

THE FLOODPLAIN

December , 1980
Prepared by the
Drainage and Waterways Agency
and the
Monmouth County Planning Board

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THE FLOODPLAIN

Errata Sheet

1. "Prepared by the Monmouth County Environmental Planning Staff", should include: RICHARD PERRO, SENIOR PLANNING DRAFTSMAN
MINH TAM NGUYEN, PLANNING DRAFTSMAN
2. Page ii - 12th Line: Prinicpal should read Principal
3. Page ii - 17th Line: orginal should read original
4. Page 4 - 11th Line: American Hornbean. should read American Hornbeam
5. Page 6 - 15th Line: (as in the ease of . . .) should read (as in the case of . . .)
6. Page 7 - Figure 4 accommadating should read accommodating
7. Page 9 - 15th Line: vegetative silt trap, and increased water velocity should read vegetative silt trap and increases water velocity
8. Page 13 - 25th Line: Enforcement of these regulations is further complicated by the extensive floodplain areas throughout the state and the necessity of an ample supply of inspectors. should read Enforcement of these regulations is complicated by the extensive floodplain areas throughout the state and a limited number of inspectors.
9. Page 13 - 31st Line: U.S.G.S. Quadrangler should read U.S.G.S. Quadrangle
10. Page 14 - 29th Line: untended should read intended

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INTRODUCTION

Floods are not a recent phenomenon but the destruction caused by them is. Only since man has been building permanent structures near the water has flooding become a major problem. If population continues to grow, and development continues to occupy "desirable" waterfront (or riverside) property, flooding problems will not only continue, but will grow worse.

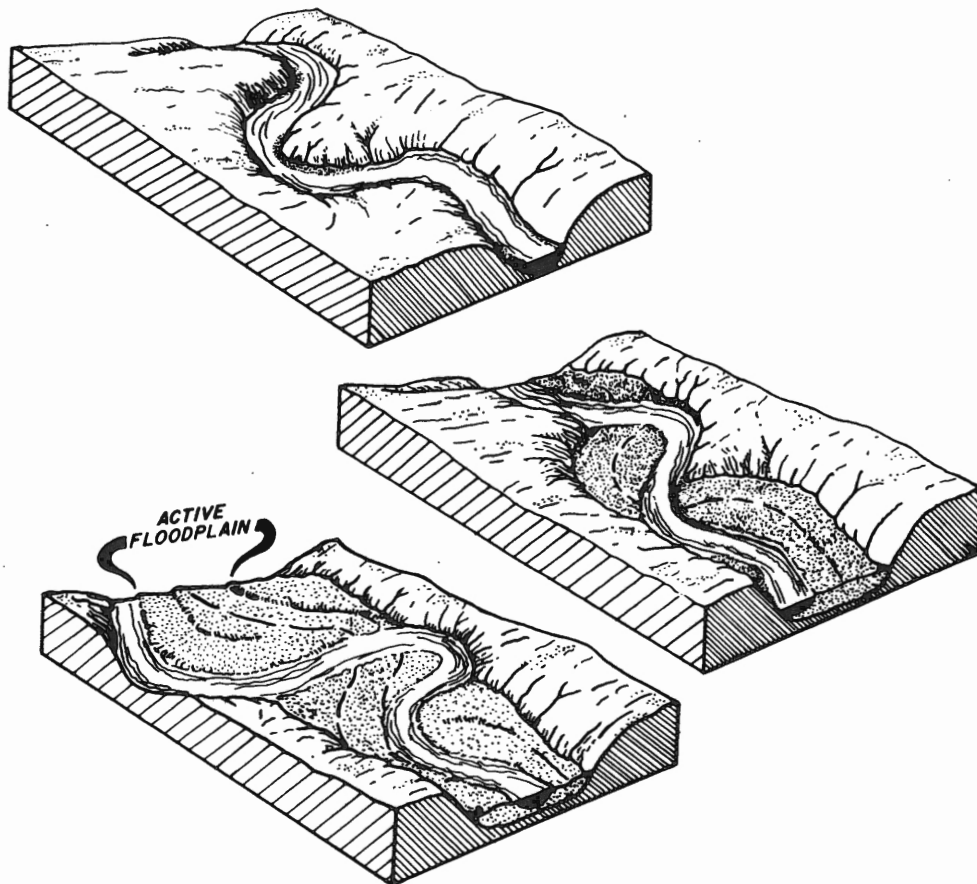
Historically, New Jersey has been subject to severe flooding. Accounts and photographs of flood damage date back as far as 1882. The Passaic River Valley is subject to severe flooding due to urbanization and encroachment on the Passaic floodplain. Damages incurred by severe floods in 1902 and 1903 would total \$702 million if they occurred today (County & Municipal Government Study Commission, 1977). Floods on the Delaware River in 1955 resulted in over \$16 million worth of damage in New Jersey. Both of these examples deal with large rivers and large amounts of damage but small rivers also flood. Damage figures from small river floods may not reach into the millions of dollars, but they are destructive nonetheless and unfortunately, much of their destruction could have been averted had local governments been more aware of floodplains.

The purpose of this report is to analyze the floodplain, what it is, its functions, compatible uses and abuses. With the flooding problems we face today, and the potential problems associated with continued urbanization, we must become cognizant of the hazards of occupying floodplains. It is hoped that this report will contribute to such an awareness.

THE FLOODPLAIN

By definition, a floodplain is a belt of low, flat land bordering a stream, which is subject to periodic inundation (Strahler & Strahler, 1973). The floodplain develops through changes in the stream channel brought about by changing water flows, erosion and deposition. Streams which overtop their banks expose the surrounding area to erosion which can level contours or cut new channels and deposition which can fill depressions and close channels. The repetition of these processes over a period of many years produces the land form known as the floodplain. (See figure 1).

LATERAL EROSION AND DEPOSITION OF A RIVER



SOURCE: Environmental Analysis, 1978, by William M. MARSH.

Prepared by the Monmouth County Planning Board, Nov., 1980.

The size of a floodplain can vary from several yards to several miles and larger, depending on the size of the waterway, the time it has been in existence and the degree of lateral erosion and deposition that has occurred. Due to erosion and deposition, rivers are continually shifting, forming new channels and closing old ones. If such is the case, one may well ask why the channel itself is not sufficient to carry all the water. Why must there be overflow, and consequently, why are there floodplains. The answer is that precipitation is not constant and extreme amounts of rainfall or snowfall greatly affect water levels. In most cases, light rains are the rule rather than the exception, and only in some instances is there adequate rainfall or snowmelt to completely fill the stream channel. The floodplain receives the few major flows that exceed the channels capacity. Figure 2 shows the floodway, flood fringe, 100-year flood and flood hazard area.

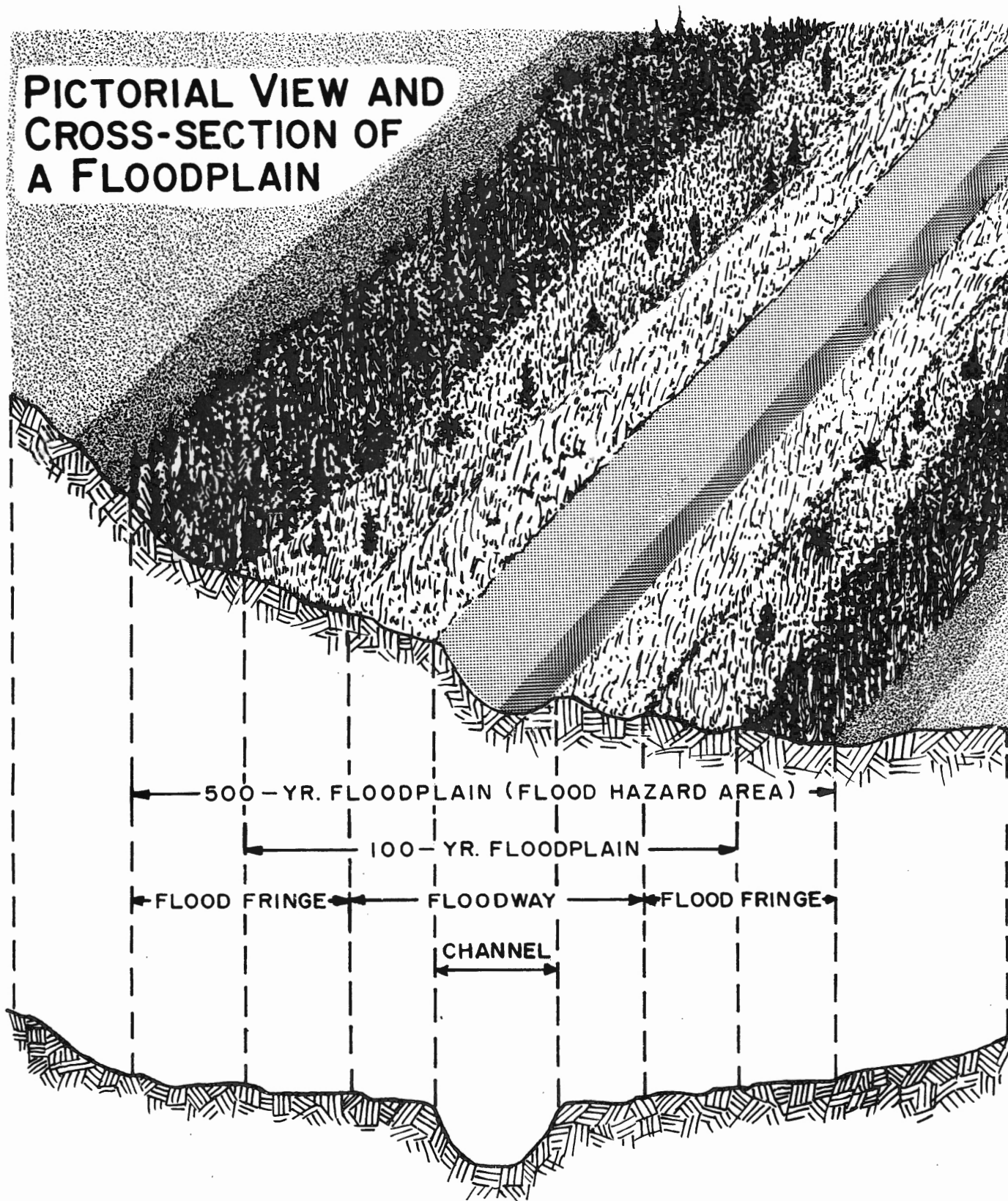
Another problem which often arises in connection with floodplains is their delineation. How does one define their boundaries for development, land-use planning or other purposes. Although it is beyond the scope of this report to discuss complex engineering and geological methodology and data, there are several basic methods which have been used:

1. Identification of the soils and vegetation surrounding the channel which are associated with alluvium deposition and hydric conditions.
2. Topographical identification and mapping of lowland areas near waterways.
3. Review of the historical records of an area, determining the extent of flooded areas and frequency of inundation.

These, among others, are readily accessible ways identifying and delineating the floodplains.

There are generally two sections composing the floodplain, the floodway and flood fringe, although for engineering purposes the flood fringe is sectioned into the 100 and 500 year flood zone. The floodway is the section immediately adjoining the stream channel (as well as the channel itself) which will be inundated without an appreciable rise in water level. This area carries the majority of the flow during floods. Structures in other parts of the floodplain are subject to flooding during overflow conditions, but if located in the floodway they could be washed away and/or destroyed. The 100-year flood zone is that area of the floodplain which has a 1% chance of being inundated in any given year. This area can be expected to flood at least once every 100 years, although it is possible a flood of this magnitude could occur two or three times in one year. The 100-year flood zone is usually considered the critical area, and most questions and decisions about floodplain use involve it and the floodway.

PICTORIAL VIEW AND CROSS-SECTION OF A FLOODPLAIN



SOURCE: N. J. D. E. P. Flood Hazard Report No. 1, 1967.

Prepared by the Monmouth County Planning Board, Nov., 1980.

Fig. 2

COMMUNITY CHARACTERISTICS

Biotic communities found in floodplains vary with geographical region and frequency of flooding but are typically composed of plants and animals adapted to life in a hydric or near-hydric environment. Plant forms are limited to those which can tolerate wet soils, high water table and periodic flooding. Some flood plain species which may be found locally are listed below.

Cattail (<u>Typha</u> spp.)	Willows (<u>Salix</u> spp.)
Three square (<u>Scirpus</u> spp.)	Red Maple (<u>Acer rubrum</u>)
Tear thumb (<u>Polygonum</u> spp.)	Sweet Gum (<u>Liquidamber styraciflua</u>)
Violets (<u>Viola</u> spp.)	American Hornbeam (<u>Carpinus</u>
Spring Beauty (<u>Claytonia virginica</u>)	<u>caroliniana</u>)
Dutchman's Breeches (<u>Dicentra cucullaria</u>)	Box Elder (<u>Acer negundo</u>)

Floodplains soils are termed alluvial (water deposited) and are derived from materials carried downstream by the water course. Their composition is dependent on the nature of their parent material but typically are high in silt and organic material. Floodplains are usually poorly drained because of their flat relief, fine grained soils and seasonally high water table. The deposition of silt and organic material by flooding replenishes soil fertility which, in turn, promotes high primary production in this region. Not only is plant life abundant, but the diversity of wildlife found in the floodplain exceeds that of the surrounding mature forests. (Figure 3 shows a typical floodplain community).



TYPICAL FLOODPLAIN VEGETATION

Prepared by the Monmouth County Planning Board, Nov., 1980.

Fig. 3

FUNCTIONS AND COMPATIBLE USES

The basic service provided by the floodplain is that of a natural detention basin (see figure 4). As stream flow increases past the capacity of the channel, water moving downstream is slowed as it moves across the floodplain, thereby decreasing the potential for damage downstream.

Several other important functions, related to the detention of flood waters are:

1. The floodplain may serve as an aquifer recharge area, funneling some of the flood waters into underground reservoirs or, slowly, back to the stream.
2. Flood waters carry nutrients which are deposited in the floodplain and enrich the soil. This rich soil supports a wealth of natural vegetation and, historically, (as in the case of the Nile Valley and Delta) has been important in man's agricultural pursuits.
3. Undeveloped floodplains, because of their diverse plant life, support a large diversity of animal populations.



Figure 4. Floodplain accomadating channel overflow.

ABUSE AND RESULTANT PROBLEMS

The floodplain, of all nature's creations, is one that has been extensively subjected to man's tampering. The result of this environmental perturbation has been severe "ecological backlash," evidenced by the millions of dollars in property damage and lives lost every year to flooding. Floodplains have been filled and used as building sites for houses, industries, commercial businesses, paved parking areas, etc. They have also been used as disposal sites for industrial, commercial and residential wastes, and dredge spoils. Figure 5 shows a representative floodplain after the impact of urbanization and construction.



Figure 5. A developed floodplain.

There are numerous problems associated with filling and/or developing floodplains, from flooded basements to extensive property damage and loss of life. Specific problems are listed below.

Floodplains are naturally poorly drained areas due to alluvial soils and high water table. Minor flooding problems can occur even if the stream doesn't overflow its banks.

Direct flooding of homes and businesses from channel overflow and inundation of floodplain causes property damage and loss of life.

Increased runoff from buildings and paved areas and reduction in storage space for the floodwaters due to construction, combine to cause increased stream flow. This, in turn, results in flooding and increased erosion and sedimentation downstream.

Removal of floodplain vegetation accelerates bank erosion (due to lack of cover), increases sedimentation (from bank erosion and loss of vegetative silt trap, and increased water velocity.

Construction in floodplains sometimes makes it difficult or impossible (without property destruction) to clean and desilt streams, resulting in restricted flow and greater flooding potential.

Aquifer recharge can be seriously retarded, since infiltration from stored water in floodplains is an important source of ground water replenishment in some areas.

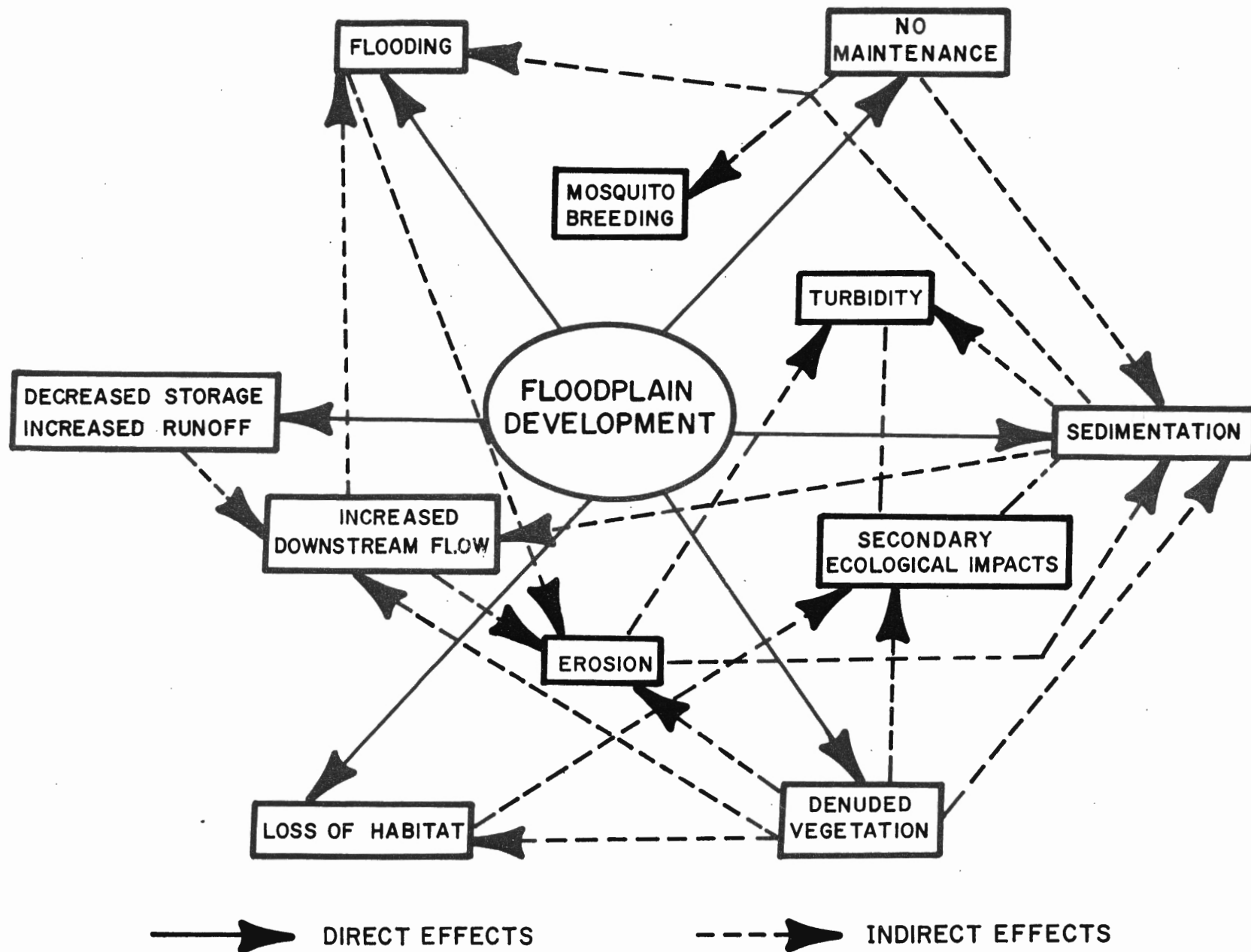
Disruption of the floodplain ecosystem.

Sedimentation resulting from disturbance of the floodplain can breed pests (mosquitos), increase accumulation of harmful substances (bacteria, toxic chemicals) reduce channel capacity, increase water treatment costs and alter or destroy biotic communities.

These are some of the numerous impacts of floodplain development, some obvious and straightforward and others which are not so obvious. Figure 6 illustrates some of these effects, and their relationship to each other.

At this point, a logical question might arise as to "why?", why do we insist on building in floodplains. After the damage that has already resulted from this practice? The answers to this question are numerous and varied. In the initial stages of urbanization and industrialization around the mid to late 1800's, floodplains were attractive areas because of their proximity to the transportation offered by riverboats and barges. Towns grew up near the factories and mills and continued to develop. Floodplains, due to their flat terrain, were also "ideal" sites for building and farming and, unfortunately, are still considered as such. Engineers and builders

INTERRELATED EFFECTS OF FLOODPLAIN DEVELOPMENT



today are supposedly cognizant of the dangers of floodplain construction but the prospect of monetary gains often interferes with good judgment.

As time progressed, people became increasingly aware of the dangers of establishing residences and businesses too near a water-course. Floodplain development, however, continues to this day with leading causes being "misplaced faith" and lack of experience. Modern man has become highly dependent on the "technological fix". Flood control structures and other engineering techniques have provided many people with a false sense of security. Unfortunately, flood control measures are not always effective. The Federal government has also encouraged development in flood prone areas by making available federally subsidized low cost flood insurance. This promotes rebuilding of flood damaged structures at public expense. Finally, one might examine the personal desire to own a home near a stream for aesthetic reasons.

Whatever the combination of reasons responsible for floodplain development, it remains a serious problem. Floods will continue to damage property and claim lives so long as this type of development continues. Figure 7 depicts developed floodplains during periods of flood.



Figure 7. Developed flooded floodplain

FLOODPLAIN ORDINANCES AND REGULATIONS

There have been numerous rules and ordinances prohibiting and/or limiting floodplain development enacted, but many of these are of an advisory nature, with no provisions for actual enforcement of the regulations. Some federal agencies have what might be termed "indirect enforcement", where financial assistance is withdrawn or refused if the floodplain regulations are not followed, but they have no direct enforcement capabilities.

Regulations and ordinances governing floodplain development are generated at four major levels, federal, state, county, and local. Federal ordinances stem from Executive Order 11988, which directs federal agencies to issue or amend existing regulations and procedures, to protect lives and property from increasing flood loss, and restore and preserve the natural purposes of the floodplain.

State ordinances for control of floodplain development in New Jersey were passed as public laws in 1962 and amended in 1972, with the Water Policy and Supply Council of the N.J. Department of Environmental Protection as the responsible agency. They are required to delineate all flood hazard areas and authorize the adoption of land use regulations for these flood hazard areas. One year after the promulgation of standards by the department, the affected municipality or entity must adopt rules concerning development and land use in the floodplain. This law also gives the state power to enforce its rules in any area not under municipal regulation. The state currently controls activities within the floodway, and the entire 100-yr. floodplain in some areas. Enforcement of these regulations is further complicated by the extensive floodplain areas throughout the state and the necessity of an ample supply of inspectors.

The state D.E.P. presently requires entities to apply for stream encroachment permits for all desnagging, silt removal and/or maintenance within a stream or ditch which is shown on the U.S.G.S. Quadrangler or State Atlas maps, or which has a drainage basin of 50 acres or more.

Stream encroachment violations may be reported to:

- (1) Violations Coordinator
Stream Encroachment Section
Bureau of Floodplain Management
Division of Water Resources (D.E.P.)
P.O. Box CN029
Trenton, N.J. 08625 (609) 292-2402
- (2) DEP Hotline (609) 292-7172

On the county level, the Monmouth County Planning Board has long supported the preservation of floodplains and other poorly drained areas. In a 1967 report titled Study of Land Use and Physical Characteristics a formal policy of drainage was delineated. This policy was put forth in three main points:

1. By retaining public control of the floodplain and its adjacent poorly drained areas, the possibility of the natural drainage-ways being impaired or destroyed by artificially induced sedimentation are diminished.
2. Retention/detention ponds can be created to regulate stream-flow or recharge groundwater. This policy would control flooding and thus minimize the need for increasing the size of drainage facilities at downstream locations.
3. Linear parks could be established in some areas and thus space would be available to build trunk and interceptor sewer lines to serve the natural drainage basins.

This drainage and floodplains policy was formally incorporated into the General Development Plan which was adopted in early 1970. On the General Development Plan map all stream valleys were designated either as local or regional conservation and drainage areas and recommended for preservation.

Existing municipal floodplain ordinances differ in specific details, but the ultimate objective of each is synonymous with the federal and state objectives of preservation of floodplains and prevention of property destruction and loss of life through unwise development. Middletown, for example, has adopted an ordinance with provisions for establishing flood zones, developing rules and procedures for interpretation and delineation of floodplain areas, preparation of floodplain maps and assigning untended uses. Prohibitions included are disposal of solid wastes, pesticides, domestic and industrial wastes, radioactive materials, petroleum products or other hazardous material (except as authorized under provisions of law).

Permitted uses included are those which have low flood damage potential, do not obstruct flows in the floodway, do not require channel modification, agricultural uses, recreational uses and other accessory uses such as lawns, gardens and landscaping. The local Planning Board and Building inspector administer and enforce the ordinance, and penalties for violation may be \$200 fine and/or 90 days imprisonment, and the possibility of litigation enacted by the Township, Building Inspector, or the owner of any property within Middletown.

Middletown's ordinance, among others, restricts much unwise floodplain utilization, but there are "regulated" uses permitting limited development after analysis of impacts and alternatives by the local Planning Board, Building Inspector and Township Engineer. These uses are limited to those which do not unduly affect the habitat and water storage capacity of the floodplain or obstruct the natural flow. One

is. must also look at the indirect consequences. Planting a lawn or garden will not seriously alter the water retention capacity, but if no drainage easement is provided, it is extremely difficult to obtain permission to bring in equipment and clean the stream, which leads to problems of sedimentation, flooding, clogged culverts, and so on.

Perhaps the best policy, and one which may become necessary in the future, is the restriction of all structures and pavement within the floodplain and mandatory drainage easements for all properties bordering and/or within the floodplain. A municipal ordinance which follows this idea closely is that of Wall Township, which states that no structures of any type are to be erected within the floodplain or/within fifty (50) feet of the stream bank, whichever distance is greater. The floodplains in Wall Township are defined by soil type, rather than the normal 100 year flood concept. This is one of the most comprehensive floodplain ordinances in New Jersey, and one which may become necessary for other municipalities in the near future.

CONCLUSIONS

Due to immediate and long range environmental effects, extensive filling and development in the floodplain constitutes both an unwise and dangerous practice, and one that should be discontinued through regulations and enforcement in all future land use planning and zoning ordinances. Past mistakes due to unwise planning, must not be repeated in view of the serious effects of floodplain development to both man and the environment. Along these lines, a hypothetical idea for long range planning could involve the acquisition of easements along all the major streams and tributaries throughout the county, a "linear greenbelt" surrounding our waterways. This would be a multi-purpose project, and the acquired greenspace would have numerous uses, including easements for drainage and stream cleaning, prevention of floodplain development and its resultant problems, recreational use such as hiking, bicycling and horseback riding, preservation of numerous habitats and preservation of our waterways in a relatively pristine state through reduction of erosion, sedimentation and pollution. As of this writing, the Monmouth County Parks Department is considering the acquisition of linear greenspace along the Manasquan River, but this and similar future projects depend on the suitability and availability of property and funding.

As a final insight into the potential problems and dangers of floodplain development, the example of Soldiers Grove, Wisconsin, is one that all future floodplain developers and residents should be aware. This small (population 524) town has experienced such devastating flooding in recent years from the nearby Kickapoo River (an ironic name, considering the situation) that plans are currently underway to "physically and functionally" move the business district of the town to a park, and houses in the area not relocated will be rehabilitated and floodproofed. Whether this nonstructural approach to flood control will materialize is dependent on public support and government funding (local, state, federal). The example of Soldiers Grove illustrates the respect for flooding displayed by one town. It is hoped that this example will motivate other municipalities to reevaluate their attitudes about floodplain development.

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APPENDIX A

GLOSSARY OF TERMS

Adventitious - Roots arising from any structure not part of the normal root system of a plant, i.e. aerial roots of parasitic vines and Spanish moss.

Alluvial - Water deposited soil, such as a floodplain, caused from erosion and deposition.

Aquifer - An underground water source that supplies water to wells, streams etc. It is supplied in turn by groundwater infiltration from bogs, floodplains, precipitation and other hydric areas.

Flood Hazard Area - The floodway and any portions of the floodplain where there exists a danger of flooding and consequent threat (hazard) to life or property resulting from improper development or use.

Flood Fringe - The portion of the flood hazard area or floodplain outside of the floodway.

Floodplain - The relatively flat, low-lying area adjoining the channel of a waterway which has been and probably will be covered by flood water. It was formed from the lateral erosion of the stream banks and deposition in the channel.

Floodway - The waterway channel and portions of the floodplain immediately adjoining the channel which carry and discharge the majority of the flow during flooding.

100-yr. Flood - A flood which has a 1% chance of occurring in any given year or number of years. Statistically it will occur once in a 100 years, although it may happen 2 or 3 times in one year and not at all for 150 years.

Heterogeneous - Stratified, where total mixing (homogeneous) has not occurred and distinctive layers or stratifications are present.

Hydric - Conditions which are associated with wet areas, i.e. swamps, bogs, marshes, floodplains.

Mesic - Conditions which are intermediate between hydric and xeric (dry i.e. desert) the state to which all communities are evolving.

Perturbation - Alteration of disturbance of the environment, causing ensuing disruptive consequences, i.e. filling and building in a floodplain may cause serious flooding downstream.

Primary Production - Productivity resulting primarily from photosyntheses,
i.e. vegetation.

Secondary Production - Increase in animal biomass through reproduction
and growth

APPENDIX B

Agencies offering assistance in flood control and floodplain management.

<u>AGENCY</u>	<u>ADDRESS</u>	<u>TECHNICAL ASSISTANCE</u>
<u>Federal</u> ¹		
1) U.S. Army Corps of Engineers	Chief Floodplain Management Services U.S. Army & Independence Ave. SW Washington, DC 20314	1) Mapping, flood history date, flood date, etc. 2) Engineering 3) Guidance in minimizing
2) U.S. Dept. of Agriculture Soil Conservation Service	Chief Floodplain, Management and Special Projects Branch River Basins Division, SCS P.O. Box 2890 Washington, D.C. 20013	1) Engineering Services 2) Conduct research, studies and investigation on soil erosion 3) Non-structural approaches to water resources management.
3) U.S. Dept. of Housing and Urban Development: Federal Housing Administration	Federal Housing Administration 451 7th Street SW Washington, D.C. 20410	1) Information on flood elevations and material necessary to determine floodplain locations.
4) U.S. Dept. of the interior; a) Geological Survey	Chief, Surface Water Branch Water Resources Division U.S. Geological Survey National Center Reston, VA 22092	1) Information on flood peaks and discharges, flood depths and velocities, water profiles, areas inundated during major floods, etc. 2) Information on 50-100- and 500-year flood discharges, computed water surface profiles.

AGENCY

ADDRESS

Federal Con't.

5) Bureau of Land
Management

Bureau of Land Management
U.S. Dept. of the Interior
18th & C Streets, NW
Washington, D.C. 20240

3) Assistance in minimizing
flood lossys by identifying
potential flood hazard
areas.

1) Floodplain maps.

Interstate

1) Delaware River Basin
Commission

Head, Branch of Operations
Delaware River Basin Comm.
P.O. Box 7360
West Trenton, NJ 08628

1) May offer technical
assistance to municipalities
for preparation and admin-
istration of fllood zoning
ordinances.

2) Information on flood data and
floodplain delineation.

2) Tennessee Valley ²
Authority

Floodplain Management Services
100 Liberty Building
Tennessee Valley Authority
Knoxville, Tennessee 37902

1) Information on floods.

2) Technical assistance for
developing in floodplains.

State

1) Dept. of Environmental
Protection

Director, Bureau of Flood-
plain Management
Division of Water Resources
Dept. of Environmental Protection
P.O. Box 2809
Trenton, N.J. 08625

AGENCY

ADDRESS

TECHNICAL ASSISTANCE

Regional

1) Soil Conservation Districts

Monmouth & Middlesex Co.
Soil Conservation District
20 Court Street
Freehold, N.J. 07728

Technical assistance to
landowners, municipalities
and developers.

County

1) County Planning Board

Monmouth County
Floodplain Section
Monmouth County Planning
Board
1 Lafayette Place
Freehold, N.J. 07728

Making data available

Local

1) Municipal Governing
Body

Information on local
ordinances.

¹The Federal addresses are central offices. There are also regional and/or district offices for different areas.

²Assistance is confined to portions of the seven states in the TVA.

