the State. Many smaller communities located within those basins and watersheds enjoy the reduction in flood damages and other benefits generated by those multi-purpose reservoirs.

Unfortunately, there are a number of small municipalities and unincorporated communities within the State that are not located downstream of those flood protection projects. These small communities do not have the concentrations of damageable property that generate sufficient flood damage benefits to justify flood protection projects of a size and scope that are effective or reliable.

Therefore, under current flood-protection justification methods and regulations, these communities must continue to endure repeated flood damages and loss of life. Procedural requirements that demand incremental economic justification of individual project components many times denies flood protection for communities through proven nonstructural measures. Other than floodplain buyout programs offered through the Hazard Mitigation Grant Program of FEMA for repetitive loss structures with flood

insurance, there are few options currently available to floodplain landowners in those communities.

Possible solutions to the technical difficulties in justifying the economic feasibility of these projects may include legislative actions negating the need for economic justification such as were obtained in the Section 202 and 581 authorities in the Tug Fork and Cheat River basins. Although legislative waivers of the benefit cost ratio economic evaluation are possible, such waivers are a rare occurrence and are frowned upon by the Executive Branch of the Federal Government and the Office of Management and Budget (OMB). Use of such economic waivers limits the ability of Federal agencies to budget funds for these projects through the normal annual project budgeting process.

Other solutions to this problem may include modification of the methodologies and procedures used in economic evaluation of Federal flood control projects. Consideration of additional benefit categories that capture improvements in social and economic factors within communities and environmental restoration enhancements could increase benefits attributable to project development and operation. Many of these secondary benefits considered external to the project and therefore not currently eligible, should be investigated for inclusion in the benefit estimation procedures.

Also, the economic evaluation of proposed flood protection projects for municipal areas located within economically depressed counties should be evaluated with consideration for the devastating economic affects that deterioration of that municipal center through flood damages has on the entire county. In West Virginia, many municipal centers function as the center of retail, wholesale, office and manufacturing commercial activities as well as the focus of financial, social, public and security services for much of the county population. Assuming that dispersal of these municipal activities and functions through market forces (reacting to flooding damages) is a normal or good result, denies the known benefits of the economic forces that originally created and shaped the municipal center.

C. Non-Federal Sponsorship: Another major impediment to implementing flood damage reduction projects and programs is the lack of adequate non-Federal sponsorship. The financial condition of many municipal and county governments in the State is marginal at best and is inextricably tied to one or two major industries in the local or regional area. As the financial condition of those industries rise and fall, the economic fortunes of the community fluctuate in lock step. These economic cycles and uncertainties limit the ability of many communities and counties to assume the capital costs or operations and maintenance (O&M) costs of certain flood protection projects. These financial limitations are most critical in situations where structural protection measures are being considered for small municipal areas.

Structural flood control projects such as dams, floodwalls, levees, channel modifications can require non-Federal capital expenditures in excess of $1 million dollars. Annual operations and maintenance (O&M) costs for these projects can exceed $50 thousand

dollars. Few counties or municipalities within the State can support these capital construction and O&M costs.

In accordance with Section 103 of the Water Resources Development Act of 1986, all flood damage reduction projects must be financially supported by a qualified non-Federal sponsor. After the passage of this Act, all non-Federal sponsors were required to financially contribute to the planning, design and construction of these projects. The costs of operation and maintenance of flood control projects constructed after the 1986 Act became the entire responsibility of the non-Federal sponsor. Tied to this financial responsibility was the requirement for the non-Federal sponsor to acquire all lands, easements, rights-of-way, and disposal areas as well as performing all relocations (utilities, roads, railroads, etc.) for the project. Although the non-Federal sponsor receives credit for such acquisitions in the total project cost, these requirements are administratively overwhelming for many small communities in the State.

In many instances, incorporated communities in the State do not have the fiscal capability to assume the cost sharing responsibilities for an effective flood damage reduction project. Likewise, many counties and the endangered unincorporated communities within them do not have sufficient fiscal resources to support an effective project either. Many formulated flood protection projects that were found effective in reducing flood damages and were determined to be economically justifiable have not been constructed because of the lack of non- Federal sponsorship. Without a qualified and financially capable sponsor, effective, economically efficient and environmentally sound projects cannot be implemented under the requirements in Section 103 of WRDA 86. Unfortunately, the costs associated with flood damages and flood protection projects continue to rise annually while the financial ability of many communities in the State to act as sponsors of those projects continues to decline. These diverging trends do not bode well for the safety and economic stability of floodplain landowners in the State under current Federal regulations and project implementation laws.

There are potential solutions to the lack of non-Federal sponsorship: a situation that has plagued several feasible flood damage reduction projects in the State. First, full use of the ability-to-pay analysis available through Section 103 (m) of WRDA 86 should be applied to all projects proposed in the State. This analysis evaluates the financial capability of the local and State government to act as capable sponsors. Using economic indices based upon income statistics of the county and state populations, the analysis determines whether the standard cost sharing rate for the non-Federal sponsor can be reduced. The lowest cost-sharing rate allowable through this analysis is five percent. Many areas within the State could qualify for a reduction in the cost sharing rate.

Second, considering the adverse affects that repeated flooding of residential and commercial property in counties and municipalities has on revenues available to the State, it may be in the best interests of the State to act as a non-Federal sponsor on behalf of municipal and county governments in flood damage reduction projects. Recently, the State (through the WV Conservation Agency) has indicated its willingness to serve as the non-Federal sponsor (financially) for flood damage reduction projects in Logan and

Cabell counties. This trend of State sponsorship provides a model for future flood damage reduction projects.

Third, non-Federal financial sponsorship for flood protection projects can be secured through local mechanisms such as the Community Improvement Assessment District (CIAD) authority provided by the State legislature. This mechanism allows counties or municipal governments to designate special assessment districts for development of infrastructure or flood protection works. Under this authority, individual properties that benefit from a particular development can be assessed a portion of the development cost through the existing real property tax system. Portions of the Section 202 nonstructural flood protection project in the Tug Fork Valley have been financed through a local CIAD.

Fourth, generally speaking, Federal funds cannot be used by a non-Federal sponsor to match other Federal funds for project construction. However, if Federal program or project funds are specifically appropriated with accompanying bill language stating that the funds are to be used as a non-Federal match for a Federal project, then those funds are eligible as a non-Federal financial funding source. This method is used sparingly due to the difficulty in securing such funding authority in Congress.

D. Environmental Impacts: The third impediment to flood protection presents a constraint to the variety of measures that can be realistically considered in formulating protection plans in the State. The same beautiful scenery of the State that draws the tourist and developer to invest within the State has become a detriment to implementation of certain measures. Proven protection measures such as reservoirs, channel modifications, and diversions have been limited in their application within the State in an effort to protect the existing quality of the State's aquatic and terrestrial ecosystems. Most of the existing flood control dams in the State were authorized and constructed prior to the Environmental Protection Agency's deployment of the National Environmental Policy Act of 1970 (NEPA) regulations. Many of the dams in the State represent not only flood protection but also reliable water supply resources for residential, commercial and industrial users and recreation opportunities.

The philosophical struggle between structural flood protection works and environmental protection was initiated by enactment of NEPA. Although irrevocable damages to the environment, especially water resources, were a growing concern before the advent of NEPA, the formal documentation and disclosure of those damages in a public forum significantly curtailed development of structural measures such as dams. National environmental groups dedicated to the protection of natural resources in the nation assumed the responsibility for protesting construction of certain structural measures in the State.

The environmental impacts of reservoir and channel modification construction and operation on aquatic and terrestrial ecosystems have been well documented through the NEPA procedures. Despite the effectiveness of structural measures in reducing flood damages, many times the scope and severity of anticipated environmental impacts are

perceived to outweigh the expected damage reduction benefits. Flood protection measures have not been implemented in several areas of the State due to concerns of anticipated environmental damages caused by structural measures.

When other, less economically efficient measures cannot be justified, those municipal areas remain subject to flood damages. Alternatives such as nonstructural floodproofing and floodplain evacuations are less effective in reducing some categories of flood damages (infrastructure and transportation uses) and are difficult to justify economically. Without groundbreaking legislative action by State Congressional leadership, nonstructural initiatives such as the Section 202 and 581 projects would not have been possible. Those areas of the State would remain subject to recurring flood damages with little hope of protection if legislative action had not been taken.

The protection of environmental ecosystems in the State is a goal that should be shared by all citizens and Federal and State agencies responsible for formulating and implementing flood protection projects. NEPA demands investigation, documentation and full disclosure of anticipated environmental impacts of flood control measures. That same rigorous analysis needs to be applied to the evaluation and disclosure of the social, financial and moral impacts on the State's population and economy due to recurring floods.

National environmental groups are frequently energized to protest, on all political levels, the construction of certain flood protection measures, but no activist group or organization lobbies against the gradual decline of communities and families due to flooding. Inability to protect municipalities and other centers of commercial activity in-place that are subjected to frequent floods will assure their eventual dissolution. Small municipalities such as Kimball and Keystone in McDowell County were nearly dissolved as much of the revenue producing property in the incorporated areas was destroyed in 2001 and 2002 flooding. Many other small communities in the State face similar realities of annual flood damages and limited protection options. County populations that rely heavily on flood-prone municipal centers for everyday life are likewise placed in jeopardy.

4. Potential Flood Damage Reduction Measures.

A. Structural measures: Flood damage reduction alternatives can be divided into two categories: structural and nonstructural. Structural measures include reservoirs, floodwalls, levees, channel modifications, and stream diversions. All of these measures are constructed to control the movement or course of the water in streams and rivers and their adjacent floodplains. There are numerous examples of structural measures throughout the State (see Table of Existing Projects).

B. Nonstructural measures: Nonstructural measures alleviate flood losses by modifying the susceptibility of land, people, and property to flood damage or by modifying the impact of flooding. Nonstructural measures include, but are not limited to flood warnings, floodproofing (wet or dry), permanent floodplain evacuation, floodplain

zoning, building codes, relocations, and ring walls or earthen dikes around individual properties. Nonstructural measures can also be used to acquire, perpetuate, restore, and enhance the natural capability of floodplains to retain excessive floodwaters, improve water quality, sustain stream flows, and provide fish and wildlife habitat. Several examples of nonstructural measures have been implemented within the State (see Table of Existing Projects).

C. Reservoirs: The State's watersheds are largely uncontrolled by upstream storage. Mainstem and tributary reservoirs are able to reduce peak flows from excess runoff in watersheds. The drainage from 3,478,854 acres out of the total 15.5 million acres within the State is controlled by these storage facilities. The remaining acres generate excess rainfall runoff that can impact downstream development. (See Table of Existing Dams and Locks and Dams).

Of the 32 major watersheds in the State, 23 have no mainstem reservoirs. Appendix L in Section 4 lists the existing reservoirs. These projects are successful in reducing damages, but their benefits only affect those structures located downstream of the dam. Mainstem reservoirs like Sutton Lake in Braxton and Webster counties, Jennings Randolph Lake in Mineral County and Tygart Lake in Taylor and Barbour counties provide a significant level of protection for structures in the floodplains immediately downstream of the dam, but that level of protection quickly deteriorates with the incidence of each uncontrolled intersecting tributary downstream of the dam. Two good examples of this phenomenon are the Bluestone and Burnsville Lake projects.

The Bluestone Lake flood control reservoir on the New River in Summers County (see Figure L-4) provides substantial flood control benefits for the communities located downstream of the dam along the New and Kanawha rivers (including Charleston. This reservoir provides flood control of the drainage from 4,565 square miles of watershed in West Virginia, Virginia and North Carolina. However, the uncontrolled Greenbrier River watershed (1,644 sq. mi.) that intersects the New River one mile downstream of Bluestone Dam can generate substantial flood damages in those same communities that are otherwise protected by Bluestone Dam.

Similarly, the Burnsville lake project in Braxton County provides substantial flood control benefits to communities within the Little Kanawha River Basin. However, an intense thunderstorm over the Sand Fork watershed located just eight river miles downstream of Burnsville caused significant flood damages to the City of Glenville in 1990. Generally speaking, reservoirs are an effective measure in reducing flood damages where their storage capacity can protect extensive floodplain development downstream and where the number of major tributaries between the dam and downstream damage centers is few.

Figure L-4. Bluestone Dam and Lake, Hinton, WV

In addition to flood control, some of these reservoir projects are operated for other purposes including water supply, low-flow augmentation, hydroelectric power generation, recreation and fish and wildlife habitat. Reliable water supplies represent one of the significant byproducts of reservoir storage in watersheds. Combining reservoirs constructed by the NRCS and the Corps of Engineers, a total of 14 reservoirs currently provide municipal and industrial water supplies for communities within the State.

In 1999, several West Virginia counties in the Potomac River basin suffered extreme drought conditions. Extreme drought conditions have also affected Mason, Ritchie, Greenbrier, Morgan, Randolph, Tucker, and Webster counties in the past 3 years. Drought conditions in the current year (2002) for 18 of the 55 counties are worse than experienced in 1999. The construction of additional flood storage reservoirs in watersheds where severe drought conditions are prevalent could address municipal and industrial water needs in those regions of the State.

D. Local Protection Projects (LLP): Local flood protection projects such as floodwalls, levees, river diversions, and channel modifications are an effective means of reducing flood damages. Floodwall and levee projects can protect concentrated residential, commercial, institutional and industrial centers from floodwaters. Several communities within the State derive their flood protection from these structural projects. The level of protection can be adjusted to meet or exceed the NFIP requirements for reductions in flood insurance costs for the protected community.

However, these projects do have some drawbacks. Construction and operation of the floodwalls and levees can require acquisition of valuable urban real estate within municipal areas. Drainage of interior stormwater within the protected community can require expensive (capital and O&M costs) pumping stations and ponding areas. In some cases, the floodwall and levee heights required to protect the community physically and visually divide and isolate neighborhoods within the community. Normally an assessment district is created within the community to fund the annual operation and maintenance costs of the floodwall or levee structure. There are numerous examples of local protection projects in the State including floodwall and levee structures at Huntington, Parkersburg, Point Pleasant, Williamson, Matewan, Moorefield, and Ceredo/Kenova, WV. Figure L-5 shows an example of the structural floodwall method of protection. Figure L-6 shows the flood protection levee project in Moorefield, WV.

Channel modification projects also can reduce flood damages for communities where concentrations of residential, commercial, institutional and industrial development can provide sufficient benefits to justify the project. The hydraulic efficiency of a stream or river can be improved substantially by reconfiguring the cross-section area and sinuosity (meandering) of the channel. Removing meanders and widening and/or deepening the channel through carefully designed excavation can provide significant improvements in the waterway's ability to handle highflow events without over bank flooding. Significant reductions in the 100-year frequency flood event can be attained through channel modifications. Unfortunately, channel modification projects can have two major drawbacks.

Figure L-5. Floodwall protection structure

Figure No. 6 Levee project at Moorefield, WV

First, most floodplain areas in the State include transportation routes (roadway and railway), utilities (sewer, water, gas, electric power, etc.) and buildings of all sizes and uses. All of these uses closely border the stream and therefore must be relocated or removed to modify the shape and direction of the stream channel. Many times, the very improvements needing flood protection must be relocated from the floodplain to construct the channel. This process dramatically reduces the economic benefits required to justify the project. The high costs of relocating railways, highways and utilities that share the floodplain with the stream further exacerbate the difficulties in economic justification of channel modification projects.

Second, in many cases, modification of a stream channel for flood control purposes requires total or partial destruction of the riparian ecosystem along one or both sides of the stream channel. In some cases, channel modifications also require excavation of the streambed as well. This excavation process can result in total or partial loss of the aquatic community in the stream and the associated riparian community as well. Recovery of these fragile ecosystems can take years without guarantee of success.

There are channel modification projects in Beckley, Montcalm, Bramwell, Elkins, Buckhannon, Spencer, Princeton, Griffithsville, Bayard, Blaine, Ridgely and Rainelle. Figure L-7 shows the channel modification project on Little Whitestick Creek in Raleigh County. This project prevented significant damages during the July 2001 flood event in that area. Together, local protection projects (floodwalls, levees, and channel modifications) can be effective in reducing flood damages, but their benefits are confined to a single facility or community while adjacent floodplain communities or individual structures remain susceptible to damages. For municipal centers such as county seats and major commercial developments that provide employment, banking, education and public

and social services to the county, local protection projects can be an effective measure for reducing damages. See Appendix H for more information on channel modification.

Figure L-7. Little Whitestick Creek channel modification project

E. Nonstructural protection measures: Nonstructural measures are generally applied to the structures, land or facilities being affected by flooding. The adjoining waterway is generally unaffected by the applied measures. These measures include floodproofing (wet or dry), permanent evacuation of the damageable structures or facilities, zoning of the floodplain land, institution of restrictive building codes, construction of ring walls or ring levees, and flood warning systems.

Floodproofing can be accomplished by raising structures (primarily residential structures) in-place on new extended foundations or by attaching veneer walls and/or applying waterproof coatings onto existing structure walls. Each of these methods prevents floodwaters from entering damageable portions of the structure. Floodwaters are allowed to occupy the lower portions of raised structures where floodwater resistant materials dominate the construction and where enclosed floodwaters offset the dynamic pressures

of moving floodwaters on the raised foundation walls. Figure L-8 shows an example of floodproofing by raising structures on extended foundations.

Figure L-8. Homes floodproofed on raised foundations

Structures with more substantial exterior wall construction can be protected by application of waterproof coatings or construction of veneer walls that prevent water penetration into the protected areas. Generally, buildings with masonry foundations (particularly commercial buildings) can be protected by these "dry" floodproofing methods. Other floodproofing methods permit floodwaters to enter the structure while flood damageable contents are raised above the flood elevation within the structure itself. All of these methods can significantly reduce flood damages when a reliable and credible flood warning system can provide sufficient warning to relocate damageable contents.

Permanent floodplain evacuations are an effective method of reducing flood damages. This method can occur through acquisition and demolition of floodplain structures or through actual physical relocation of structures from the floodplain to a flood-safe site Figure L-9 shows removal of a residential structure from the floodway. Most floodplain acquisition programs are voluntary in nature and result in clearing of the floodplain property and reduction of vacant market housing or construction of new housing in the region. Federal, State and local government structures can be relocated to flood-safe locations under these programs. Acquisition and removal of residential, commercial, institutional and industrial structures and associated facilities from the floodplain accomplishes several flood damage reduction objectives.

Figure L-9. Residential structure being relocated from floodway.

First, permanent removal of structures from the floodplain ends the potential for future damages to those structures. Second, evacuation of structures from the floodway effectively removes obstructions within this hydraulically sensitive area thus reducing the surface elevation of the Base Flood Elevation (100- year frequency flood). In affect, permanent evacuation of the floodway results in decreased flooding potential for all structures located in the adjoining flood fringe. Reducing the flood surface elevation in turn decreases costs of floodproofing structures in the flood fringe and reduces flood insurance costs for non-participating structures. Third, removing structures from the floodway reduces the potential for storage of floatable materials on that property that could add to debris dams at stream crossings. Fourth, removal of floodway structures decreases the potential sources of point and non-point water pollution. Floodplain evacuations also realize an opportunity to upgrade housing resources within the State by construction of new relocation housing in flood-safe locations.

Two relocation communities (Valley View and Mate Creek) were developed during the Section 202 nonstructural project resulting in construction of 78 new homes in that watershed. Once the structure is removed, the evacuated floodplain land can be used for floodplain compatible uses such as recreation, gardening, farming, silviculture, and wildlife habitat. In the Tug Fork Valley Section 202 nonstructural project, evacuated floodway lands were used as replacement wildlife mitigation for riparian lands lost in adjoining floodwall construction in municipal areas. This mitigation technique saved millions of dollars in project costs and increased the supply of high-quality, protected riparian habitat in the stream corridor.

The application and enforcement of zoning restrictions and special building codes to floodplain property can be effective in reducing future damages for new construction and reconstruction/rehabilitation of damaged structures. These measures in and of themselves

do not reduce the incidence of flood damages on existing structures, but they do reduce the possibility of total structure loss that was prevalent in the July 2001 floods in McDowell and Wyoming counties.

5. Proposed Strategy to Reduce Flood Damages of Pre-FIRM Structures.
A. Strategic Plan: A strategic plan does not target specific geographic locations such as named towns, cities or counties for flood protection as has been the premise for previous tactical flood protection initiatives. Being strategic in nature, the plan and its specific components addresses the flooding problems confronting the State and provides broad solutions aimed directly at the problems (not the location of the problems) themselves. The strategic plan components are dedicated to reducing losses of life and flood damages occurring in specific flood zones that are common among all watersheds and political subdivisions within the State. Recommending specific flood protection proposals for communities without full NEPA disclosure of the anticipated environmental impacts is prohibited by Federal Law. Such analysis of environmental impacts would be addressed in subsequent decision documents and action plans.

Considering the large number of structures within the floodplain (approximately 114,000) and floodway (approximately 11,000) zones in the State, any program formulated to effectively reduce damages will require a substantial investment of capital construction funds, years of implementation time (patience), sustained commitment by national, State and local political interests to the Plan, Federal, State and local staff resources, and ongoing cooperation between implementing agencies. The following proposals are based upon a sustained, multi-year effort to reduce flood damages across the State.

B. Strategic Plan Components: The proposed plan components listed below are formulated to address specific flooding and water resources problems experienced by the existing inventory of at-risk structures and the many communities located with the State's watersheds. Each of the 32 major watersheds contains specific floodplain zones (floodway and flood fringe) that are addressed by the plan components. The components are effective in each watershed because they address common problems of flooding in each location. The progression of these components assumes that the proposed statewide flood warning system (see Appendix B) would be implemented as a necessary initial component of the strategic plan providing an increment of protection against loss of life and movable property while these components are being developed.

The Task Force recommends that West Virginia implement the following components of a strategic flood damage reduction plan:

(1) Through a collaborative effort, the USACE and NRCS work jointly with the WVCA to assess the major watersheds. The purpose of this assessment would be to determine whether there are any opportunities to construct additional upstream flood storage & retention facilities in the watersheds that would attenuate flooding, reduce downstream damages, potentially provide a reliable source of potable water for communities within the region and provide improvements in downstream water quality and flow. Several of

the watersheds shown on the map have existing storage facilities operating for flood control, low- flow augmentation and water supply. Previous studies conducted for several of the watersheds by various Federal and State agencies would form the basis for these studies.

This assessment could be funded in part through the USACE Section 22 Planning Assistance to States program for State/regional flood protection studies. Full consideration of the anticipated environmental effects of these potential storage facilities would be coordinated with the WVDNR, WVDEP and USFWS during the assessment.

Those potential storage projects generating substantial flood protection benefits would be proposed for more detailed study through existing or new Congressional authorities. More detailed feasibility evaluations would be initiated only after firm commitments from eligible and financially capable non-Federal sponsors.

(2) Through a collaborative effort of the USACE, NRCS and WVCA, watershed specific assessments should be conducted to determine whether existing municipalities and major unincorporated commercial/industrial centers within the State need to be protected in place to preserve the commercial, service and employment base that now supports the surrounding county population. These protected centers also can serve as relocation sites for commercial and residential development acquired from the floodway. Existing data from previous protection studies for these communities can form the basis for this assessment. The recommendations of these watershed assessments would form the basis for funding requests to pursue specific protection projects at critical municipal centers.

The watershed assessments may be conducted through programs such as the Section 22 PAS and P.L. 83-566 Watershed Protection and Flood Prevention Act. Full consideration of the environmental effects of these potential structures would be coordinated with the WVDNR, WVDEP and USFWS during the assessment.

(3) A voluntary program of permanent acquisition should be developed to address the inventory of existing structures in the regulatory floodway. These structures and their associated facilities are subject to frequent and severe flooding and impact damages by floating debris. During flood events, these structures can become floatable debris blocking stream crossings and battering other downstream floodplain development. These structures can also serve as point-sources of stream pollution. The floodway acquisition program would be initiated in the non-municipal areas to avoid interference with possible structural protection of incorporated cities, towns, villages and communities and commercial centers discussed in (2) above. The program would be voluntary in nature and relocation benefits and services would be provided to assist families to secure flood-safe replacement housing. Feasible commercial and industrial relocations would be assisted through Federal and State economic development grant and loan programs. Federal, State and local government offices and facilities would be relocated to flood-safe sites.

The Section 202 Nonstructural flood Damage Reduction program, being implemented in the Tug Fork Valley since 1985, has acquired several hundred floodway structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and a reduction in the 100-year frequency flood profile in project areas. In conjunction with this program, three replacement housing sites were constructed to accommodate relocated families. In some cases, commercial structures acquired in the floodway relocated within communities protected by local protection projects (floodwalls). WVOES projects administered through FEMA's Hazard Mitigation Grant Program have also successfully acquired floodway structures throughout the State.

The proposed floodway acquisition program could be best administered through FEMA (Pre-Disaster Mitigation Program) in cooperation with WVOES. The WVHDF and WVDO could support this effort through identification and funding of replacement housing and commercial relocation sites. The success of the floodway acquisition program would be partially contingent upon the ability to secure decent, safe and sanitary replacement housing outside of the floodplain. Equally important would be a site development process for commercial relocations from the floodplain.

(4) A voluntary program of nonstructural protection should be developed for structures located in the flood fringe areas of the State that cannot be protected by structural floodwalls, upstream retention, or channel modifications. Nonstructural protection would include floodproofing, replacement on-site or permanent acquisition depending upon the height of flooding at the structure, the structure type and building condition and comparative option costs. The Section 202 Nonstructural flood Damage Reduction program being implemented in the Tug Fork Valley since 1985 has floodproofed several hundred flood- fringe structures in West Virginia and Kentucky. This action has resulted in an overall reduction in flood damages and an improvement in housing quality throughout the basin. The proposed program would not be initiated until the assessments in (1) and (2) above are completed and the floodway acquisition program has been initiated in a watershed. This nonstructural program would be best administered through the USACE, NRCS, WVCA and WVOES.

C. Plan Costs: The costs associated with this multi-component program can be divided into the four basic project/program phases of development: 1) preparation of planning/decision documents and NEPA compliance, 2) design or engineering of proposed features if needed, 3) construction of approved projects or implementation of program elements, and 4) O&M by non-Federal sponsors of completed projects or programs. Depending upon which of many existing Federal programs are used to implement the proposed strategy, the funding needs for planning/NEPA compliance, design/engineering and construction will differ. Likewise, the cost sharing responsibilities between the Federal and non-Federal sponsor will fluctuate depending upon the program applied. Table L-5 shows the range of costs associated with these four categories for the four strategic components. These approximate costs would be applied to each of the major watersheds in the State according to the number of at-risk structures and municipal centers that are located within the watersheds.

At any one time, several of these phases could be underway for various regions within the State. Annual funding requirements would fluctuate depending upon the number of active regional projects and their phases of development.

Table L-5. Projected Plan Costs*

Strategic Component	Component Phase	Planning	Design/ Engineering	Construction/ Implementation	Annual O&M
Watershed Storage Assessment (Dams and Reservoirs)		$500K	$5.0M	$50-$100M per project	$10K-$100K
Municipal Protection Assessment (Floodwalls, Levees & Channel Modifications)		$250K	$2.0M	$40-$80M per project	$40K-80K
Floodway Property Acquisition		$100K	$500K	$50K-$100K per structure	$2K-5K
Flood Fringe Nonstructural protection (Flood proofing & acquisitions)		$250K	$750K	$50K-$100K per structure	$5K-10K

* Costs are approximated based upon costs experienced in past projects and programs. Many other components of the comprehensive strategy to reduce flood damages will have limited capital and O&M costs. Proposed regulations, legislative changes, and training and education will have relatively minimal costs compared to those displayed above. These administrative and legislative Plan components can proceed independently of the Components suggested above.

D. Plan Administration: Given the immense scope of this undertaking and the level of sustained commitment needed by many agencies and organizations involved in this program, it is recommended that the existing Task Force be retained in a more formal organization to assure coordination of the many interrelated components of this program. Coordination of the strategic program among the Task Force members could be maintained through quarterly meetings. Members of Task Force working groups may be team leaders (within their respective agencies) on projects and programs proposed in this Plan. An ongoing Task Force presence in the process would assure close coordination of the program components among the implementing agencies.

E. Plan Implementation Schedule: Through the development of the Statewide Plan, the Task Force members determined that a watershed approach to analysis of the problems, formulation of plans and plan implementation would be most appropriate for this scope of undertaking. The watershed approach to plan implementation would allow many existing Federal and State programs for flood damage reduction to be easily applied to the State. Additionally, many associated water resources development issues such as water supply, water quality improvements, stream restoration, and infrastructure can be best applied at the watershed level.

Of these watersheds, several already contain some form of flood storage through one or a series of reservoirs. The remaining uncontrolled watersheds would be assessed for potential storage facilities. Several of these watershed studies can be accomplished concurrently, if sufficient funding can be secured. Individual watershed storage studies could be completed within 12 months with the most economical projects moving forward into detailed planning, design and NEPA compliance procedures.

A total of seventeen municipalities are currently protected by local protection projects. The remaining unprotected municipal centers would be assessed for local protection projects with economically justifiable projects proceeding into design and construction. Individual municipal center protection studies could be completed within 12 months with several studies proceeding concurrently. Those projects supported by a non-Federal sponsor with economic justification could proceed into detailed planning, design and NEPA compliance procedures.

Nonstructural planning to support floodway acquisitions and flood fringe floodproofing and acquisitions can be accomplished at the watershed level. Depending upon the size of the watershed and the numbers of structures in the watershed, nonstructural studies to support implementation of these activities can be completed in 12-18 months. Implementation of nonstructural projects can be accomplished at various production levels. Since floodway acquisition and floodproofing implementation occurs on a per structure basis, a nonstructural program can proceed at whatever level of funding is provided. However, eventual completion of a nonstructural project is dependent upon sustained funding and dedication of agency resources. The existing Tug Fork nonstructural project has been progressing since 1985 with many floodway structures acquired and significant numbers of structures floodproofed during that 17-year timeframe.

FLOOD CONTROL PROJECTS IN WEST VIRGINIA		
AGENCY		
	PROJECT	**COMMENTS**
WEST VIRGINIA CONSERVATION AGENCY		
	Salem Fork	Harrison County. Partnered with USDA-NRCS. 10,500 linear feet of channel modification completed. Includes 7 dams.
	Warm Springs Run	Includes 8 dams.
	New Creek – Whites Run	Includes 9 dams
	South Fork	Pendleton County. Partnered with USDA-NRCS. 6,050 linear feet of channel modification completed. Includes 23 dams
	Patterson Creek	Grant and Mineral Counties. Partnered with USDA-NRCS. 2,110 linear feet of channel modification remaining to be built. Includes 23 dams
	Lunice Creek	Grant County. Partnered with USDA-NRCS. 4,600 linear feet of channel modification completed. Includes 3 dams
	Upper Buffalo Creek	Marion County. Partnered with USDA-NRCS. 6,760 linear feet of channel modification under construction. Includes 7 dams

	Upper Grave Creek	Marshall County and Pennsylvania. Partnered with USDA-NRCS. 19,000 linear feet of channel modification completed. Includes 7 dams
	Daves Fork-Christians Fork	Mercer County. Partnered with USDA-NRCS. 6,600 linear feet of channel modification completed. Includes 3 dams
	Saltlick Creek	Includes 5 dams
	Marlin Run	Includes 1 dams
	Bond's Creek	Ritchie County. Partnered with USDA-NRCS. 30,300 linear feet of channel modification completed. Includes 1 dams
	Brush Creek	Mercer County. Partnered with USDA-NRCS. 30,300 linear feet of channel modification completed. Includes 10 dams
	Polk Creek	Lewis County. Partnered with USDA-NRCS. 6,860 linear feet of channel modification completed. Includes 8 dams
	Harmon Creek	Includes 6 dams
	Wheeling Creek	Includes 5 dams
	Upper Deckers Creek	Preston County. Partnered with USDA-NRCS. 35,300 linear feet of channel modification completed. Includes 7 dams
	Pecks Run	Upshur County. Partnered with USDA-NRCS. 27,000 linear feet of channel modification completed.
	Blakes Creek – Armour Creek	Includes 1 dam.
	Big Ditch Run	Webster County. Partnered with USDA-NRCS. 19,300 linear feet of channel modification completed. Includes 1 dams
	Elk Twomile Creek	Includes 2 dams
	Shooks Run	Barbour County. Partnered with USDA-NRCS. 3,800 linear feet of channel modification completed.
	Pond Run	Wood County. Partnered with USDA-NRCS. 15,450 linear feet of channel modification completed. Includes 1 dam.
	Mill Creek	Includes 5 dams.
	South Branch	Includes 5 dams that have not been built.
	Lost River	Includes 2 dams under construction and 3 dams that have not been built.
	Pocatalico River	Includes 2 dams.

	Soak Creek of Piney Creek	Raleigh County. Partnered with USDA-NRCS. 14,300 linear feet of channel modification completed.
	Little Whitestick-Cranberry of Piney Creek	Raleigh County, Partnered with USDA-NRCS. 11,170 linear feet of channel modification under construction, 8,080 linear feet remaining to be built.
	North and South Mill Creek	Includes 4 dams and 2 dams that have not been built.
	Upper Mud River	Includes 1 dam.
	Howard Creek	Greenbrier County, Partnered with USDA-NRCS. 2,940 linear feet of channel modification under construction. Includes 1 dam.
	Middle Grave Creek	Marshall County. Partnered with USDA-NRCS. 4,820 linear feet of channel modification completed.
	North Fork of Hughes River	Includes 1 dam.
	Tributary of Evitts Run	Jefferson County. Partnered with USDA-NRCS. 1,900 linear feet of channel modification completed.
FEDERAL EMERGENCY MANAGEMENT AGENCY		
	Cabell, Wyoming, Raleigh, McDowell, Putnam County-wide Map Conversion and Studies.	Fully funded and underway.
	Jackson County Map Conversion and Study.	Released in January 2003.
	Mercer County, Oceana, Smithers, Reedy and White Sulphur Springs Map Conversion and Studies.	Released in 2002.
	Tug Fork River - Revised Hydrographic and Hydrologic Study	McDowell County. Revise data.
	Elkhorn Creek- Revised Hydrographic and Hydrologic Study	McDowell County. Revise data.
	Guyandotte - Revised Hydrographic and Hydrologic Study	Wyoming County. Revise data.
	Clear Fork – Oceana - Revised Hydrographic and Hydrologic Study	Wyoming County. Community suspended (Oceana was reinstated after the 2001 flood event.) Revise data.
US ARMY CORPS OF ENGINEERS		

	Elkins LPP	Channel Cutoff and Levees on Tygart Valley River
	Buckhannon LPP	Channel modification and cutoff on Buckhannon River
	Rainelle LPP	Channel Modification
	Spencer LPP	Channel Modification
	Milton LPP	Feasibility Study completed, sign PCA – Floodwall and Levee
	Griffithville / Yawkey LPP	Channel Modification
	Marlinton LPP	Feasibility Study completed, sign PCA – Floodwall and Levee
	Pocatalico River Basin Study	Basin Study completed – no economically justified projects
	Point Pleasant LPP	Combination Floodwall and Levee
	Ceredo/Kenova LPP	Combination Floodwall and Levee
	Huntington LPP	Combination Floodwall and Levee
	Parkersburg LPP	Combination Floodwall and Levee
	McDowell County Nonstructural Project	Floodproofing and permanent floodplain relocations
	Hatfield Bottom Nonstructural Project	Ringwall at High School and Floodproofing and permanent floodplain relocations
	Matewan LPP	Floodwall and Fill (Mate Creek Housing Site)
	Matewan Nonstructural Project	Floodproofing and permanent floodplain relocations
	Mingo County Nonstructural Project	Floodproofing and permanent floodplain relocations
	West Williamson LPP	Concrete Floodwall
	Williamson Central Business District LPP	Combination Floodwall and Cell / Levee
	Williamson Nonstructural Project	Floodproofing and permanent floodplain relocations
	Wayne County Nonstructural Project	Floodproofing and permanent floodplain relocations
	Island Creek LPP	Feasibility study complete, sign PCA - Channel modification
	Mullens LPP	Inactive feasibility study - no local sponsor
	Oceana LPP	Inactive feasibility study – no local sponsor
	Princeton LPP	Feasibility study underway
USDA - FARM SERVICE AGENCY		
	Emergency Conservation Program	Disaster specific allocations used to restore farmlands.
USDA - NATURAL RESOURCES CONSERVATION SERVICE		
	Salem Fork	Harrison County. Partnered with WVCA. 10,500 linear feet of channel modification completed. Includes 7 dams.
	Warm Springs Run	Partnered with WVCA. Includes 8 dams.

	New Creek – Whites Run	Partnered with WVCA. Includes 9 dams
	South Fork	Pendleton County. Partnered with WVCA. 6,050 linear feet of channel modification completed. Includes 23 dams
	Patterson Creek	Grant and Mineral Counties. Partnered with WVCA. 2,110 linear feet of channel modification remaining to be built. Includes 23 dams
	Lunice Creek	Grant County. Partnered with WVCA. 4,600 linear feet of channel modification completed. Includes 3 dams
	Upper Buffalo Creek	Marion County. Partnered with WVCA. 6,760 linear feet of channel modification under construction. Includes 7 dams
	Upper Grave Creek	Marshall County and Pennsylvania. Partnered with WVCA. 19,000 linear feet of channel modification completed. Includes 7 dams
	Daves Fork-Christians Fork	Mercer County. Partnered with WVCA. 6,600 linear feet of channel modification completed. Includes 3 dams
	Saltlick Creek	Partnered with WVCA. Includes 5 dams
	Marlin Run	Partnered with WVCA. Includes 1 dams
	Bond's Creek	Ritchie County. Partnered with WVCA. 30,300 linear feet of channel modification completed. Includes 1 dams
	Brush Creek	Mercer County. Partnered with WVCA. 30,300 linear feet of channel modification completed. Includes 10 dams
	Polk Creek	Lewis County. Partnered with WVCA. 6,860 linear feet of channel modification completed. Includes 8 dams
	Harmon Creek	Partnered with WVCA. Includes 6 dams
	Wheeling Creek	Partnered with WVCA. Includes 5 dams
	Upper Deckers Creek	Preston County. Partnered with WVCA. 35,300 linear feet of channel modification completed. Includes 7 dams
	Pecks Run	Upshur County. Partnered with WVCA. 27,000 linear feet of channel modification completed.
	Blakes Creek – Armour Creek	Kanawha County. Partnered with WVCA. Includes 1 dam.
	Big Ditch Run	Webster County. Partnered with WVCA. 19,300 linear feet of channel modification completed. Includes 1 dams
	Elk Twomile Creek	Kanawha County. Partnered with WVCA. Includes 2 dams

	Shooks Run	Barbour County. Partnered with WVCA. 3,800 linear feet of channel modification completed.
	Pond Run	Wood County. Partnered with WVCA. 15,450 linear feet of channel modification completed. Includes 1 dam.
	Mill Creek	Partnered with WVCA. Includes 5 dams.
	South Branch	Partnered with WVCA. Includes 5 dams that have not been built.
	Lost River	Partnered with WVCA. Includes 2 dams under construction and 3 dams that have not been built.
	Pocatalico River	Partnered with WVCA. Includes 2 dams.
	Soak Creek of Piney Creek	Raleigh County. Partnered with WVCA. 14,300 linear feet of channel modification completed.
	Little Whitestick-Cranberry of Piney Creek	Raleigh County, Partnered with WVCA. 11,170 linear feet of channel modification under construction, 8,080 linear feet remaining to be built.
	North and South Mill Creek	Partnered with WVCA. Includes 4 dams and 2 dams that have not been built.
	Upper Mud River	Partnered with WVCA. Includes 1 dam.
	Howard Creek	Greenbrier County, Partnered with WVCA. 2,940 linear feet of channel modification under construction. Includes 1 dam.
	Middle Grave Creek	Marshall County. Partnered with WVCA. 4,820 linear feet of channel modification completed.
	North Fork of Hughes River	Ritchie County. Partnered with WVCA. Includes 1 dam.
	Tributary of Evitts Run	Jefferson County. Partnered with WVCA. 1,900 linear feet of channel modification completed.
	Upper Marsh Fork Preliminary Investigation Report	Raleigh County. 1962
	Raleigh County Floodplain Management Study	Raleigh County. 1982 and 1985
	Upper Bluestone River Preliminary Investigation Report	Mercer County. 1966
	Dunloup Creek Local Implementation Plan	Fayette County. 1998
	Arbuckle Creek Feasibility Report	Fayette County. 1986
	Meadow Creek Preliminary Investigation Report	Fayette County. 1976

	Oceana Preliminary Investigation Study	Wyoming County. 1965
	Rockcastle Creek Preliminary Investigation Study	Wyoming County. 1964
	Mullens Preliminary Investigation Study	Wyoming County. 1965
	Request for Watershed Plan under PL - 566	Wyoming County. 2001
	Water Resources Study for Water Supply	McDowell County. 1995
US FISH AND WILDLIFE SERVICE		
	Partners for Fish and Wildlife	Technical and financial assistance to private landowners for fish and wildlife habitat restoration.

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY			
	PROJECT NAME	**COUNTY**	**STREAM LOCATION**
USDA-NRCS AND WVCA DAMS			
	Saltlick Creek 4	Braxton	Berry Fork
	Saltlick Creek 6	**Braxton**	Pickles Fork
	Saltlick Creek 7	Braxton	Spruce Fork
	Saltlick Creek 8	Braxton	Hughes Fork
	Saltlick Creek 9	Braxton	Saltlick Creek
	Harmon Creek 1	Brooke	Sappingtons Run
	Harmon Creek 13	Brooke	Brown Hollow
	Harmon Creek 14	Brooke	Alexanders Run
	Harmon Creek 2	Brooke	Tributary of Harmon Cr
	Harmon Creek 3	Brooke	Tributary of Meckling Run
	Harmon Creek 4	Brooke	Meckling Run
	Lunice Creek 10	Grant	Saltblock Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Lunice Creek 11	Grant	Tributary of North Fork
	Lunice Creek 9	Grant	North Fork Lunice Creek
	New Creek 12	Grant	Tributary of New Creek
	New Creek 14	Grant	Linton Creek
	North And South Mill Creek 16	Grant	Gum Hollow Of North Mill Creek
	North And South Mill Creek 3	Grant	Rough Run
	North And South Mill Creek 4	Grant	Tributary of South Mill Creek
	North And South Mill Creek 7	Grant	South Mill Creek
	Patterson Creek 1	Grant	Tributary of Patterson Creek
	Patterson Creek 12	Grant	Lower Thorn Run
	Patterson Creek 13	Grant	Rosser Run
	Patterson Creek 2	Grant	Tributary of Patterson Creek
	Patterson Creek 3	Grant	Upper Thorn Run
	Patterson Creek 4	Grant	Middle Fork
	Patterson Creek 41	Grant	North Fork
	Patterson Creek 49	Grant	Tributary of Patterson Creek
	Patterson Creek 6	Grant	Elklick Run
	Howard Creek 12	Greenbrier	Dry Creek
	Lost River 27	Hardy	Upper Cove Run
	Lost River 4	Hardy	Kimsey Run
	South Fork 1	Hardy	Shooks Run
	South Fork 2	Hardy	Stump Run
	South Fork 4	Hardy	Rohrbaugh Run
	South Fork 5	Hardy	Radabaugh Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Salem Fork 11	Harrison	Tributary of Jacobs Run
	Salem Fork 11a	Harrison	Tributary of Jacobs Run
	Salem Fork 12	Harrison	Tributary of Jacobs Run
	Salem Fork 13	Harrison	Tributary of Salem Fork
	Salem Fork 14	Harrison	Dark Hollow Of Jacobs Run
	Salem Fork 15	Harrison	Jacobs Run
	Salem Fork 9	Harrison	Tributary of Patterson Fork
	Mill Creek 10	Jackson	Elk Fork
	Mill Creek 13	Jackson	Tug Fork
	Mill Creek 4	Jackson	Joes Run
	Mill Creek 5	Jackson	Big Run
	Mill Creek 8	Jackson	Left Fork Of Frozencamp Creek
	Mill Creek 9	Jackson	Right Fork Of Frozencamp Creek
	Pocatalico River 28	Jackson	Middle Fork
	Blakes Creek-Armour Creek 7	Kanawha	Blakes Creek
	Elk Twomile Creek 12	Kanawha	Tributary of Elk Twomile Creek
	Elk Twomile Creek 13	Kanawha	Tributary of Elk Twomile Creek
	Elk Twomile Creek 14	Kanawha	Hunter Run
	Polk Creek 1	Lewis	Tributary of Polk Creek
	Polk Creek 13	Lewis	Sassafras Run
	Polk Creek 4	Lewis	Tributary of Polk Creek
	Polk Creek 5	Lewis	Tributary of Polk Creek
	Polk Creek 6	Lewis	Tributary of Polk Creek
	Polk Creek 7	Lewis	Dry Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Polk Creek 8	Lewis	Tributary of Polk Creek
	Polk Creek 9	Lewis	Keith Fork
	Upper Mud River 2-A	Lincoln	Tug Fork
	Upper Buffalo Creek 16	Marion	Hibbs Run
	Upper Buffalo Creek 2	Marion	Huey Run
	Upper Buffalo Creek 22	Marion	Big Run
	Upper Buffalo Creek 33-A	Marion	Flat Run
	Upper Buffalo Creek 37-A	Marion	Whetstone Run
	Upper Buffalo Creek 39	Marion	Llewellyn Run Of Flat Run
	Upper Buffalo Creek 4	Marion	Owen Davy Fork
	Upper Grave Creek 1	Marshall	Tributary of Grave Creek
	Upper Grave Creek 3	Marshall	Tributary of Grave Creek
	Upper Grave Creek 4	Marshall	Tributary of Grave Creek
	Upper Grave Creek 5	Marshall	Ramp Hollow
	Upper Grave Creek 7	Marshall	Tributary of Grave Creek
	Upper Grave Creek 8	Marshall	Tributary of Grave Creek
	Upper Grave Creek 9	Marshall	Tributary of Grave Creek
	Wheeling Creek 18	Marshall	Grandstaff Run
	Wheeling Creek 23	Marshall	Turkey Run
	Wheeling Creek 25	Marshall	Wolf Run
	Wheeling Creek 3	Marshall	Dunkard Fork
	Brush Creek 10	Mercer	Tributary of South Fork
	Brush Creek 12	Mercer	Glady Fork
	Brush Creek 14	Mercer	North Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Brush Creek 15	Mercer	North Fork
	Brush Creek 19a	Mercer	Middle Fork
	Brush Creek 4	Mercer	Tributary of South Fork
	Brush Creek 5	Mercer	Tributary of South Fork
	Brush Creek 6	Mercer	Tributary of South Fork
	Brush Creek 7a	Mercer	Tributary of South Fork
	Brush Creek 9	Mercer	South Fork
	Daves Fork-Christian Fork 1	Mercer	Tributary of Daves Fork
	Daves Fork-Christian Fork 2	Mercer	Tributary of Daves Fork
	Daves Fork-Christian Fork 3	Mercer	Christian Fork
	New Creek 1	Mineral	Tributary of New Creek
	New Creek 10	Mineral	Ash Spring Run
	New Creek 16	Mineral	Thunder Run
	New Creek 17	Mineral	Ash Spring Run
	New Creek 5	Mineral	Tributary of New Creek
	New Creek 7	Mineral	Tributary of New Creek
	New Creek 9	Mineral	Mill Run
	Patterson Creek 14	Mineral	Harness Run
	Patterson Creek 15	Mineral	Mikes Run
	Patterson Creek 20	Mineral	Liller Run Of Mill Creek
	Patterson Creek 21	Mineral	Mill Run
	Patterson Creek 22	Mineral	Wild Meadow Run
	Patterson Creek 24	Mineral	Tributary of Patterson Creek
	Patterson Creek 25	Mineral	Johnson Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Patterson Creek 26	Mineral	Tributary of Patterson Creek
	Patterson Creek 27	Mineral	Tributary of Patterson Creek
	Patterson Creek 28	Mineral	Cabin Run
	Patterson Creek 30	Mineral	Tributary of Cabin Run
	Patterson Creek 32	Mineral	Purgit Run
	Patterson Creek 36	Mineral	Tributary of Patterson Creek
	Patterson Creek 37	Mineral	Tributary of Patterson Creek
	Patterson Creek 38	Mineral	Hollenbeck Run
	Patterson Creek 44	Mineral	Pasture Run
	Patterson Creek 45	Mineral	Graveyard Run
	Patterson Creek 46	Mineral	Painter Run
	Patterson Creek 47	Mineral	Tributary of Patterson Creek
	Patterson Creek 48	Mineral	Pursley Run
	Patterson Creek 50	Mineral	Horseshoe Creek (Georges Run)
	Patterson Creek 52	Mineral	Mud Run
	Warm Springs Run 1	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 2	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 3	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 4	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 5	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 6	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 7	Morgan	Tributary of Warm Springs Run
	Warm Springs Run 9	Morgan	Tributary of Warm Springs Run
	Wheeling Creek 7	Ohio	Middle Wheeling Creek

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	South Fork 10	Pendleton	Stony Run
	South Fork 11	Pendleton	Road Run
	South Fork 12	Pendleton	Detimer Run
	South Fork 13	Pendleton	Hawes Run
	South Fork 14	Pendleton	Broad Run
	South Fork 15	Pendleton	Miller Run
	South Fork 16	Pendleton	George Run
	South Fork 17	Pendleton	Little Fork
	South Fork 18	Pendleton	Stony Run
	South Fork 19	Pendleton	Brushy Fork
	South Fork 21	Pendleton	Little Rough Run
	South Fork 27	Pendleton	Dry River Hollow Of Hawes Run
	South Fork 32	Pendleton	Tributary of South Fork
	South Fork 33	Pendleton	Tributary of South Fork
	South Fork 35	Pendleton	Tributary of South Fork
	South Fork 36	Pendleton	Little Stony Run
	South Fork 37	Pendleton	Camp Run
	South Fork 6	Pendleton	Wilson Run
	South Fork 9	Pendleton	Dice Run
	Marlin Run 1	Pocahontas	Marlin Run
	Upper Deckers Creek 1	Preston	Deckers Creek
	Upper Deckers Creek 2	Preston	Laurel Run
	Upper Deckers Creek 3	Preston	Tributary of Dillan Run
	Upper Deckers Creek 4	Preston	Dillan Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY	PROJECT NAME	COUNTY	STREAM LOCATION
	Upper Deckers Creek 5	Preston	Kanes Run
	Upper Deckers Creek 6	Preston	Tributary of Deckers Creek
	Upper Deckers Creek 7	Preston	Tributary of Decker Creek
	Bonds Creek 1	Ritchie	Long Bottom
	Pullman 1	Ritchie	Tributary of Left Fork Slab Creek
	North Fork Hughes River	Ritchie	North Fork Hughes River
	Charles Fork 17	Roane	Charles Fork
	Pocatalico River 14	Roane	Silcott Fork
	Jumping Branch 1	Summers	Jumping Branch
	Big Ditch 1	Webster	Tributary of Big Ditch Run
	Pond Run 1	Wood	Pond Run
	Walker Creek Recreation Impoundment	Wood	Walker Creek
US ARMY CORPS OF ENGINEERS DAMS			
	Beech Fork Lake and Dam	Wayne	Beech Fork of Twelvepole Creek
	Bluestone Lake and Dam	Summers	New River
	Burnsville Lake and Dam	Gilmer	Little Kanawha River
	East Lynn Lake and Dam	Wayne	Twelvepole Creek
	R. D. Bailey Lake and Dam	Wyoming	Guyandotte River
	Rowlesburg Lake and Dam	Preston	Cheat River (Not Constructed)
	Summersville Lake and Dam	Nicholas	Gauley River
	Sutton Lake and Dam	Braxton	Elk River
	Stonewall Jackson Lake and Dam	Lewis	West Fork River
	Tygart Lake and Dam	Taylor	Tygart Valley River
	Jennings Randolph Lake and Dam	Mineral	North Branch of the Potomac River

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY	PROJECT NAME	COUNTY	STREAM LOCATION
US ARMY CORPS OF ENGINEERS LOCKS			
	London	Kanawha	Kanawha River
	Marmet	Kanawha	Kanawha River
	Racine	Mason	Ohio River
	Robert C. Byrd	Mason	Ohio River
	Belleville	Wood	Ohio River
	Winfield	Putnam	Kanawha River
	Hannibal	Wetzel	Ohio River
	Pike Island	Brooke	Ohio River
	Willow Island	Tyler	Ohio River
	New Cumberland	Hancock	Ohio River
	Morgantown	Monongalia	Monongahela River
	Hildebrande	Monongalia	Monongahela River
	Opekiska	Monongalia	Monongahela River
ADDITIONAL DAMS SUBJECT TO REGULATION BY DEPARTMENT OF ENVIRONMENTAL PROTECTION, DIVISION OF WATER AND WASTE MANAGEMENT, DAM SAFETY PROGRAM			
	Belington Water Supply Dam	Barbour	Mill Creek
	Teter Creek Lake Dam # 1	Barbour	Teter Creek
	R. P. Smith Power Station	Berkeley	Potomac
	R. Paul Smith # 3 Dam	Berkeley	Potomac River
	Sleepy Creek Dam	Berkeley	Meadow Branch
	Sleepy Hollow Creek Dam	Berkeley	Cherry Run
	Burek Farm Pond	Brooke	North Fork of Short Creek
	Castleman's Run Lake No. 1	Brooke	Castleman's Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Culloden Water Supply Dam	Cabell	Indian Fork
	Hatfield Farm Lake	Cabell	Guyandotte River
	Lake Of Eden	Cabell	Goose Run
	Lakeview Dam	Cabell	Unnamed Tributary of Tom Creek
	Melody T Ranch Lake	Cabell	Unnamed Tributary of Mud River Of Guyandotte River
	Trout Lake	Cabell	Unnamed Tributary of Guyandotte River
	Crystal Lake	Doddridge	Unnamed Tributary of Middle Island Creek
	Babcock Lake Dam	Fayette	Glade Run
	Plum Orchard Lake Dam	Fayette	Paint Creek
	Mt. Storm Lake Dam	Grant	Stony River
	Pond No. #1 Dam	Grant	Buffalo Creek
	Stony River Dam	Grant	Stony River Of Potomac River
	Boone Farms Lake Dam	Hampshire	Little Cacapon
	Ferndale Farms Recreation Lake	Hampshire	Unnamed Tributary of South Branch of Potomac River
	Wilson Big Hollow Dam	Hampshire	
	Cherry Lake Dam	Hancock	Deep Gut Run
	Thorn Bottom Farm Lake	Hardy	Trout Run
	Warden Lake	Hardy	Moore's Run
	Clarksburg Ws Dam	Harrison	Buffalo Creek
	Deegan Lake	Harrison	Davisson Run
	Harrison Power Station Sediment Pond #1	Harrison	Piggots Run
	Hinkle Lake	Harrison	Davisson Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Joyce Lake	Harrison	Unnamed Tributary of West Fork River
	Lake Floyd Dam	Harrison	West Fork River
	Lower Salem Ws	Harrison	Salem Fork
	Maple Lake	Harrison	Peddlers Run
	New Lumberport Dam	Harrison	
	Oral Lake Dam	Harrison	Spring Fed
	Shinnston Water Supply	Harrison	Robinson Run
	Upper Salem Dam	Harrison	Dog's Run
	West Milford Dam	Harrison	
	Cedar Lake Dam No.1	Jackson	Unnamed Tributary Of Mill Creek Of Ohio River
	Cedar Lake Dam No.2	Jackson	Unnamed Tributary Of Mill Creek
	Hutchinson Farm Pond	Jackson	Mill Creek
	Rollins Dam No.2	Jackson	Mill Creek
	Rollins Lake Dam No.1	Jackson	Spring Fed
	Turkey Run Lake	Jackson	Turkey Run
	Shannondale Club Ltd.	Jefferson	Furnace Run
	Anderson Dam	Kanawha	Dutch Hollow
	Blake's Creek Site No.7	Kanawha	Ritenour Lake
	Cunningham Flyash Pond	Kanawha	Dutch Hollow
	Finney Branch Embankment	Kanawha	Finney Branch
	FMC Waste Retention Basin	Kanawha	Davis Creek
	Holz Dam	Kanawha	Sugar Camp Creek
	Lake Chaweva Dam	Kanawha	Rocky Fork
	Poffenbarger Dam No.1	Kanawha	Rocky Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Poffenbarger Farm Lake No. 3	Kanawha	Rocky Fork
	Scott's Run Cinder Barrier	Kanawha	Scott's Run
	Bendale Dam	Lewis	West Fork River
	Jackson Mill Dam	Lewis	Unnamed Tributary of West Fork
	Lake Riley	Lewis	Murphy Creek
	Murphy Creek Dam	Lewis	
	Right Fork Dam	Lewis	Murphy Creek
	Stonecoal Creek Dam & Reservoir	Lewis	Stonecoal Creek
	Weston Dam	Lewis	West Fork River
	Lee's Fishing Lake	Lincoln	Mahoney Creek
	Mannington Water Supply Dam	Marion	Dent's Run
	Rachel Hunting & Fishing Dam	Marion	Mods Run
	Rock Lake	Marion	Glady Creek
	Burch Run Lake No.1	Marshall	Burch Run
	Conner Run Flyash	Marshall	Conner Run
	Kaliya Ghat	Marshall	
	Mitchell Bottom Ash Ponds	Marshall	Ohio River
	AEP Project 1301 Ash Pond	Mason	Little Broad Run
	Chief Cornstalk Public Lake	Mason	Ninemile Creek
	McClintic #23 Dam	Mason	Oldtown Creek
	Anawalt Lake	McDowell	Millseat Branch
	Anawalt Lake Dam	McDowell	Millseat Branch
	Berwind Lake	McDowell	War Creek
	Twin Branch Dam No.1	McDowell	Tug Fork

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Ada Dam	Mercer	East River
	Horton Dam	Mercer	East River
	Jimmy Lewis Dam	Mercer	Bluestone River
	Laurel Creek Dam	Mercer	Laurel Creek
	New Bramwell Dam	Mercer	Unnamed Tributary of Bluestone River
	Old Bramwell Dam	Mercer	Unnamed Tributary of Bluestone River
	Lakewood Dam	Mineral	Death Valley
	Old Keyser Reservoir	Mineral	Limestone Run
	Laurel Creek Lake No.1	Mingo	Laurel Fork
	Cobun Creek Dam	Monongalia	Cobun Creek
	Crooked Run No. 3	Monongalia	Crooked Run
	Lough Lake	Monongalia	Little Indian Creek
	Lynch Lake	Monongalia	Little Indian Creek
	Paradise Lake	Monongalia	Boyd Run
	Tibbs Run Dam	Monongalia	Tibbs Run
	Wildwood Lake	Monongalia	Boyd Run
	Moncove Lake	Monroe	Devil Creek
	Cacapon Reservoir Dam	Morgan	North Fork
	Cacapon State Park Lake	Morgan	North, Middle & South Fork
	Coolfont Dam	Morgan	Cold Spring Run
	Dam C	Morgan	Potomac River
	Grasshopper Hollow Tailings Dam	Morgan	Potomac River
	Old Cacapon Power Dam	Morgan	Cacapon River
	Bear Rocks Lake No.1	Ohio	Todd Run

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Bear Rocks Lake No.2	Ohio	Todd Run
	Bear Rocks Lake No.3	Ohio	Todd Run
	Millcrest Farm Pond	Ohio	Hall Run
	Schenk Lake	Ohio	Waddles Run
	McElroy Run Dam	Pleasants	McElroys Run
	Lake Sam Hill	Pocahontas	Thorny Creek
	Seneca Lake	Pocahontas	Little Thorny Creek
	Watoga Lake Dam	Pocahontas	Island Lick Run
	Albright Bridge Dam	Preston	Cheat River
	Alpine Lake	Preston	Wardwell Run
	Appalachian Lake	Preston	Fike Run
	B & O Dam	Preston	Little Raccoon Creek
	Big Bear Lake	Preston	Beaver Creek
	Bruceton Mills Dam	Preston	Big Sandy Creek
	Chippewa Lake	Preston	Laurel Run
	Fairfax Pond	Preston	Kanes Creek
	Lake O' Woods Dam	Preston	Patterson Run
	Masontown Water Supply Dam	Preston	Back Run
	Terra Alta Lake	Preston	Snowy Creek
	Big Bear Lake Dam	Preston	Beaver Creek
	Bottom Ash Pond 1b	Putnam	
	Bottom Ash Ponds 1a	Putnam	
	FMC Employees Sportsman’s Club	Putnam	
	Hurricane Water Supply Reservoir	Putnam	Mill Creek

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	John Amos Flyash Dam	Putnam	Little Scary Creek
	Lake Washington	Putnam	Hurricane Creek
	Long Branch Reservoir	Putnam	Long Branch of Poplar Fk.
	Poplar Fork Dam	Putnam	Poplar Fork
	Westvaco Sportsman Club No. 2	Putnam	Unnamed Tributary of Little Hurricane Creek.
	Winfield Water Supply Dam	Putnam	Little Hurricane Creek.
	Flat Top Lake Dam	Raleigh	Beaverpond Branch
	Glade Creek Dam No. 1	Raleigh	Glade Creek
	Glade Creek Dam No. 2	Raleigh	Glade Creek
	Grandview Farm Lake	Raleigh	Packs Branch
	Lake Stephens Dam	Raleigh	Stephens Branch
	Little Beaver Dam	Raleigh	Little Beaver Creek.
	South Sand Branch	Raleigh	
	Winter Place Dam	Raleigh	Glade Creek
	Scott Lake	Randolph	Stalnaker Run
	Harrisville City Reservoir	Ritchie	Hughes River
	No. 1-West Of Cornwallis	Ritchie	Hughes River
	Pennsboro Water Supply Dam #2	Ritchie	Reservoir Run of Hughes River
	Lake Trotter	Roane	Lick Fork
	Lawsons Farm Lake	Roane	McKeown Creek
	Methodist Church Camp Lake	Roane	Spring Fed
	Miletree Run Dam No. 1	Roane	Miletree Run Creek
	Miletree Run Dam No. 2	Roane	Miletree Run Creek
	Pipestem Lake	Summers	Long Branch

DAMS AND LOCKS IN WEST VIRGINIA

AGENCY

	PROJECT NAME	COUNTY	STREAM LOCATION
	Sun Valley Lake Dam	Summers	Pipestem Creek
	Flat Run Lake	Tucker	Flat Run
	Pendleton Lake	Tucker	Pendleton Creek
	Sand Run Lake	Tucker	Unnamed Tributary of Blackwater River
	Spruce Island Lake	Tucker	Sand Run
	Thomas Dam (Concrete)	Tucker	North Fork
	Thomas Reservoir Dam	Tucker	Unnamed Tributary of North Fork
	Conaway Run Public Fishing Are	Tyler	Conaway Run
	Sludge Impoundment No. 2	Tyler	Sugar Camp Run
	Buckhannon Ws Dam	Upshur	
	Hall's Farm Pond	Upshur	Unnamed Tributary of Sand Run
	Moses Fork Fishing Lake	Wayne	Right Fork
	Big Ditch Lake No. 1	Webster	Long Glade Ditch
	Camp Caesar Dam	Webster	Upper Glade Run
	Wells Locks And Dam	Wirt	Little Kanawha
	A & O Farm Pond	Wood	Unnamed Tributary of Stillwell Creek.
	Lake Washington	Wood	Vaughts Run Of Sandy Creek
	Tennant's Farm Pond	Wood	Unnamed Tributary of Laurel Fork
	Upper Smith Dam	Wood	Unnamed Tributary of Neal Run
	Horse Creek Dam #1	Wyoming	Guyandotte River