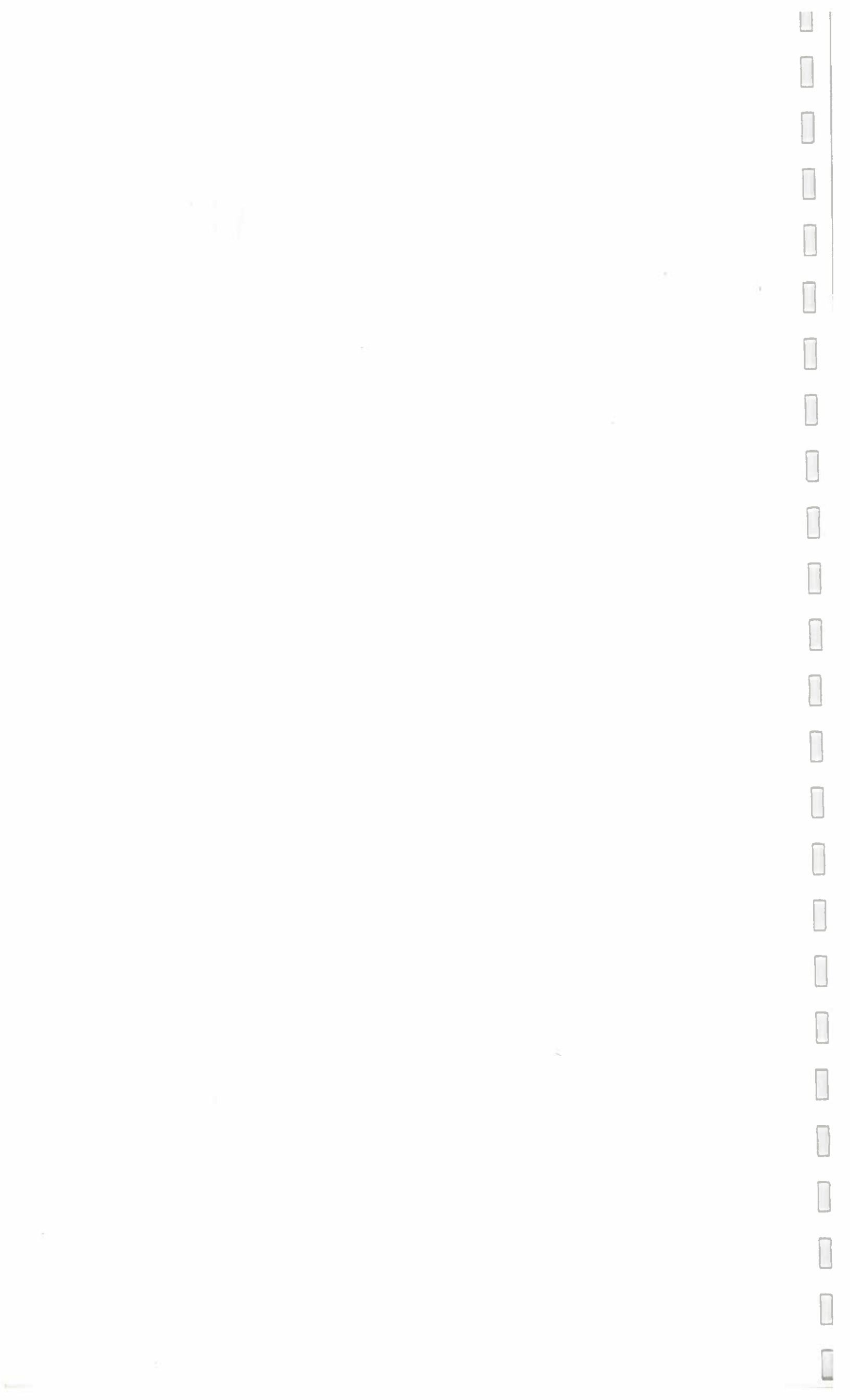


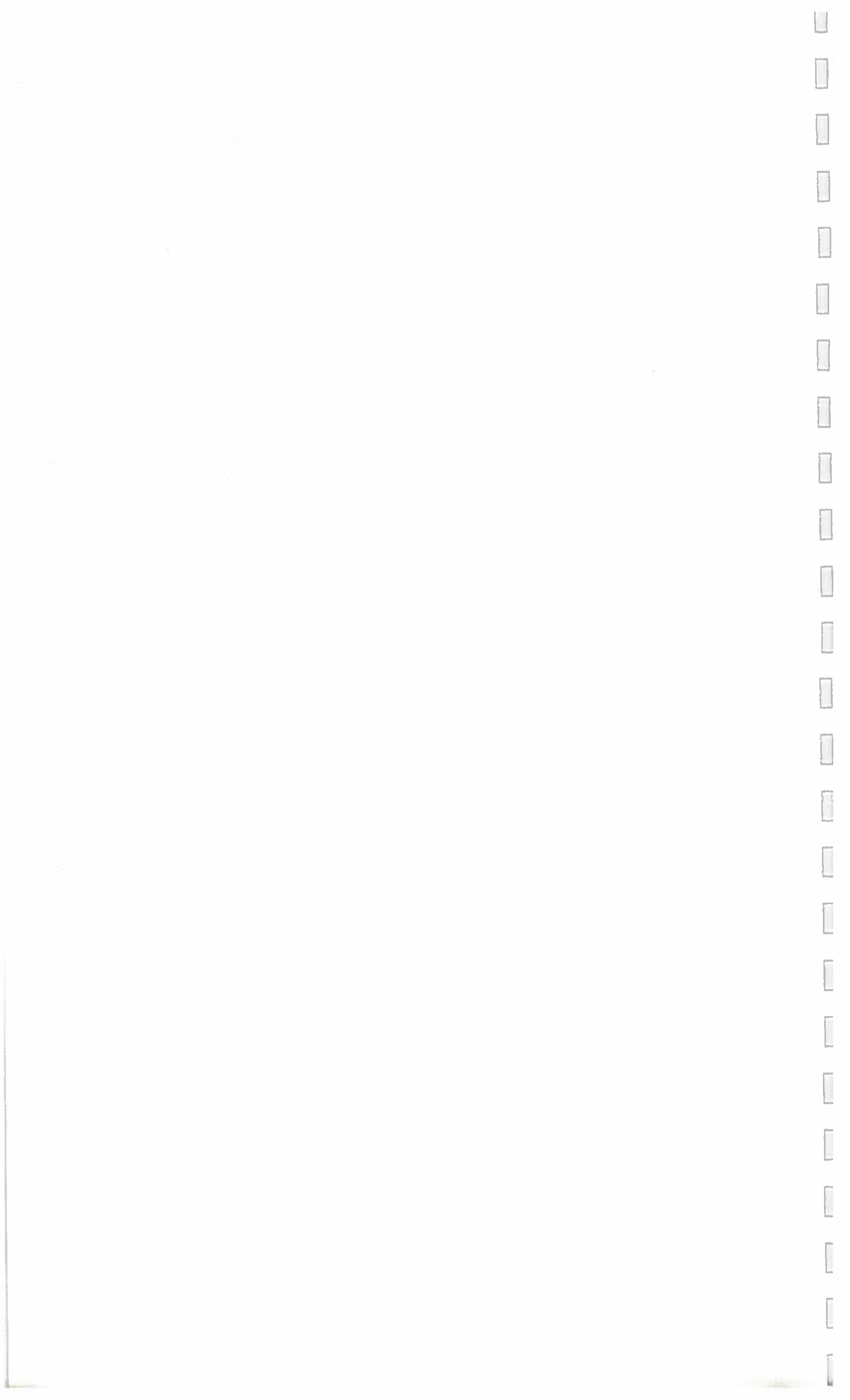
BALTIMORE CITY

FLOODPLAIN MANAGEMENT
PLAN

JONES FALLS
WATERSHED



JONES FALLS WATERSHED PLAN



SUMMARY OF FINDINGS AND RECOMMENDATIONS

The Jones Falls is the second of the drainage systems in Baltimore City for which a watershed plan has been completed. The plan addresses flooding problems in the Jones Falls and recommends cost-effective approaches to reduce flood damage and hazard.

Findings

The Jones Falls is one of three stream systems in Baltimore. Flooding damages occur at several locations within the Jones Falls watershed. The most severe damages occur in the vicinity of the confluence with Western Run and in the industrialized area around Union Avenue and 41st Street.

The Jones Falls Watershed Plan describes the natural features of the drainage area, as well as historic flood damages suffered in the area. All previous reports and studies done in the Jones Falls watershed relating to flood control are reviewed. On the basis of the findings and recommendations set forth in the Analysis volume of the Baltimore City Floodplain Management Plan, alternatives have been chosen to alleviate flooding damages and to develop a comprehensive plan for the Jones Falls watershed. Interjurisdictional coordination is an element of this plan.

RECOMMENDATIONS

The following floodplain management strategies are recommended in the Jones Falls Watershed Plan:

- Several areas in the Jones Falls watershed have been identified as high hazard residential areas. The Plan recommends that these properties be eligible for public acquisition on a voluntary basis. There are 57 properties in the Jones Falls considered eligible in the first phase of the residential acquisition program. The cost of purchasing these homes will be approximately 3.1 million dollars. Owners of residential structures not located in the highest hazard areas but still subject to flooding will be eligible for low-interest loans to floodproof the structure. Information on floodproofing will be sent to these owners to promote this technique. Areas where residential floodproofing may be useful include Mt. Washington area, homes near Western Run, and homes in areas where further studies are to be done.
- There are approximately twenty non-residential structures located in flood-prone areas in the Jones Falls. The Plan recommends that, in cooperation with the Army Corps of Engineers, these structures be eligible for no-cost floodproofing surveys.
- Several flood-prone areas in the Jones Falls watershed have not received adequate detailed hydrologic/hydraulic study needed to formulate final plans. The Plan recommends that detailed studies be performed under the State Water Resources Administration's floodplain management program. The two areas needing study are the Lower Jones Falls area from the harbor to about North Avenue and Stony Run.
- Although many properties in flood-prone areas of the Jones Falls watershed are covered by flood insurance, there remain structures uninsured under this Federal program to promote the benefits of flood insurance in the Jones Falls watershed. This effort will consist of mailings to property owners and renters as well as workshops and publications.

- Baltimore City has in place an existing early warning system for snow, wind, ice, flood and tornado (SWIFT). The Plan recommends that SWIFT be fully implemented in the Jones Falls watershed, utilizing all available data generated during this planning effort.
- Debris located in stream beds in the Jones Falls continues to aggravate flooding. The Plan recommends that the City's erosion control and stream stabilization program be targeted to areas where debris accumulation is a problem.

These recommendations are discussed in detail in the Recommended Plan section of this report.

ENVIRONMENTAL DESCRIPTION

Introduction

The Jones Falls is one of three major stream systems in Baltimore City. It flows southward, from its origin in the Greenspring Valley of Baltimore County, through the northwest and central portion of the City, to empty into Baltimore Harbor and the Chesapeake Bay. Along the length of its streambanks one encounters a variety of natural features and land uses. In the Jones Falls Valley, development proceeds from a rural, agricultural setting to a highly urbanized and industrial stream valley. This diversity requires a comprehensive approach in managing the floodplain for rural, suburban and urban land uses. Such an approach will be taken here, by applying several distinct floodplain management strategies which, when used in combination, can reduce or eliminate flood damages in a cost-effective, environmentally sound manner. These strategies are chosen from among those selected in the Baltimore City Floodplain Management Plan Analysis.

In developing a watershed plan for the Jones Falls, an identification of areas prone to flooding was conducted. This included the type and severity of flooding, damages, the existing land uses, and the nature of the stream in the given area. Recommendations were then developed, often utilizing several management strategies in order to shape a program which addresses short and long-term problems, financial considerations, environmental impacts and social concerns. These recommendations are presented, in this report, by strategy and by location. Maps accompany a discussion of each recommendation where applicable.

The goal of the Jones Falls Watershed Plan is to provide alternatives for coping with existing problems, and a framework for preventing future flood damages. The implementation of this Plan will require the support and participation of all levels of government, including interjurisdictional efforts as well as the understanding and cooperation of the citizens of Baltimore.

Jones Falls Watershed Description

The Jones Falls watershed encompasses approximately 58 square miles. The drainage area is divided into 2 segments by the Lake Roland Dam, located about one half mile north of the Baltimore City/Baltimore County line. About 37 square miles of the total Jones Falls drainage basin discharges to Lake Roland, and from there, flows down the main stem of the Jones Falls. The lower drainage basin contains approximately 21 square miles.

The upper portion of the drainage area is fed by the following streams:

Jones Falls

North Branch	6.0 square miles
Dipping Pond Branch	2.8 square miles
Deep Run	2.5 square miles
Slaughterhouse Branch	1.8 square miles
Moore's Branch	1.8 square miles
Northern Jones Falls	6.8 square miles
Southern Jones Falls	1.4 square miles
Towson Run	2.3 square miles
Roland Run	6.0 square miles
Cochrans Run	1.1 square miles

The lower portion of the drainage area is comprised of the following tributaries:

Western Run	5.0 square miles
Stony Run	3.0 square miles

The tributaries located wholly or partially within the City boundaries are the lower portion of the main stem, Western Run and Stony Run, as well as several small, unnamed streams and mill races.

The watershed area within the City is nearly fully developed with high density urban residential and commercial areas, moderately dense residential areas and about 800 acres of public parkland (Druid Hill Park, Cylburn Park). Lake Roland and the surrounding, City-owned Robert E. Lee Memorial Park constitute an additional 450 acres of parkland. The portion of the drainage area above the Lake Roland Dam is about 60% developed. Population centers occur above and east of the lake (Ruxton, Towson, Lutherville). Aside from a number of large development tracts, single-family residential development predominates. The remainder of the upper watershed is comprised of farms, large estates and undeveloped lands. Encroachment in the City portion of the Jones Falls floodplain has been much more intensive than in the County portion, mostly due to lack of utilities, poorly drained soils, and planning policies in the latter. The historical development of the Jones Falls floodplain in the City accounts for the degree of encroachment (see section on Flooding History).

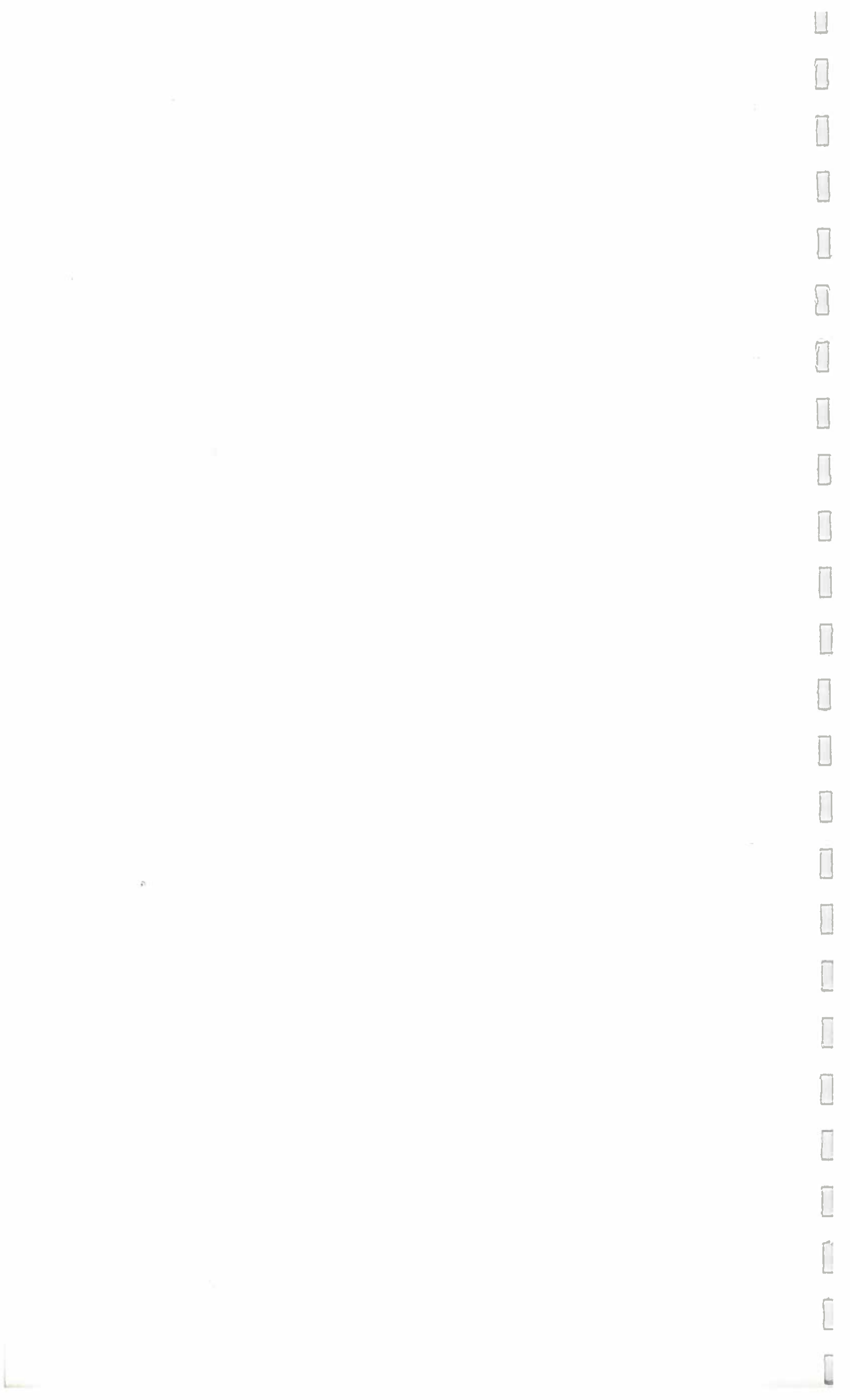
The Jones Falls watershed lies within the Piedmont Upland and Coastal Plain Physiographic Provinces. The Piedmont Upland Province is composed of a complex series of igneous and metamorphic rock. In the Jones Falls and tributary valleys, the major formations include Baltimore gneiss, the Setters Formation (a series of gneisses, quartzites and mica schists), Cockeysville Marble, and the Wissahickon Formation (mica schist and mica gneiss). South of Lake Roland, Baltimore gneiss and the Baltimore gabbro complex (granular, crystalline rock of medium to coarse-grained texture, usually dark gray to purplish black or green in color) predominate to the Fall line, where the Piedmont Upland meets the Coastal Plain. A small hill composed of serpentine lies to the west of Lake Roland.

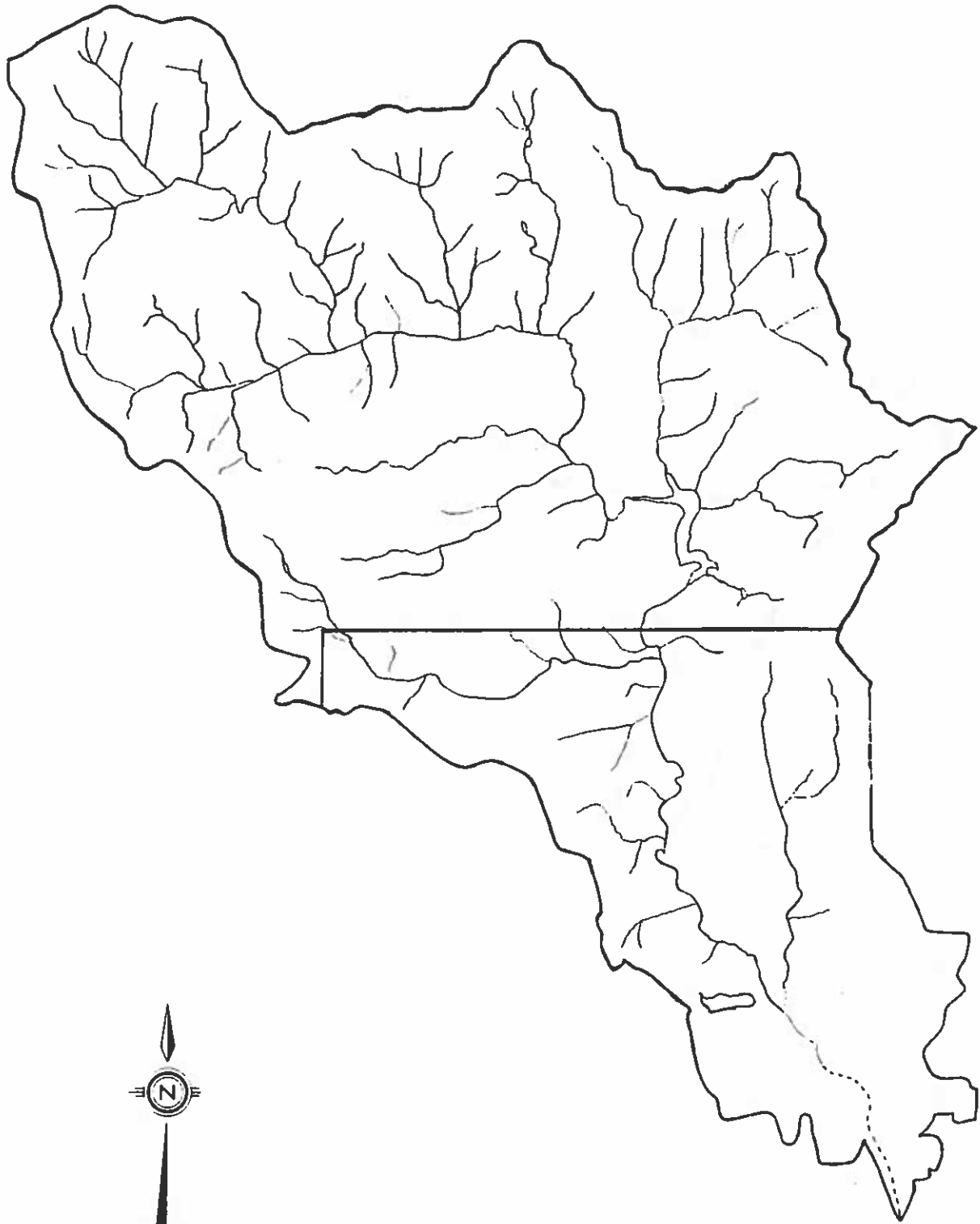
Soils in the Jones Falls watershed are generally deep and fertile, having weathered in place from parent material such as Baltimore Gneiss. The Greenspring Valley consists of Baltimore Silt Loams in the floodplains, Conestoga Loams in the lower elevations and Glenelg Loams in the upper elevations. North of the valley the Chestnut Ridge contains Manor Loams. East of Lake Roland, Glenelg Loam predominates at the higher, and Brandywine Loam predominates at the lower, elevations. West and southwest of Lake Roland Relay Silt Loam and Chrome Silt Loam (from weathering of serpentine) are found. West to northwest of the Lake, Manor Loams and Mixed Alluvial soils predominate, underlain by the Wissahickon formation. Soil characteristics for the City portion of the Jones Falls watershed are less well documented. Generally, the soils are of the Manor-Glenelg Association, and the Wachtung Association. Alluvial soils predominate in the valley, and give way to Coastal Plain soils south of the Fall Line. Coastal Plain Associations common to the area are the Sassafras-Woodstown-Fallsington and Mattapex-Barclay-Othello Associations. It must be noted that the soils in the highly urbanized City portion of the watershed have been extensively disturbed.

The Jones Falls watershed is traversed by the Fall Line, the transition zone between the Piedmont and the Coastal Plain, at the lower end of the main stem. The heavy industrial development in this transition zone dates back to 1789, when flour and grist mills, and later, textile mills used the Falls for power. Today, while no factories rely on water power, the area remains industrial. Many of the original mills and factories are still in use. In addition, there are residential areas in the Jones Falls floodplain, whose locations are tied to the mills and factories where people worked, and may work today as well.

Flooding damages occur at several locations along the Jones Falls. In Baltimore County, there is a residential acquisition program to remove persons and structures from these flood hazard areas. In Baltimore City, flooding damages are most severe in the Mount Washington-Falls Village area and in Hampden-Woodberry. The former area consists mostly of residential and commercial structures, while the latter is heavily industrialized with some residential properties. The village of Mount Washington was severely damaged in Hurricane Agnes in 1972 and again from Tropical Storm David in 1979. Industries in the lower Jones Falls Valley have sustained millions of dollars in damages and lost production time. In addition, loss of life has occurred in the Jones Falls Valley. Flooding here, as elsewhere in the region, occurs quickly and violently, often with only hours of warning time.

In the next section, those portions of the Jones Falls watershed within the City limits will be examined to determine the kind and severity of flooding damages. Utilizing the matrix developed in the Analysis section of the Baltimore City Floodplain Management Plan, alternatives will be chosen to alleviate these damages and to synthesize a comprehensive floodplain management plan for the Jones Falls. The Jones Falls Watershed Plan will address interjurisdictional problems and opportunities in the Jones Falls. A City-County strategy will be presented on the basis of this analysis.





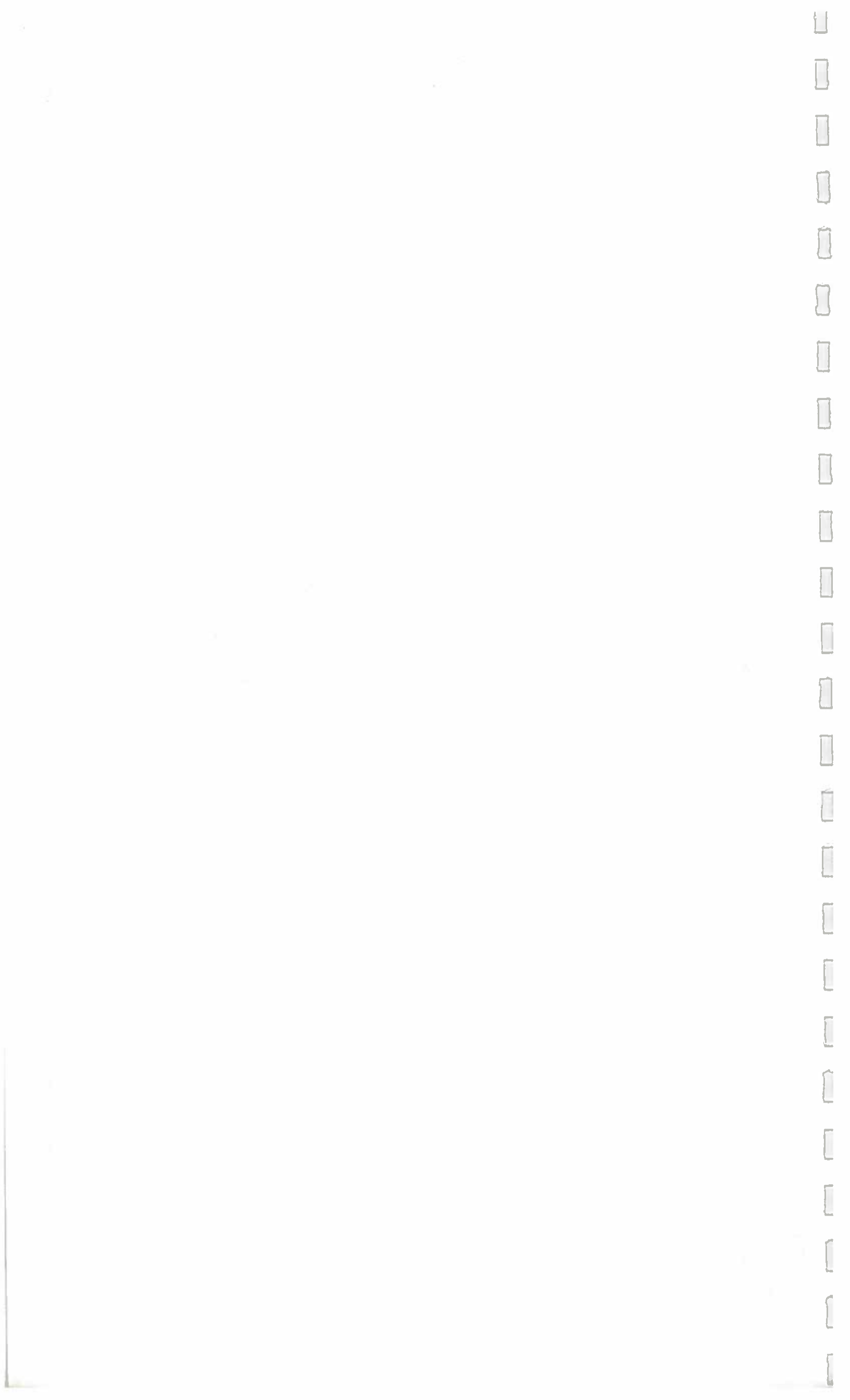
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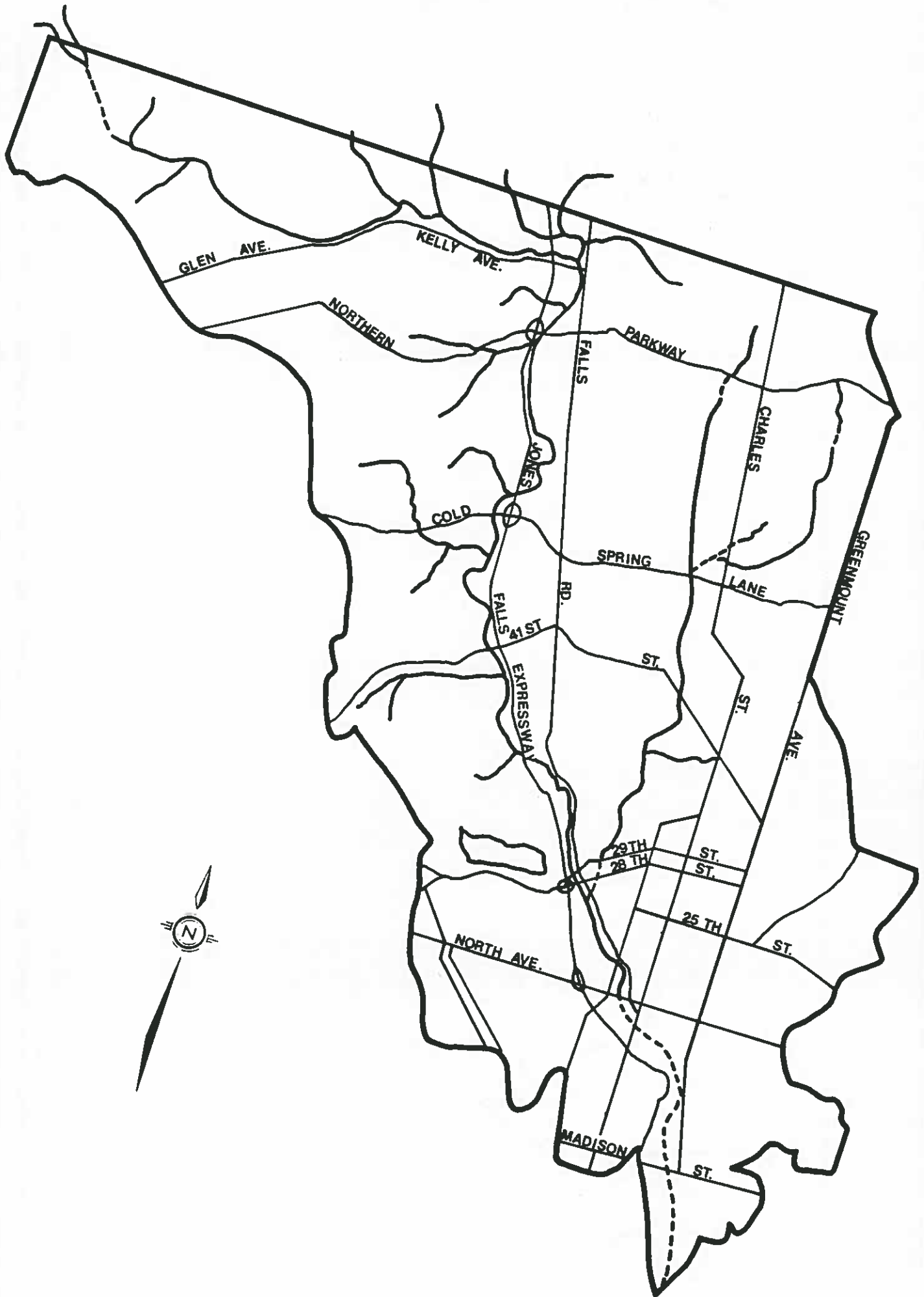
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JONES FALLS WATERSHED

MAP 1







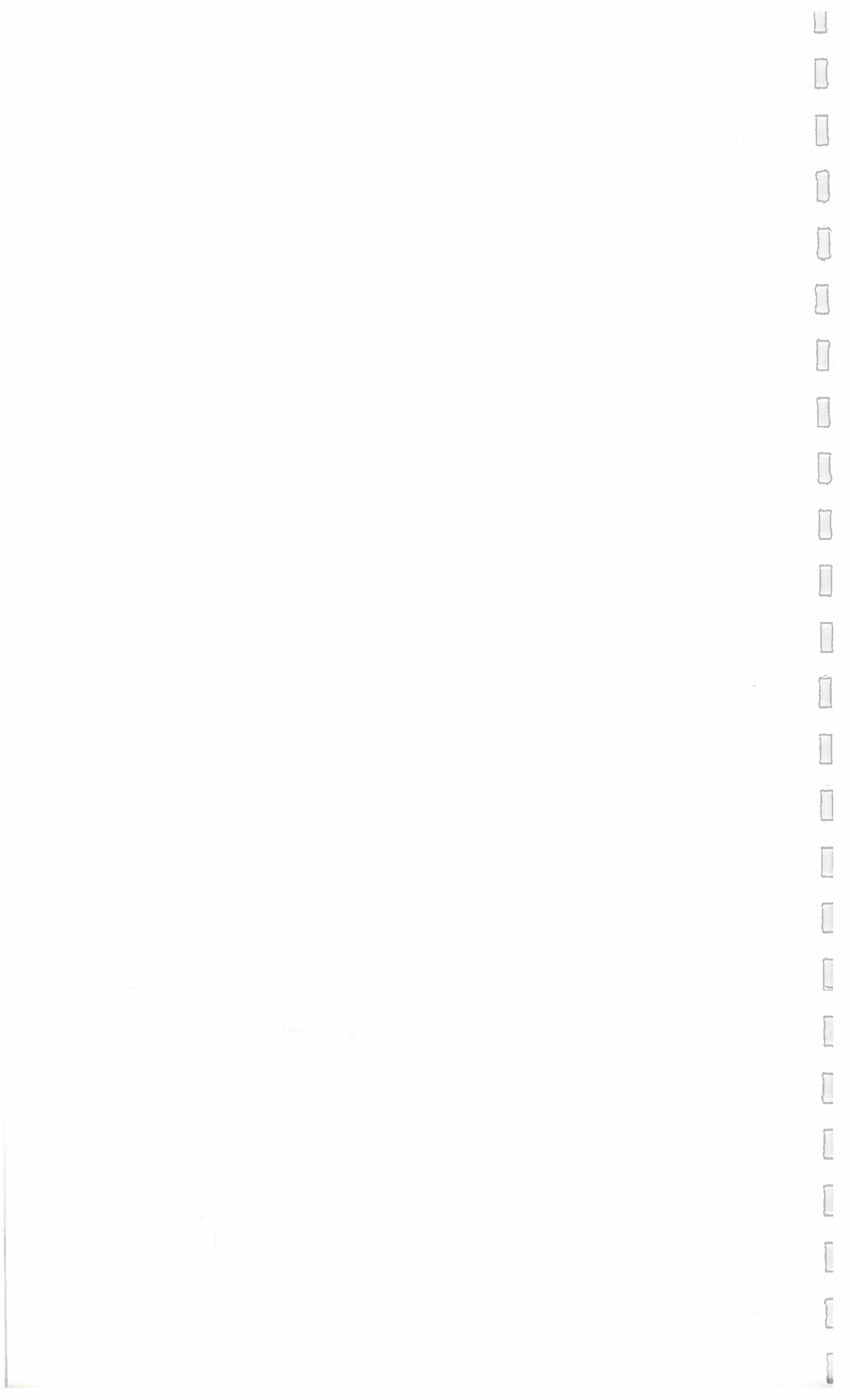
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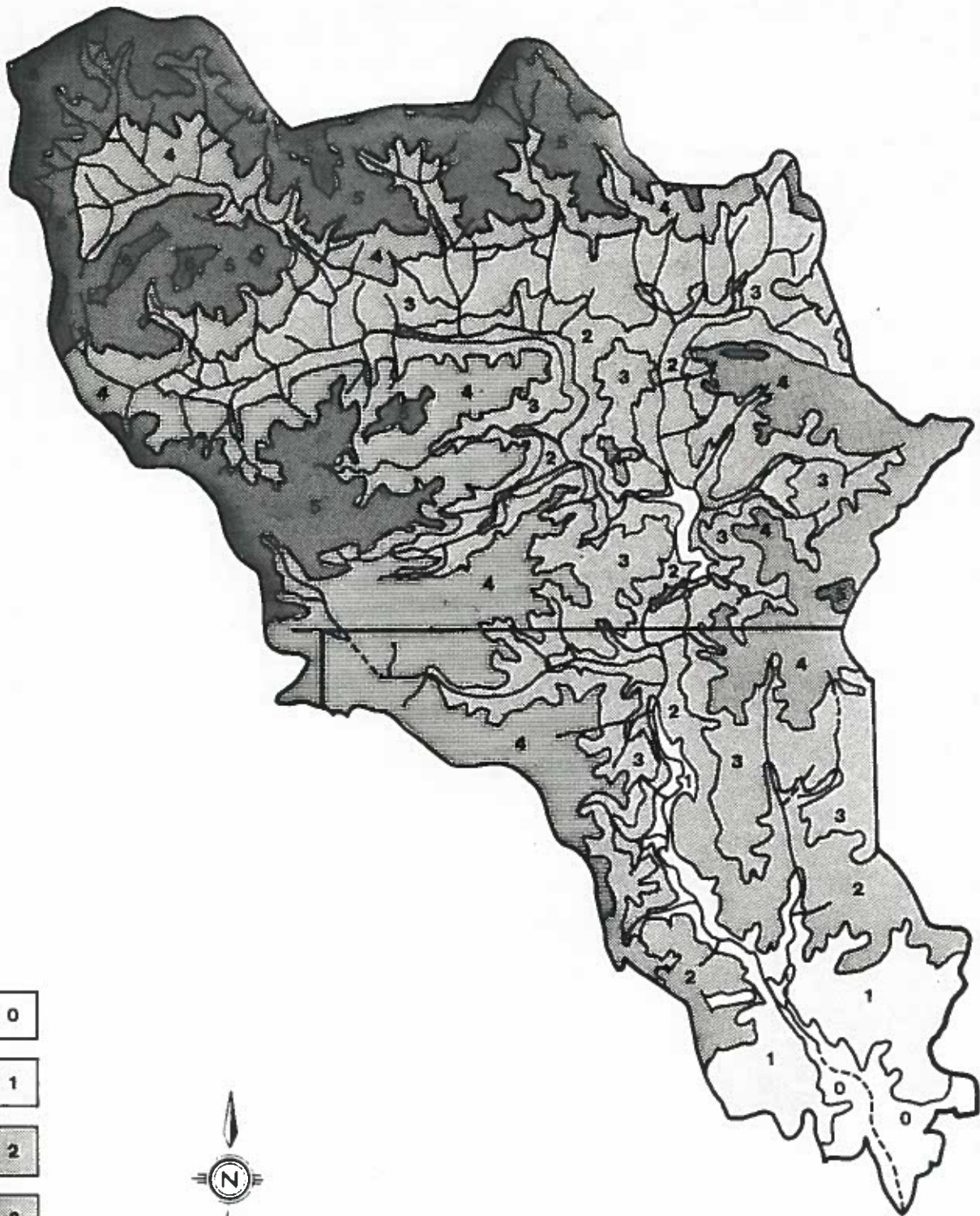
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JONES FALLS WATERSHED

MAP 2







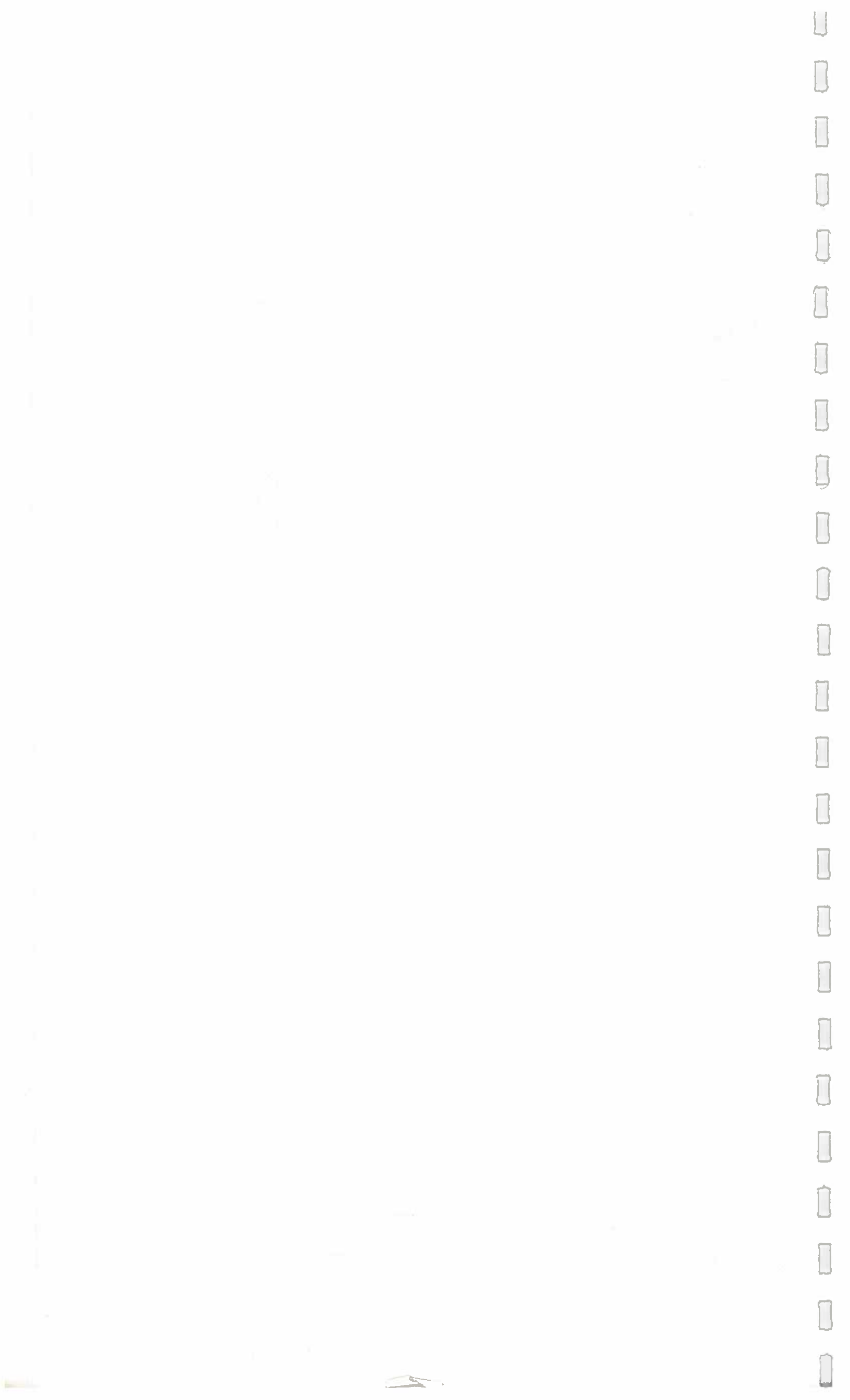
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1981

JONES FALLS WATERSHED
TOPOGRAPHIC ELEVATIONS

MAP 3





HISTORIC FLOOD DAMAGES IN THE JONES FALLS

Flooding History

Historical accounts of flooding in the Jones Falls Valley date back to 1786, when a severe and prolonged thunderstorm caused flooding and damages in the City. In 1837, waters were reported 8 to 10 feet deep from flooding of the Falls, and more than 20 persons were killed. The July, 1868, Black Friday Flood caused the Falls to rise 20 feet above normal, washing out bridges, damaging homes, factories and shops, and killing at least 50 persons. This storm was particularly devastating financially as Baltimore City was experiencing a prosperous post-Civil War boom.

More recent floods include those from Hurricanes Connie and Diane in 1955, a severe rainstorm in 1971, Hurricane Agnes in 1972, Hurricane Eloise in 1975 and Tropical Storm David in 1979. The Army Corps of Engineers put a damage estimate of \$10.8 million on industrial and commercial properties along the Jones Falls from Agnes. The Small Business Administration disbursed \$2.3 million to the Sekine Company, Commercial Envelope Company, Londontown Manufacturing Company, Rockland Bleach and Dye Works, and the Meadowbrook Swim Club. The Maryland Nut and Bolt Company and Allegheny Beverage Company also suffered flooding damages. Londontown and the Allegheny Beverage Company reported an estimated combined loss of \$4 million.

Tropical Storm David also caused extensive damages in the Jones Falls Valley. After four inches of rain in fifteen hours on September 5, 1979, another four inches was dropped in less than an hour by intense thunderstorms over the City. Six feet of water flooded Mount Washington. Downstream industries recorded up to 8 feet of water as the "wall of water" raced down the Falls. Baltimore City received several million dollars to repair damages to roads, bridges, utilities, existing stream improvements and public lands in the Jones Falls caused by David. Funding for this program was provided by the Federal Emergency Management Agency. This program does not cover the cost of repairs to private property. The funds may only be used to restore damaged structures to their pre-David condition.

Flooding and Development

The Jones Falls Valley has experienced extensive growth and development. In the early days of settlement, land in the watershed was cleared for farmland. The conversion of forest to field increased the rate of soil erosion and runoff by removing the protective vegetative canopy, and by intensive manipulation of the soil by plowing and grazing animals. The loss of vegetative cover was rapidly accelerated in the lower watershed by the establishment of industrial, residential and commercial centers, and by the system of roadways developed in the area. The Jones Falls Expressway, for example, built in the early 1960's, is located low in the valley, and, in fact, is constructed over the Falls in several segments. Interstate 695 (the Beltway), built in the mid 1960's, travels east-west through the Jones Falls watershed. The construction of this major interstate, along with the development its presence has spurred, has contributed to the problems of increased runoff and soil erosion.

The effects of increased runoff and soil erosion have exacerbated flooding in the Jones Falls Valley in several ways. First, although flooding has historically been abrupt and flashy in nature, the accelerated rate and increased absolute amount of runoff from developed areas causes more water to flow sooner and with greater velocity through the system. Sedimentation of streams has raised the bed level; therefore "bankfull" conditions occur sooner. It must here be emphasized that, due to the geomorphology of the Piedmont/Coastal Plain area, sedimentation is the natural result of steep gradients and somewhat to highly erodable soils.

In the last two decades, the effects of urbanization have raised special concerns among those persons affected by flooding. Commonly, it is believed that downstream flooding is due solely to upstream development. After Hurricane Agnes, for example, a local business association called for a ban on all new construction in the Jones Falls drainage basin to solve flooding problems.

There have also been many structural suggestions offered to alleviate flooding problems in the Valley. As early as 1817, the proposal to enclose the stream in conduits was made. In 1914, the lower end of the Falls, from Baltimore Street up to Mount Royal was enclosed. Henry Barton Jacobs, the master of ceremonies at the dedication of this project, stated "I have come to bury Jones Falls, not to praise it." Four workers were killed during this engineering feat. Later, this conduit system was extended up to North Avenue.

The Lake Roland dam and the impoundment behind it, part of the City's Robert E. Lee Memorial Park, has been viewed by many as the solution to downstream flooding. Lake Roland was created in 1862 by damming the Jones Falls. Its original use was as a City drinking water supply, and had an original capacity of 500 million gallons. By 1973, this capacity had been reduced to about 180 million gallons (Whitman, Requardt and Associates, 1974). Siltation however, has always been a problem. The reservoir was dredged once in the late 1800's before being abandoned in 1915 as a water supply impoundment and turned into a recreation lake due to siltation.

In the mid 1970's many citizens were calling for another dredge operation to restore the original capacity. It was felt that this would enhance both water quality and flood control features of the lake. This suggestion was investigated by the City. However, due to environmental opposition, and the lack of funds to perform the recommended triennial dredging, the project was not implemented.

The flood storage capacity of Lake Roland is limited by its depth, even given dredging, and by the topography of the area. Calculations done by the Baltimore City and Baltimore County Public Works engineers show that the lake would have minor flood control benefits.

At the present time, no major structural measures are being considered to reduce flooding damages on the Jones Falls. However, the severity of damages indicates the need to mitigate these damages in alternative ways. The following section will describe previous studies done on the Jones Falls. The recommended plan will present a combination of non-structural alternatives to help reduce flooding damages and the threats to human life and safety posed by floods.

PREVIOUS STUDIES

There have been several studies done, in the recent past, investigating the flooding problems and potential solutions in the Jones Falls watershed. This section summarizes these studies, noting the purpose, findings and recommendations of the authors.

1. Baltimore County Flood Control Task Force (1975) Flood Control Task Force Report

The task force was formed to review County programs related to floodplain management, and to develop a set of findings and recommendations to reduce flood damages. A watershed by watershed analysis of problem areas, projected costs of resolving the problems and probable impact was completed. A project priority listing for implementation was developed from this analysis. Changes in the County Code were recommended to better restrict and control floodplain development. Other recommendations included acquisition, better inter-governmental coordination, State flood control legislative needs and other measures to improve floodplain management. The interjurisdictional nature of the Jones Falls makes this report relevant to the Plan.

2. Baltimore County Bureau of Civil Defense (no date) Baltimore County Flood Plan

This is the flood emergency preparedness and response manual for Baltimore County. It outlines areas prone to flooding, the responsibilities of various County agencies, operations procedures, and general instructions for implementation. Its importance here is how it ties in with City plans for emergency preparedness and response for floods.

3. Goucher College (1972) The Analysis of the Degradation of Lake Roland, Baltimore, Maryland

This study focussed on the sedimentation and pollution problems exhibited by Lake Roland, but was influential in identifying the dam and reservoir as a potential water storage area which has been rapidly dwindling in capacity due to siltation. The value of the dam as a flood control structure has not yet been assessed.

4. Knoerle, Bender, Stone and Associates (1971) Jones Falls Flood Control Study for Dept. of Public Works, Bureau of Engineers, City of Baltimore, MD.

This study included hydrologic and hydraulic analyses of the Jones Falls watershed, with plan and profile diagrams of main stem and tributaries, elevations and locations of water crossings and adjacent structures. The study included recommendations for reducing flood damage, primarily by means of channel modification, replacement of crossings and culverts, and construction of berms and other structural alterations.

5. U.S. Army Corps of Engineers (1973) Flood Insurance Study, City of Baltimore (Preliminary Report)

A determination of flood hazard areas in the Jones Falls and City-wide, to be utilized in floodplain regulatory processes. This report contains flow and hydraulic characterization of portions of the Jones Falls.

6. U.S. Army Corps of Engineers (1977) Flood Insurance Study, City of Baltimore: done by Stanley Consultants, Inc.

Investigation of the existence and severity of flood hazard areas for use in the administration of the Flood Insurance Act of 1968 and Flood Disaster Protection Act of 1973. An update and more complete report than the 1973 Preliminary Report, it includes flood profiles, and flood boundaries and floodways of the streams in the City. Jones Falls from North Avenue to the City limits was studied in detail, using the Anderson method to evaluate peak discharge for the 10-, 25-, 100- and 500-year floods.

7. U.S. Army Corps of Engineers, Baltimore District (1979)
Lake Roland Dam - Phase I Inspection Report, National Dam
Inspection Program

The Phase I investigation of the Lake Roland dam assessed the physical condition of the dam, and made recommendations on needed improvements. This report led to the Phase II study on the dam, now in progress, which is studying the dam in greater detail.

8. U.S. Army Corps. of Engineers, Baltimore District (1979)
Review Report, Baltimore Metropolitan Streams

In this report, the Corps of Engineers determined the feasibility of providing flood protection along streams in the Baltimore area. Various structural and non-structural alternatives were investigated as solutions to flooding problems, and analyzed according to the Corps' cost/benefit methodology. The flooding caused by Agnes in 1972 provided the impetus for the study. Structural alternatives considered included bridge modifications and replacements, diversion, channel improvement, upstream reservoirs, and levees and floodwalls. Non-structural measures included floodproofing, evacuations, legislative controls, flood forecast and warning, and flood insurance. Specific technical, economic, environmental and social well-being criteria were used to evaluate the cost-effectiveness of these techniques. The findings of the study were that none of the plans of improvement investigated warranted further detailed study because they either lacked economic justification or did not meet Federal implementation criteria.

Based on these findings the report recommended that no further action be taken toward providing improvements for flood control along streams in the Baltimore Metropolitan Area. However, the report itself contains a useful discussion of the flooding problems, management alternatives and the analysis used to determine the feasibility of these alternatives.

9. Weston Engineers (1975) Jones Falls Watershed Management
Study for Baltimore City Department of Public Works

The report contains hydrologic information on Jones Falls watershed, with major emphasis on analysis of non-structural flood management alternatives, consistent with goals of the 208 program. The report is management, rather than technically oriented.

10. Whitman, Requardt and Associates (1974) Restoration of
Lake Roland

This document represents a proposal by the consultants to dredge Lake Roland to restore water capacity and control sedimentation. Although the proposal does not specifically address the use of the impoundment in flood control, community and other groups have been interested in the potential of the dam and lake to reduce downstream flooding.

While these studies have provided some information on the flooding problems in the Jones Falls drainage area, and offer several alternative solutions, the development of a comprehensive watershed plan requires the following:

- (1) Adequate hydrologic (TR-20) and hydraulic (HEC-2) models for the lower Jones Falls and Stony Run, upon which to base management strategies.
- (2) Interjurisdictional cooperation on storm water management projects and programs, development plans and flood control or mitigation strategies to insure watershed integrity and effective floodplain management.

INTERJURISDICTIONAL COORDINATION

The Jones Falls watershed is the drainage basin for a large portion of Baltimore County. Its tributaries drain the Green-spring Valley, as well as the more fully developed areas in the vicinity of Towson. Below Lake Roland, the Jones Falls and its two major urban tributaries (Western Run and Stony Run) flow through the northeast and central portion of Baltimore City to the Patapsco River in the Inner Harbor. The interjurisdictional nature of the watershed presents problems in the management of the shared resource. However, opportunities also exist for interlocal planning and cooperation to achieve wise management of the Jones Falls.

Baltimore County has in place local land use regulations to control development in floodplains, and to control and monitor storm water, erosion and sediment contribution to waterways. The County has been enrolled in the regular phase of the National Flood Insurance Program since 1981. Their zoning regulations restrict construction in the 100-year floodplain. Allowed types of new construction or substantial improvements must conform to County requirements for adequate flood proofing and construction standards. These requirements are included in the County Code. The Sediment Control Section in the Department of Permits and Licenses performs site review, assists in erosion and sediment control plan development, helps formulate County policy relating to sediment control and storm water management, and performs field inspections of all sites with sediment control storm water management plans. The Storm Drain Design and Approval Section, Bureau of Engineers, in the County Department of Public Works, prepares drainage area, floodplain and watershed studies. This section also prepares studies and technical reports used to implement the recommendations of the County Flood Control Task Force. One of the objectives defined by this Task Force is the "design and implementation of an interjurisdictional agreement for planning and management of common watersheds between Baltimore County and Baltimore City." (Flood Control Task Force, 1975). The Office of Planning and Zoning reviews subdivision plans for conformance with flood-planning, storm water management and erosion and sediment control regulations. The Soil Conservation District of Baltimore County works with the above mentioned and other County agencies in areas relating to water and soil conservation.

Similarly, as described in detail in the Baltimore City Floodplain Management Plan, the City has in place land use regulations (zoning, subdivision and building codes) to restrict floodplain development. The City has been in the regular phase of the Flood Insurance program since 1978. The Flood Plan recommends changes in the City's building code to further restrict new development and substantial improvements in flood-prone areas. Development and subdivision plans are reviewed by the Sediment Control Division in the Bureau of Solid Waste, and by storm drain engineers in the Bureau of Water and Waste Water.

Both Baltimore City and Baltimore County have early warning and evacuation systems in place for flood events. The City and County Emergency Operation Centers exchange information on flood conditions, weather updates and road, bridge and stream conditions. The County notifies the City EOC when a rain gauge in the County registers one inch of rainfall during the early phase of a storm watch, and updates the rainfall data to the City at regular intervals.

The City and County have in place adequate tools for a strong interjurisdictional floodplain management plan for the Jones Falls. Local programs should be integrated to insure that the interests of both jurisdictions are met without the exacerbation of flooding damages and an increase to the threat to human health and safety. The early warning system is a good example of interjurisdictional cooperation.

Efforts in this and other aspects of floodplain management should be supported and improved. Ways in which this coordination and cooperation could be implemented include:

- 1) mutual notification and review of (permitted) development plans in or near flood-prone areas.
- 2) mutual notification of City/County agencies when local government is to perform significant stream work or hydrologic/hydraulic studies on interjurisdictional streams in anticipation of a future project. This would avoid duplication of effort and help to coordinate stream work efforts where possible.
- 3) mutual review of local ordinances, regulations and policies to insure compatibility of allowed uses, standards for construction and of general programs for flood-related activities.

A letter of understanding has been written and signed by the Directors of Public Works in each jurisdiction, and by the Directors of the City Department of Planning and County Office of Planning and Zoning, to insure a mutual review of plans and studies in interjurisdictional watersheds. The letter further states that each jurisdiction will conduct activities in the floodplain to prevent any increase in downstream flooding as well as incompatible uses in the floodplain.

CITY OF BALTIMORE

WILLIAM DONALD SCHAEFER, Mayor



DEPARTMENT OF PUBLIC WORKS

FRANCIS W. KUCHTA, Director
600 Municipal Building, Baltimore, Maryland 21202

December 28, 1981

Mr. Thomas Andrews, Director
Water Resources Administration
Department of Natural Resources
Tawes State Office Building
Annapolis, Maryland 21401

Dear Mr. Andrews:

Baltimore County and Baltimore City have, in the past, both experienced extensive flood damages.

Recognizing the need to establish programs to minimize safety risks and to protect property and natural resources, and recognizing the interjurisdictional nature of flooding and floodplain management, Baltimore City and Baltimore County have established a process for coordination. To guide this process each jurisdiction has adopted the following goals:

1. Floodplain management plans and programs will establish the necessary mechanisms to assure that actions in either jurisdiction will not result in aggravated flooding hazards.
2. Floodplain management plans and programs will establish the necessary mechanisms to assure that inappropriate development in flood hazard areas is prohibited.
3. Along open streams acquisition of residential property is the preferred floodplain management alternative except where shown to be not cost/effective.

In addition to these goals, Baltimore City and Baltimore County will mutually review and comment on all plans, projects, grant applications and studies related to interjurisdictional watersheds.

The goals and the process of coordination outlined in this letter are established to promote effective and coordinated floodplain management in shared watersheds and to fulfill requirements outlined in the Natural Resources Code 8-9A-03 (e).

The Department of Public Works and Planning from each jurisdiction will be responsible for implementing the goals and process outlined above.

Sincerely,

Director

Director, Baltimore City
Department of Planning

FWK:eg

INTRODUCTION

In keeping with the goals and objectives of the Baltimore City Floodplain Management Plan the recommended program for reducing flood damages in the Jones Falls will be a combination of non-structural strategies and techniques. The report is therefore organized by technique or strategy. The areas of application of each related technique are then discussed and shown on accompanying maps.

The strategies chosen for use in the Jones Falls include acquisition, floodproofing, flood insurance, regulations, operation SWIFT and minor stream channel improvements. Based on the results of earlier studies, structural projects are considered non-cost-effective for these areas. It is recognized that one non-structural technique used alone cannot achieve the desired reduction in flood damages. Therefore, two or more are used together. The result is a combination of approaches that collectively address short- and long-term floodplain problems and issues, such as land use, disaster recovery, and protection of natural resources.

The highly urbanized nature of the Jones Falls mandates an innovative, responsive and multi-faceted approach to achieve a significant reduction in flood damages and enhance the natural features of the floodplain. The following strategies, selected for their complementary functions and adaptability to the urban environment, constitute such an approach.

ACQUISITION OF FLOOD-PRONE PROPERTIES

Several areas in the Jones Falls watershed have been identified for acquisition. This floodplain management technique, as described in the Baltimore City Floodplain Management Analysis, is to be used where flooding is frequent and severe, and where other techniques will not be as cost-effective as acquisition. The acquisition of flood-prone residential structures is the highest priority in the Plan. However, the acquisition of non-residential properties will be considered if the proposal includes substantial financial participation by the property owner, if the proposal will have floodplain benefits for the City as a whole, and if the proposal is found to be cost-effective.

The areas in City portion of the Jones Falls eligible for residential property acquisition include the Mount Washington area and the flood-prone homes in the Hampden area (see Map 4.3). The following is a brief description of each area, the number of properties eligible for acquisition and the expected benefits from the acquisition of properties in these areas.

Mount Washington/Western Run

Homes in the Mount Washington/Western Run area have experienced repeated and severe flooding. This area is subject to flooding from both the main stem of the Jones Falls and Western Run, which flows westward from the County to join the Jones Falls in Mount Washington Village. Many of the affected homes are located in the floodway or in the 25-year floodplain. Recognition of the flooding problems here is well documented in flood damage survey reports, newspaper articles, insurance claims, and City memoranda. The removal of these residential structures and the relocation of the residents outside the floodplain is considered a high priority.

Approximately 60 residential structures have been identified as eligible (See Maps 4.4 through 4.5). The tax assessment value on these properties ranges from a minimum of \$5,000 to a maximum of \$63,000. Market value, however, will be higher.

In addition to these improved properties, there are 10 unimproved lots in the area (see Maps 4.4 and 4.5). The acquisition of these vacant lots will prevent future development and contribute to the open space created by the acquisition of homes in the area. The total assessment of these 10 lots is \$34,760. Fair market value is expected to be higher.

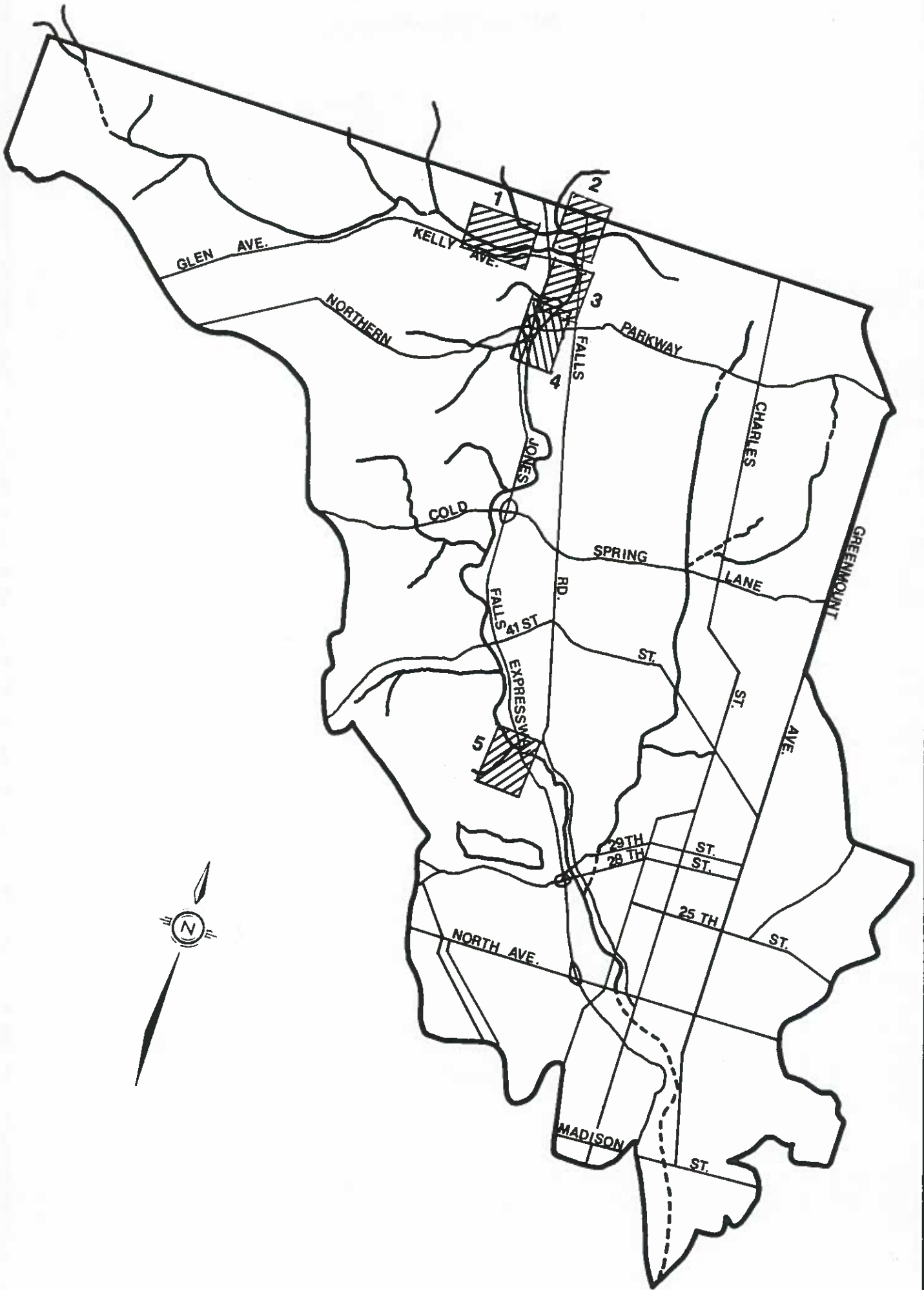
The acquisition of homes which experience flooding in the Jones Falls will have several benefits. The first and most important is the removal of citizens from a serious flood hazard area. This act benefits the citizens by reducing physical risk and by purchasing property which is difficult to sell on the market because of the flooding risks. The City benefits by decreasing the number of citizens who will require emergency warning and evacuation, as well as the number of post-flood emergency repairs that must be made to damaged utilities, roads and streams which directly service or threaten adjacent private properties.

A second benefit is the increased open space that will result from the acquisition and removal of residential structures. The acquisition of eligible properties and the removal of existing structures will total approximately 15 acres. This will create attractive open spaces for local residents. It will offer increased opportunities for passive recreation in a highly urbanized area.

Hampden

The residential properties eligible for acquisition are shown on Map # 4.5. These homes are situated adjacent to the Jones Falls, and are downhill topographically from dense development in the Hampden area. A total of seven structures have been identified as high hazard residences. The acquisition program for this area will include consideration of the historical significance of some of these structures, which were built by nearby mill companies as employee housing. Acquisition of the indicated homes could provide a small area of open space adjacent to the Falls, to be used for passive recreation, or perhaps some other recreational use.

The acquisition program described above is the recommended course of action for removing the highest hazard residential structures from the Jones Falls floodplain. The following sections describe additional floodplain management techniques to be used to reduce or prevent future flood damages in the Jones Falls watershed.



BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

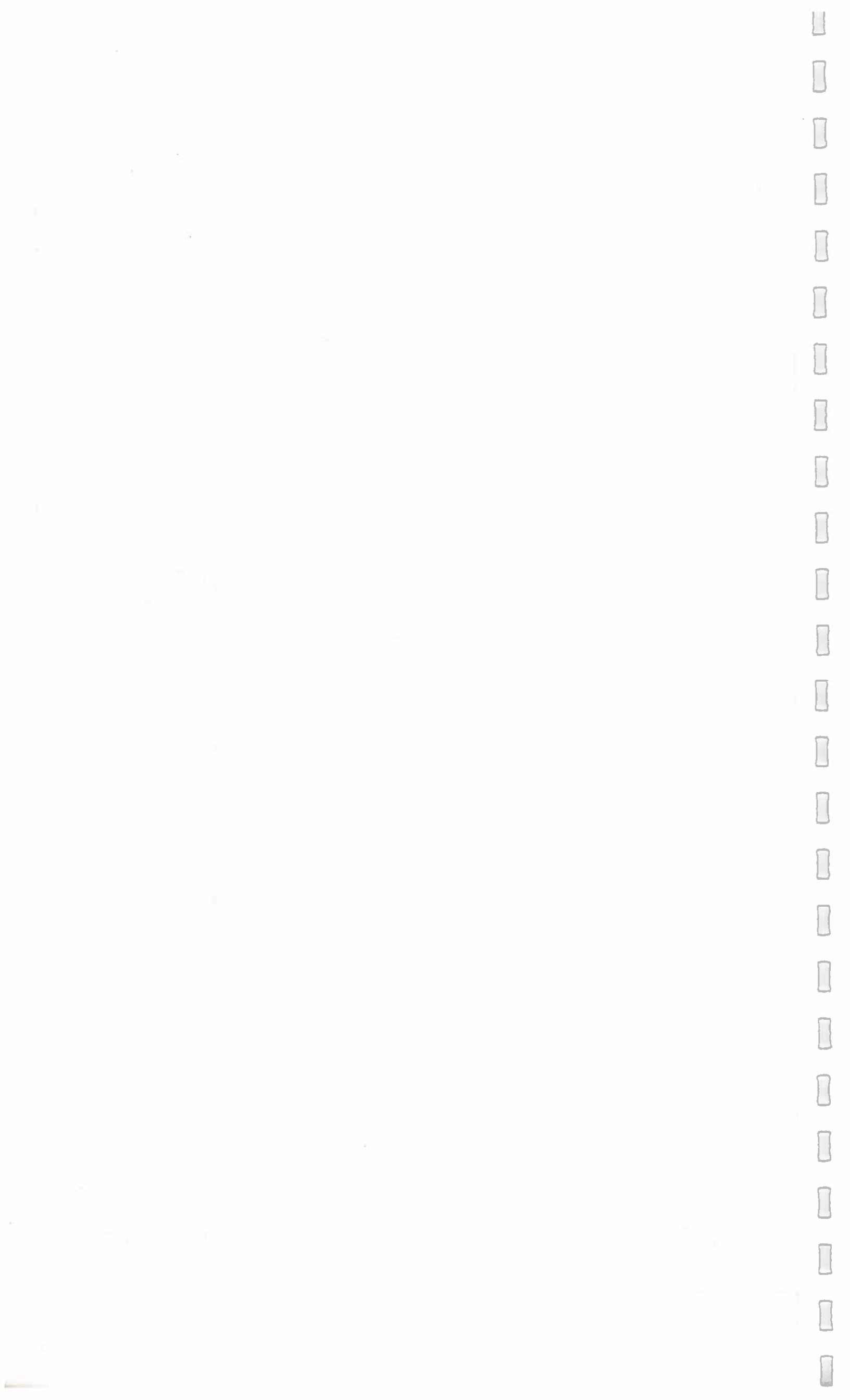
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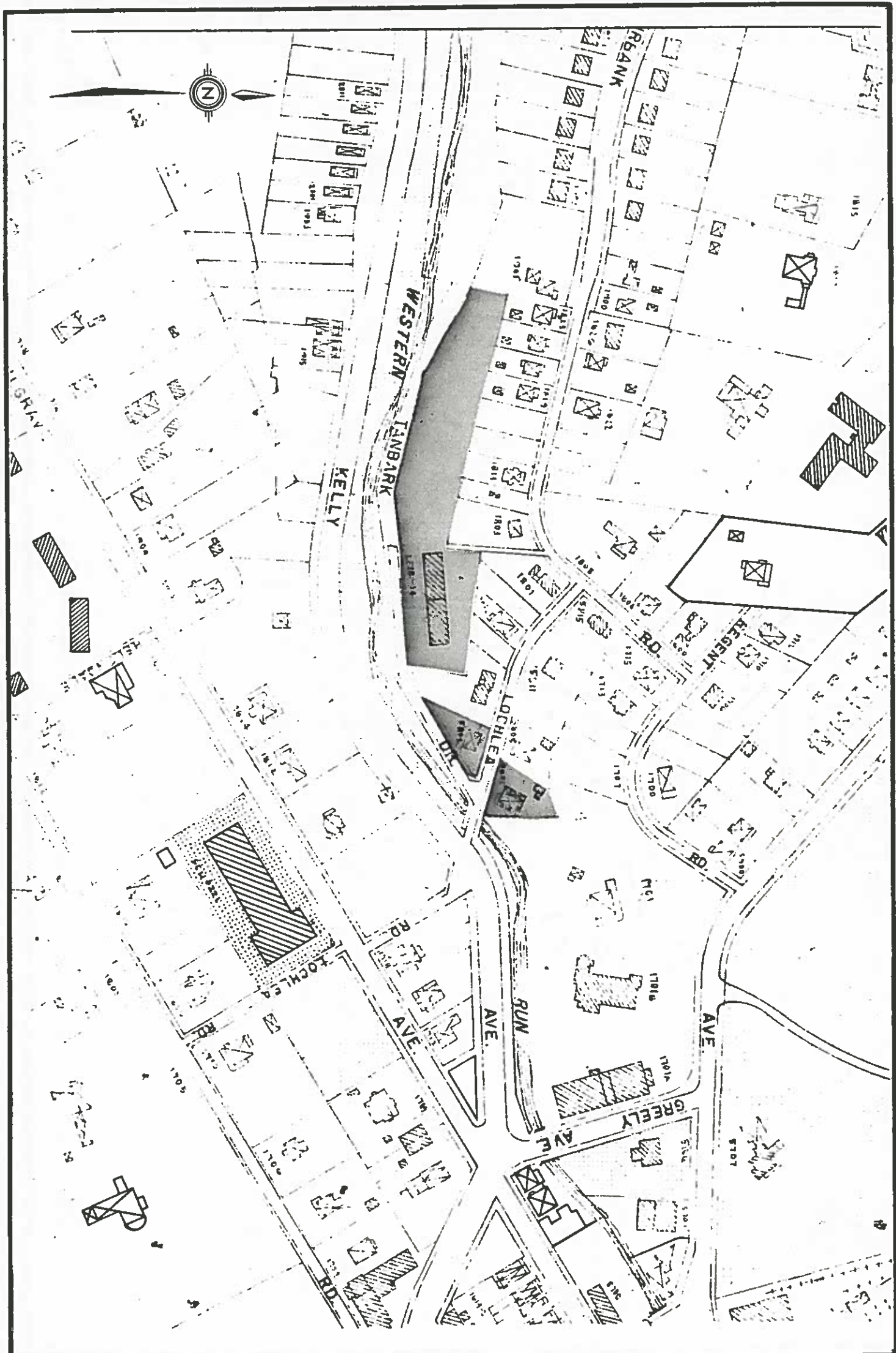
JONES FALLS WATERSHED

RESIDENTIAL ACQUISITION - KEY TO DETAILED MAPS

MAP 4-0







BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

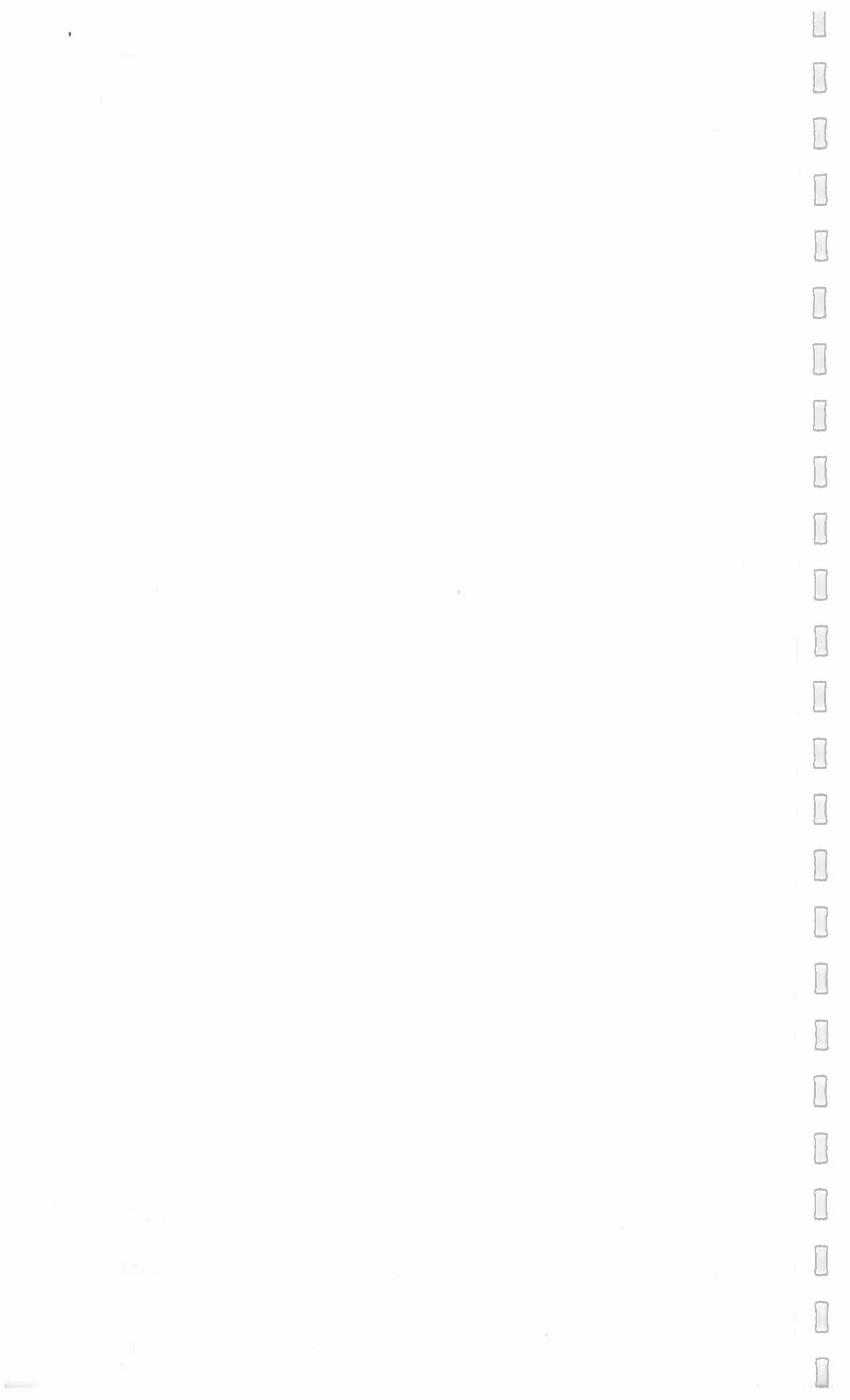
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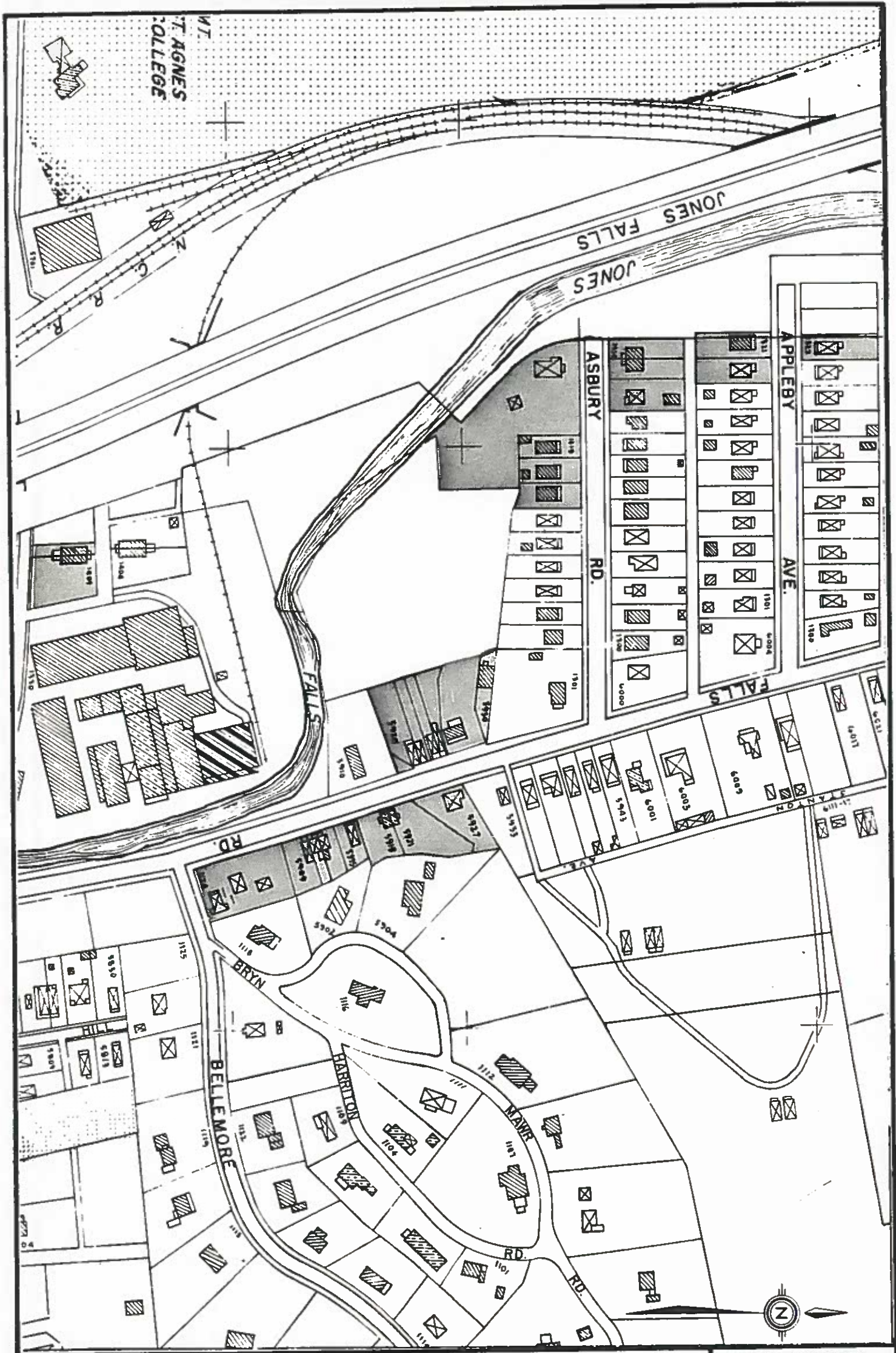
JONES FALLS WATERSHED - WESTERN RUN

RESIDENTIAL AREAS ELIGIBLE FOR ACQUISITION

MAP 4-1







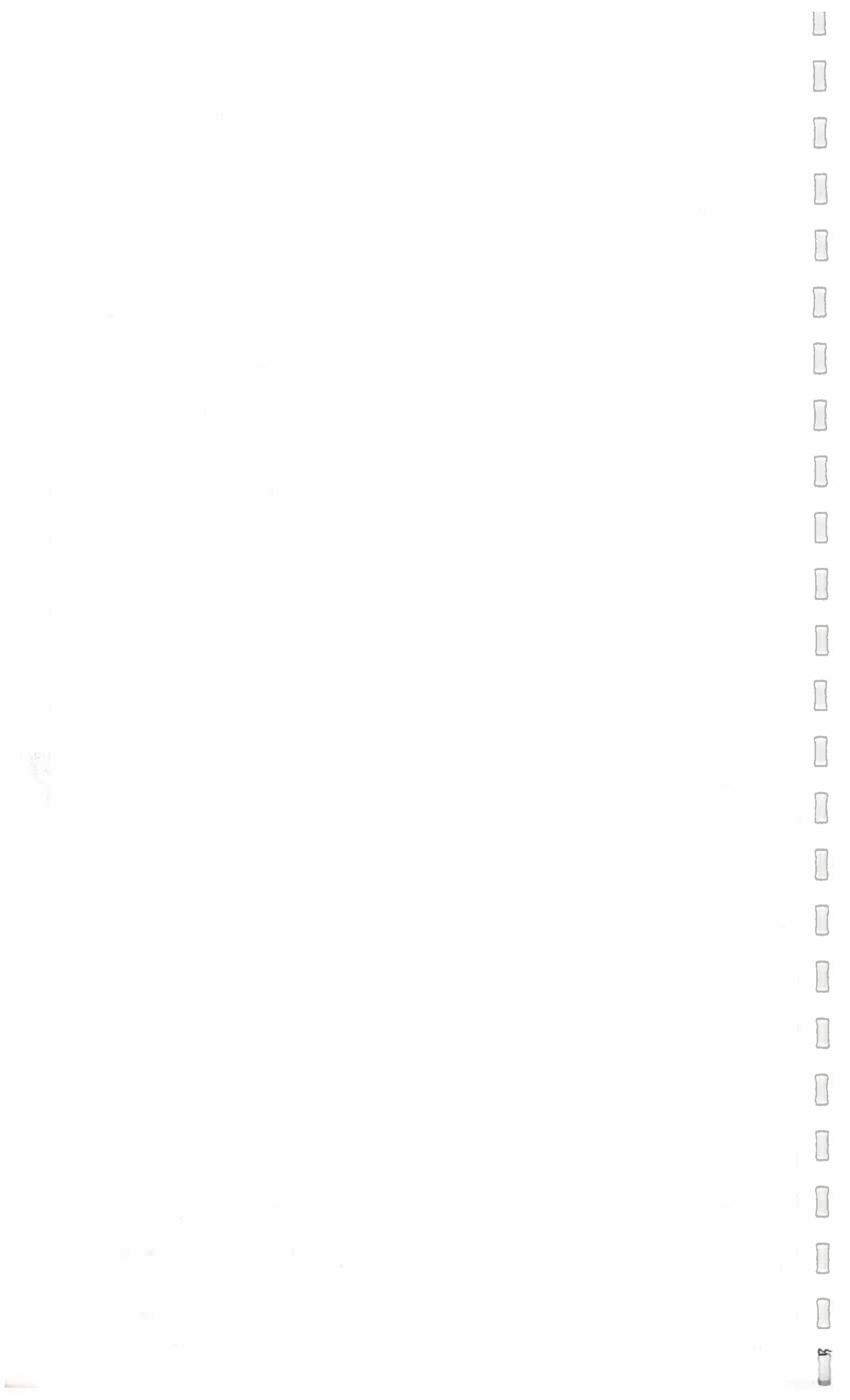
**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

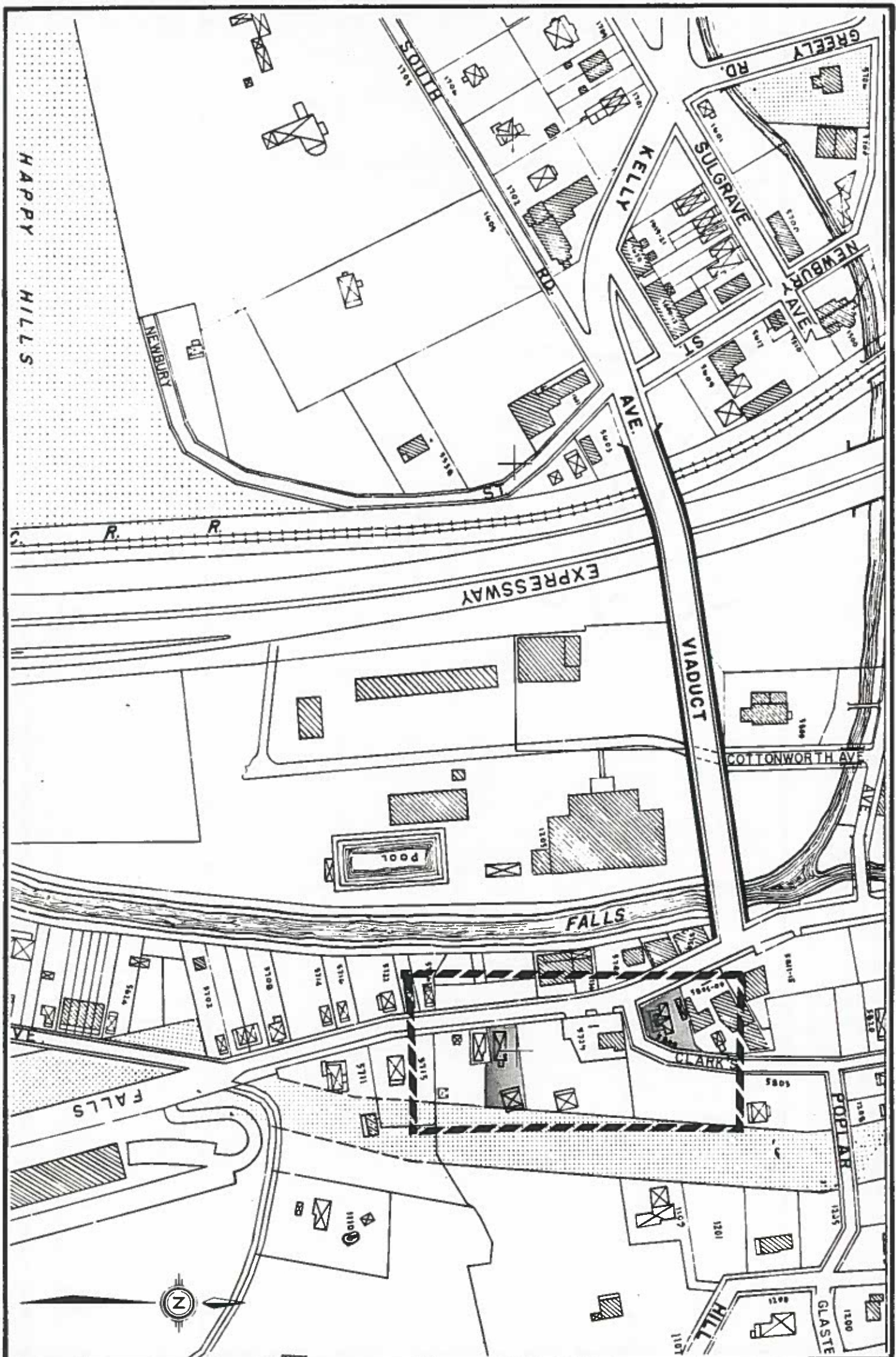
**DECEMBER
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JONES FALLS WATERSHED - JONES FALLS
RESIDENTIAL AREAS ELIGIBLE FOR ACQUISITION

MAP 4-2







**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

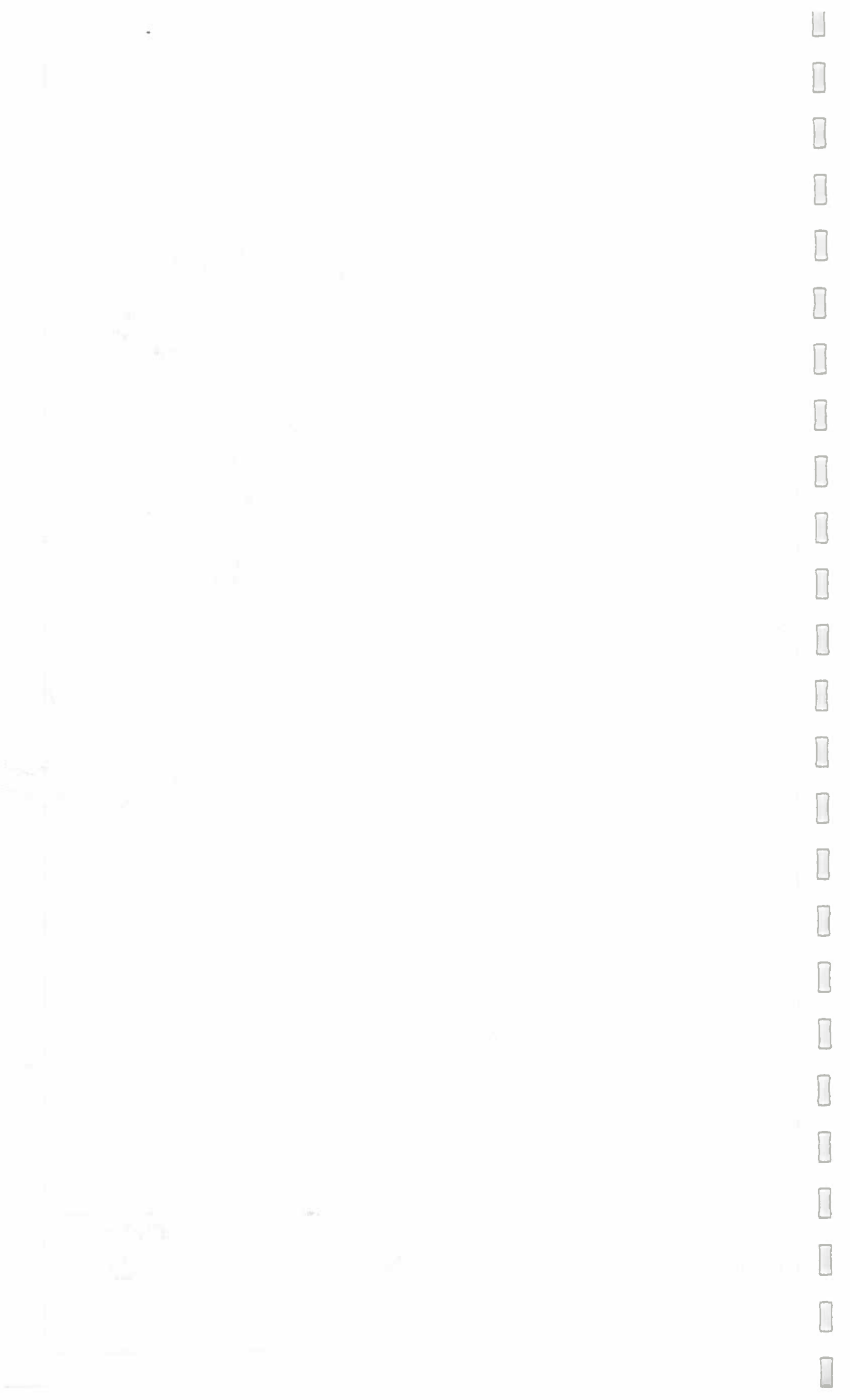
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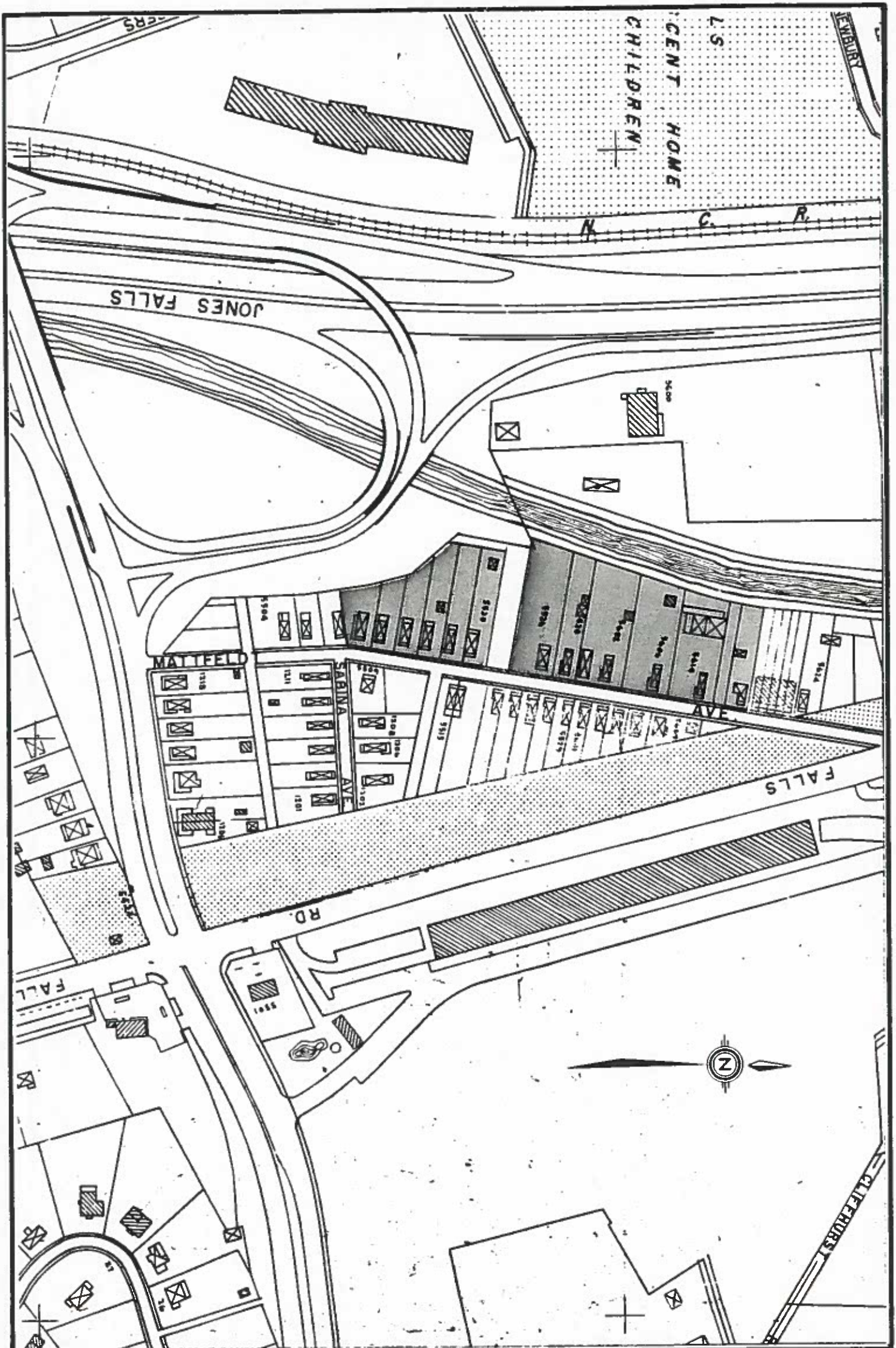
JONES FALLS WATERSHED - JONES FALLS

MAP 4-3

RESIDENTIAL AREAS ELIGIBLE FOR ACQUISITION







**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

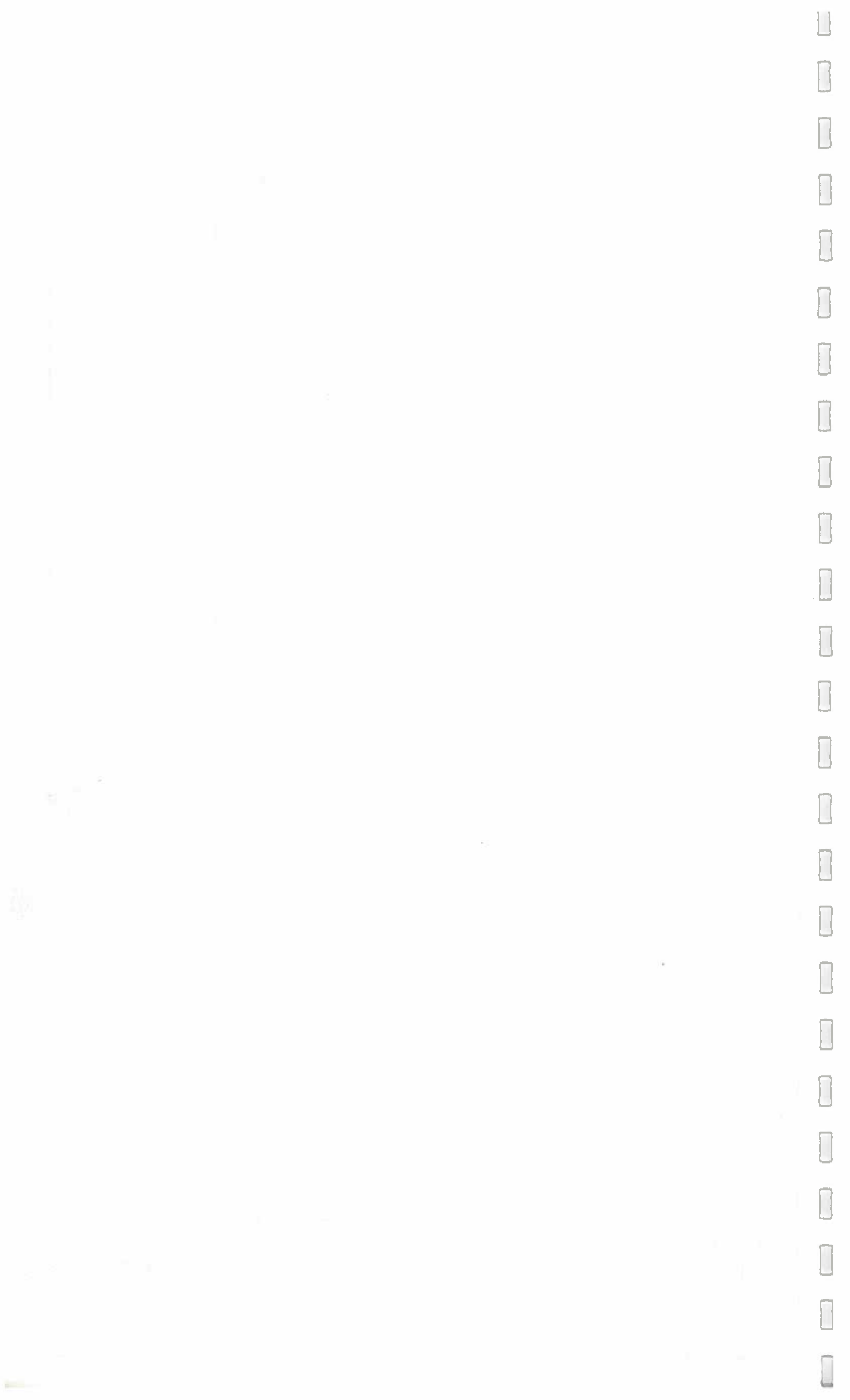
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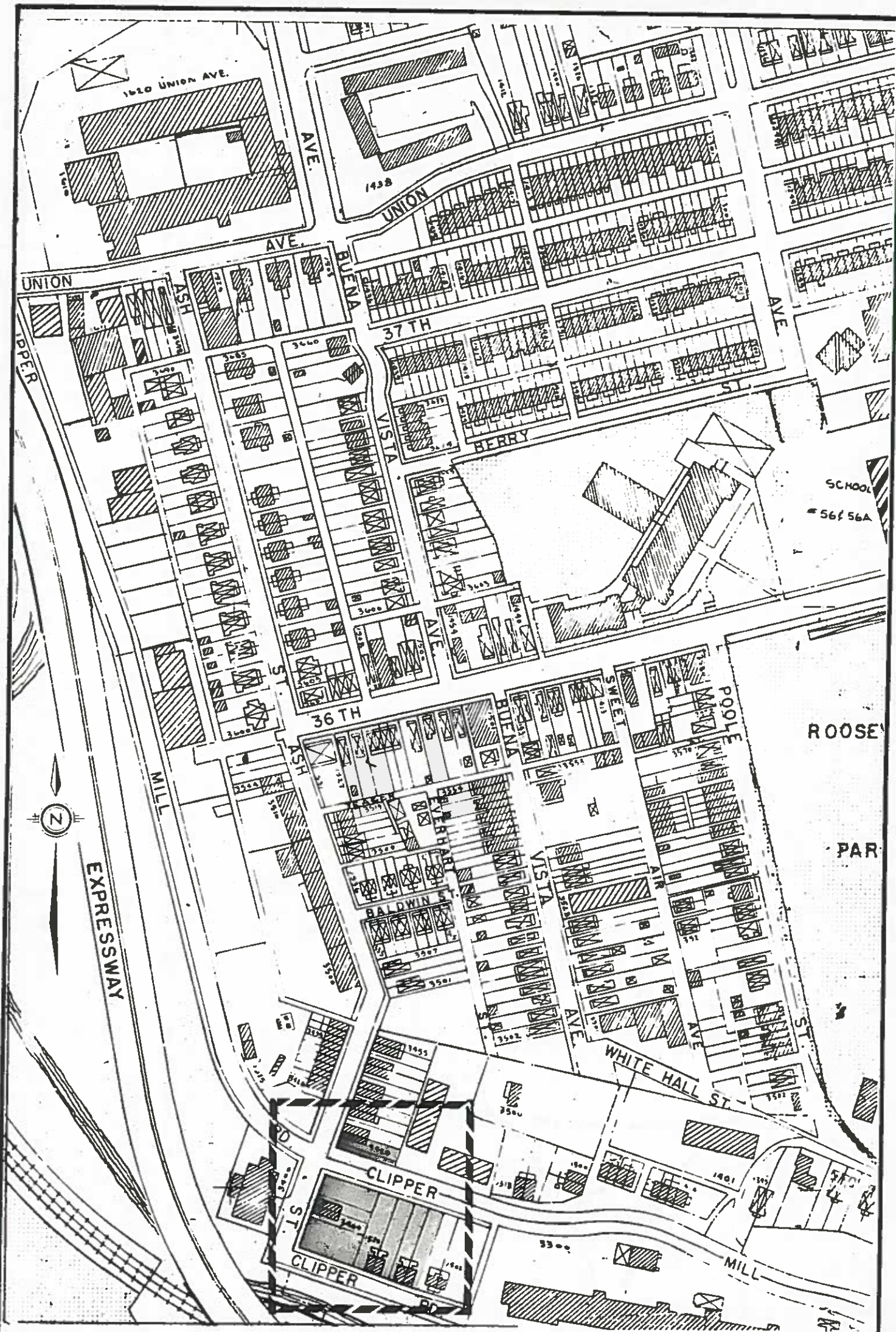
JONES FALLS WATERSHED - JONES FALLS

MAP 4-4

RESIDENTIAL AREAS ELIGIBLE FOR ACQUISITION

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BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

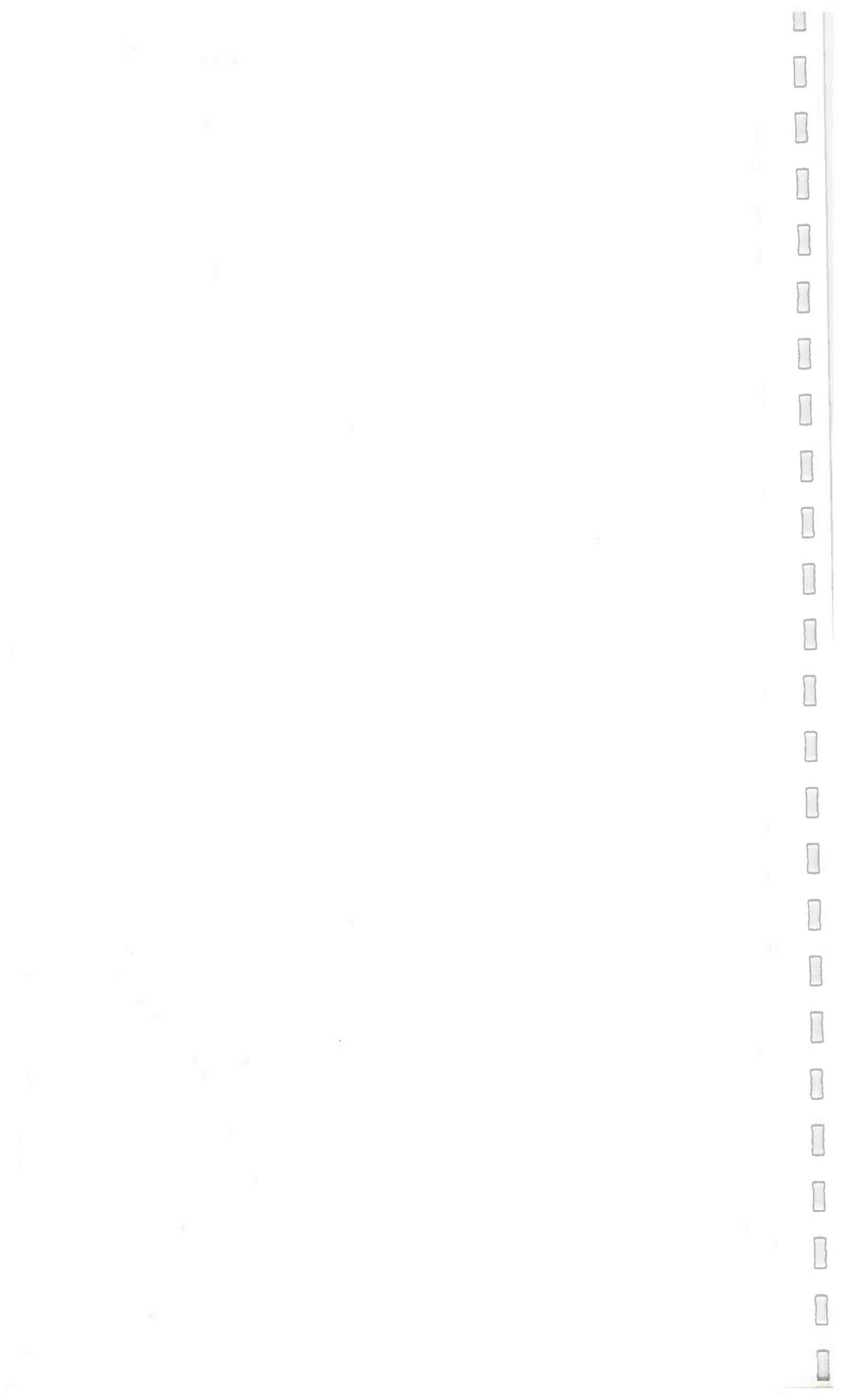
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JONES FALLS WATERSHED - JONES FALLS

RESIDENTIAL AREAS ELIGIBLE FOR ACQUISITION

MAP 4-5





FLOODPROOFING

Floodproofing in the Jones Falls watershed will have a residential and a non-residential component. The need for both kinds of programs reflects the variety of land uses, the degree and kind of flooding damages and the economic framework within which the City Floodplain Management Plan must be implemented. The presence of commercial and industrial properties as well as homes in the Jones Falls requires that some degree of protection of existing structures be considered. The residential nature of the Western Run drainage area similarly demands that some program be instituted to help property owners protect their homes and possessions. The floodproofing program is an element of the Baltimore City Floodplain Management Plan intended to be applied where acquisition is infeasible, and where structural solutions are not cost-effective. To be fully effective, it will be implemented in conjunction with an emergency warning and evacuation system, and an effort by the City to encourage home owners and renters to participate in the National Flood Insurance Program.

Jones Falls Main Stem

There are numerous commercial and industrial structures in the Jones Falls, which receive flooding damages during severe storms. Damages may range from a small amount of water and silt in a building to major damages to the structure and contained equipment, as well as loss of raw materials. These damages are costly to the industry, in terms of both recovery and replacement of damaged equipment, and losses accrued from the time out of production.

The cost/effective approach to most of the larger industrial properties in the Jones Falls is floodproofing. Structures shown on Maps 5-1 through 5-7 are currently being scheduled for floodproofing surveys with the Army Corps of Engineers. Following initial contact of eligible industries (approximately 17 located in the 100-year floodplain) by the Planning Department, a priority list of interested industries will be developed, based on relative flood hazard and flood history. The U.S. Army Corps of Engineers will, at the request of Baltimore City and the industry, perform a floodproofing survey for each industry. This survey will provide the property owner with a set of recommendations on reducing flood damage. The industry must hire an engineering firm to work out the details of implementing the recommendations. The development of an emergency preparedness and evacuation plan is considered a part of any floodproofing plan.

In addition to these commercial and industrial properties, there may be residential property owners who do not wish to relocate through the acquisition program. These homeowners will be encouraged, through such methods as a low-interest loan program, to floodproof their homes where feasible.

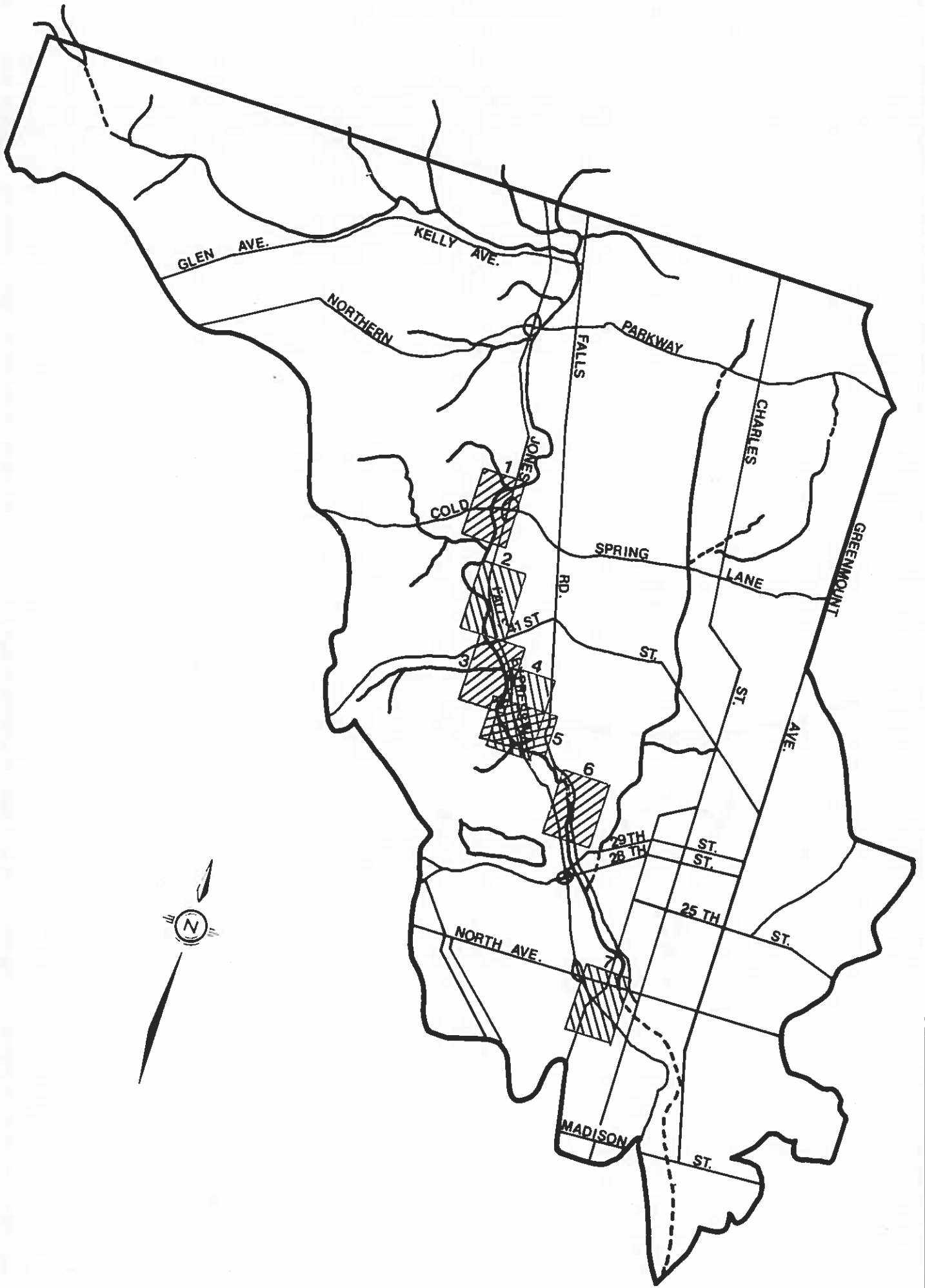
Western Run

The areas along Western Run susceptible to flooding are predominately residential with some commercial development in the Mt. Washington Village area. The list of flood-prone properties on Western Run are mostly detached houses with some apartment buildings included. While some of these residential structures will be eligible for acquisition, most receive only moderate flooding and will be excellent candidates for floodproofing.

In Mt. Washington, the flooding can be severe. Structural protection of the village area would be prohibitively expensive and it would be necessary to remove some of the buildings originally intended for protection to construct a dike or floodwall.

Floodproofing offers a real opportunity to reduce flood damage. The floodplain management plan encourages floodproofing approaches in these areas through education programs and the possibility of low-interest loans.

The various methods are discussed in earlier chapters.



BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

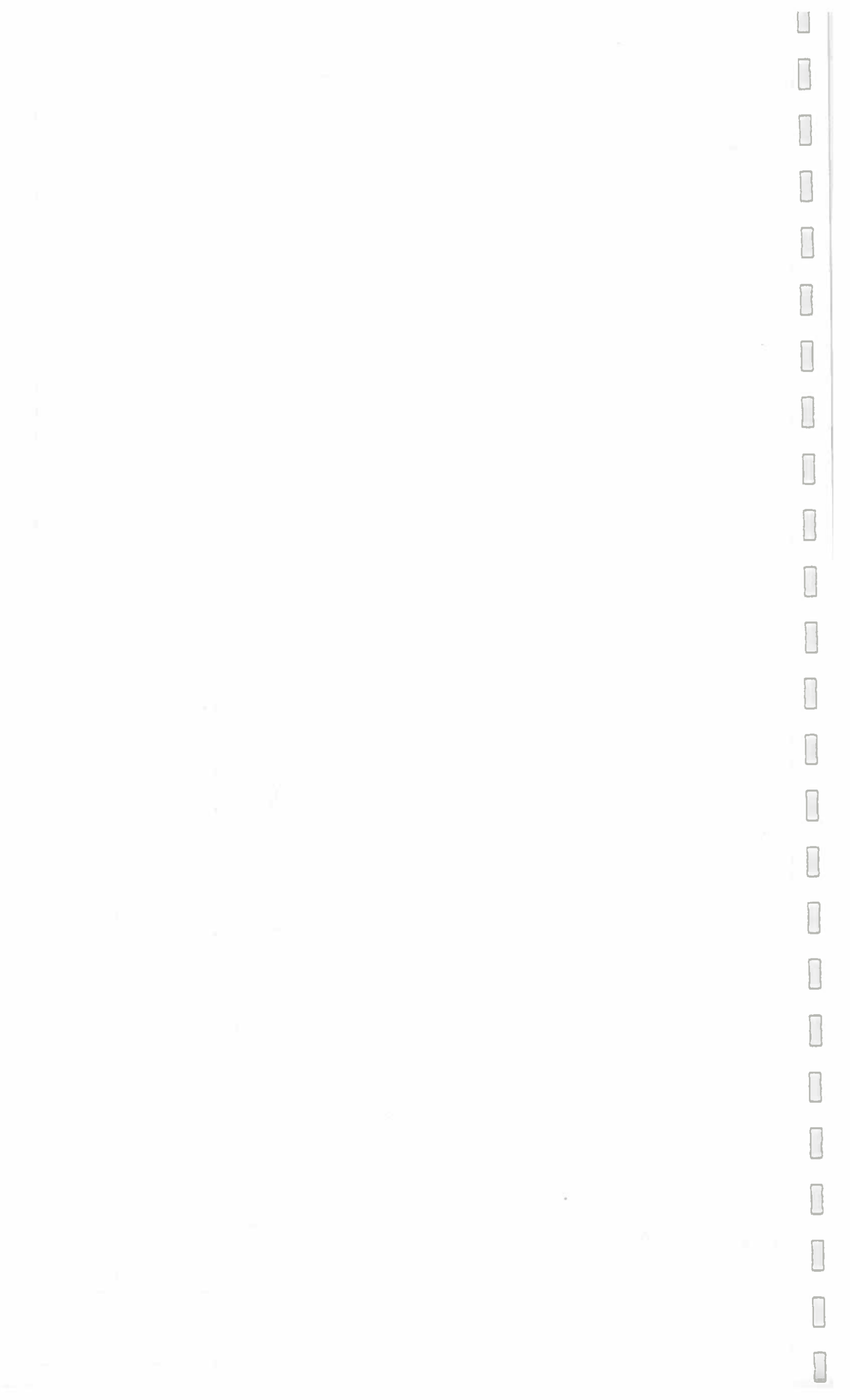
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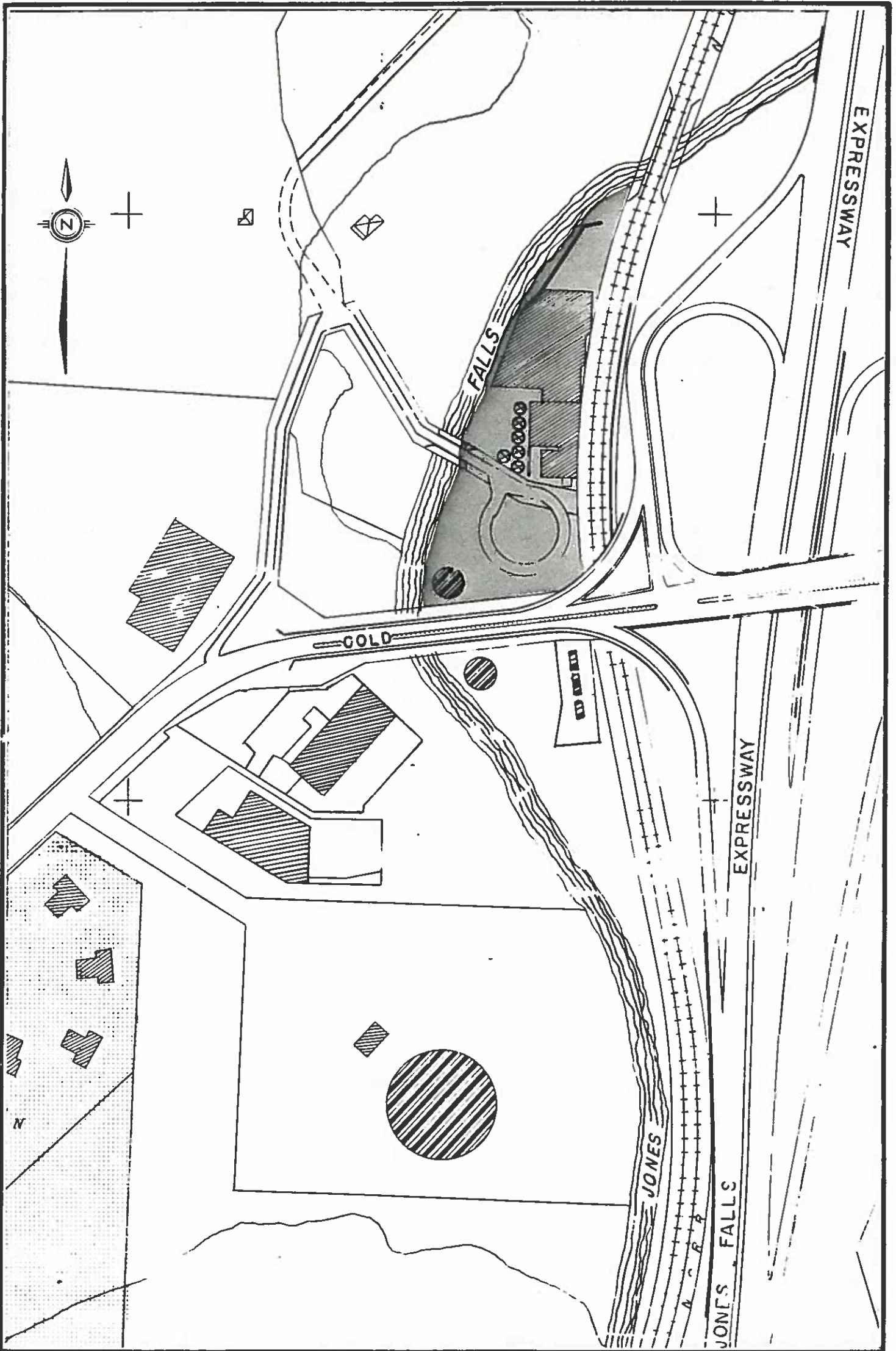
JONES FALLS WATERSHED

MAP 5-0



FLOODPROOFING - KEY TO DETAILED MAPS





**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

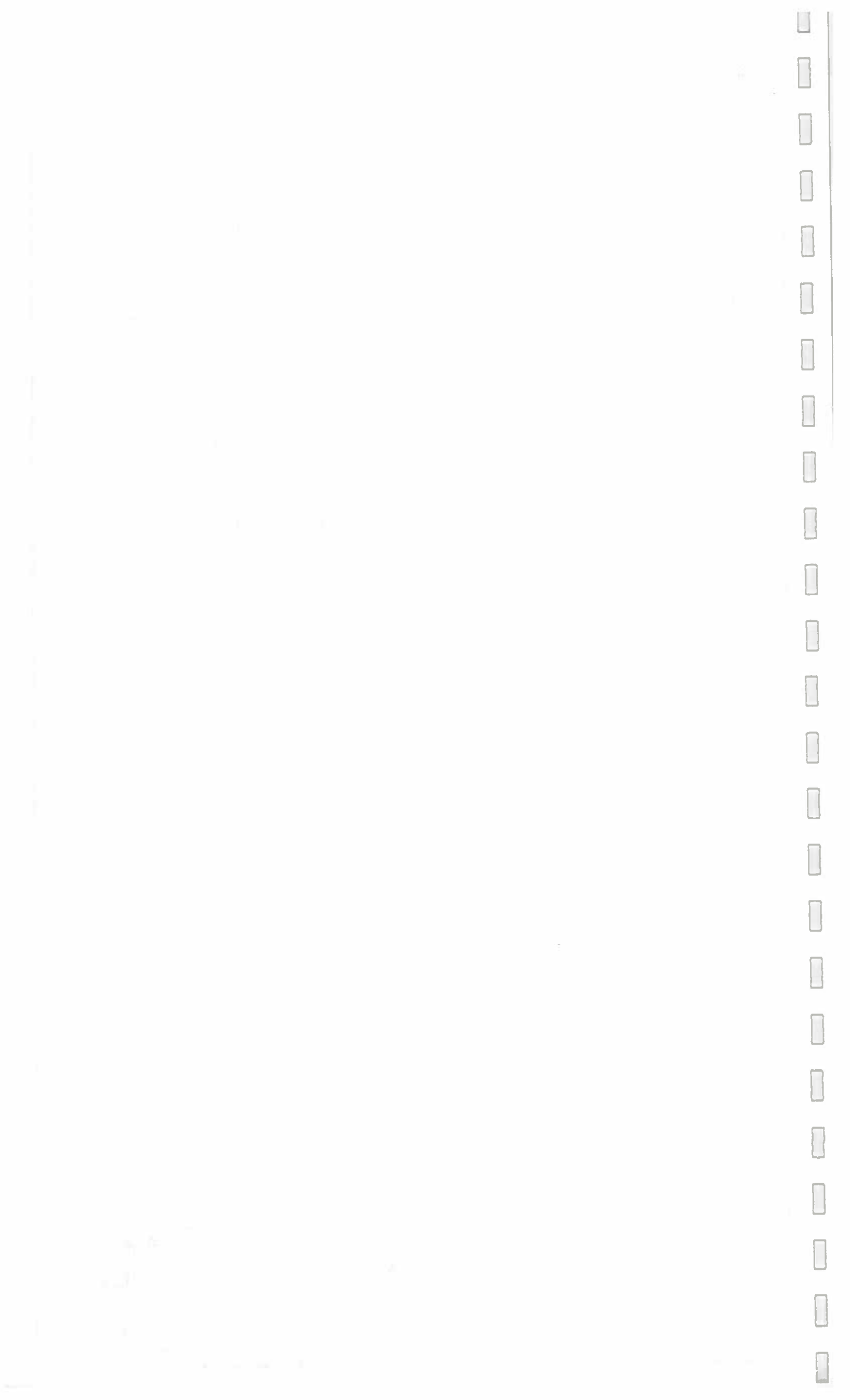
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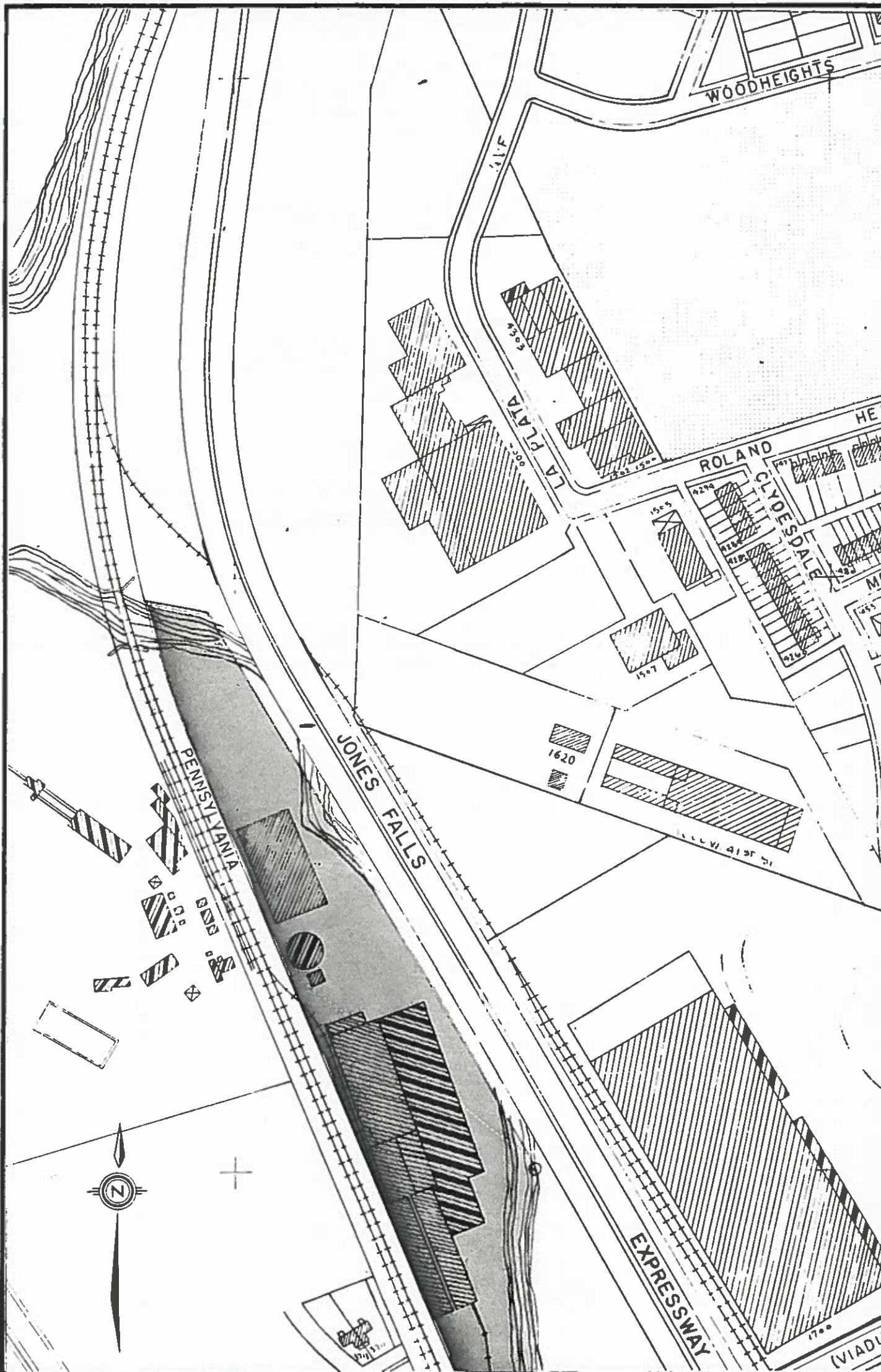
JONES FALLS WATERSHED - JONES FALLS

MAP 5-1

AREAS ELIGIBLE FOR FLOODPROOFING







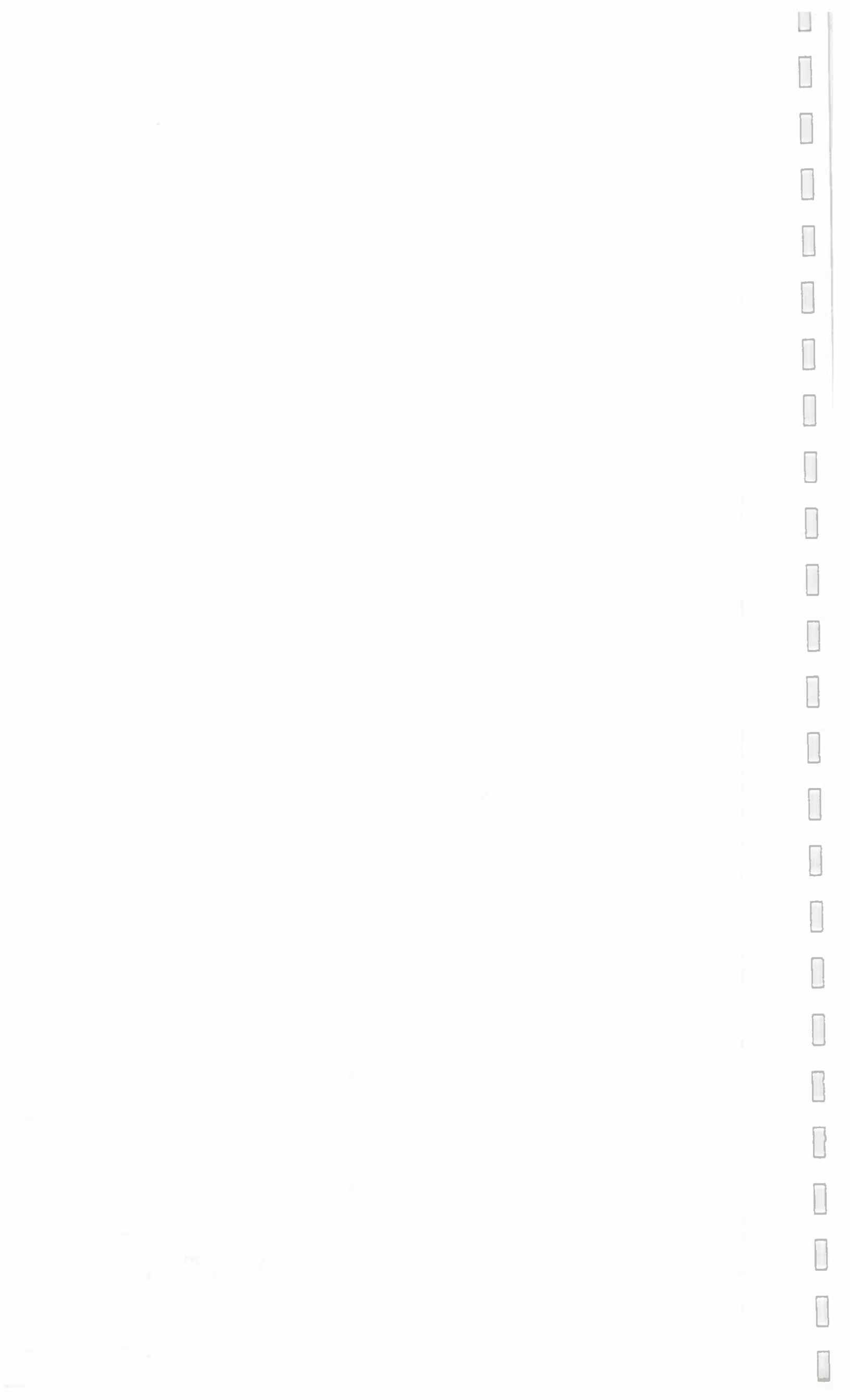
**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

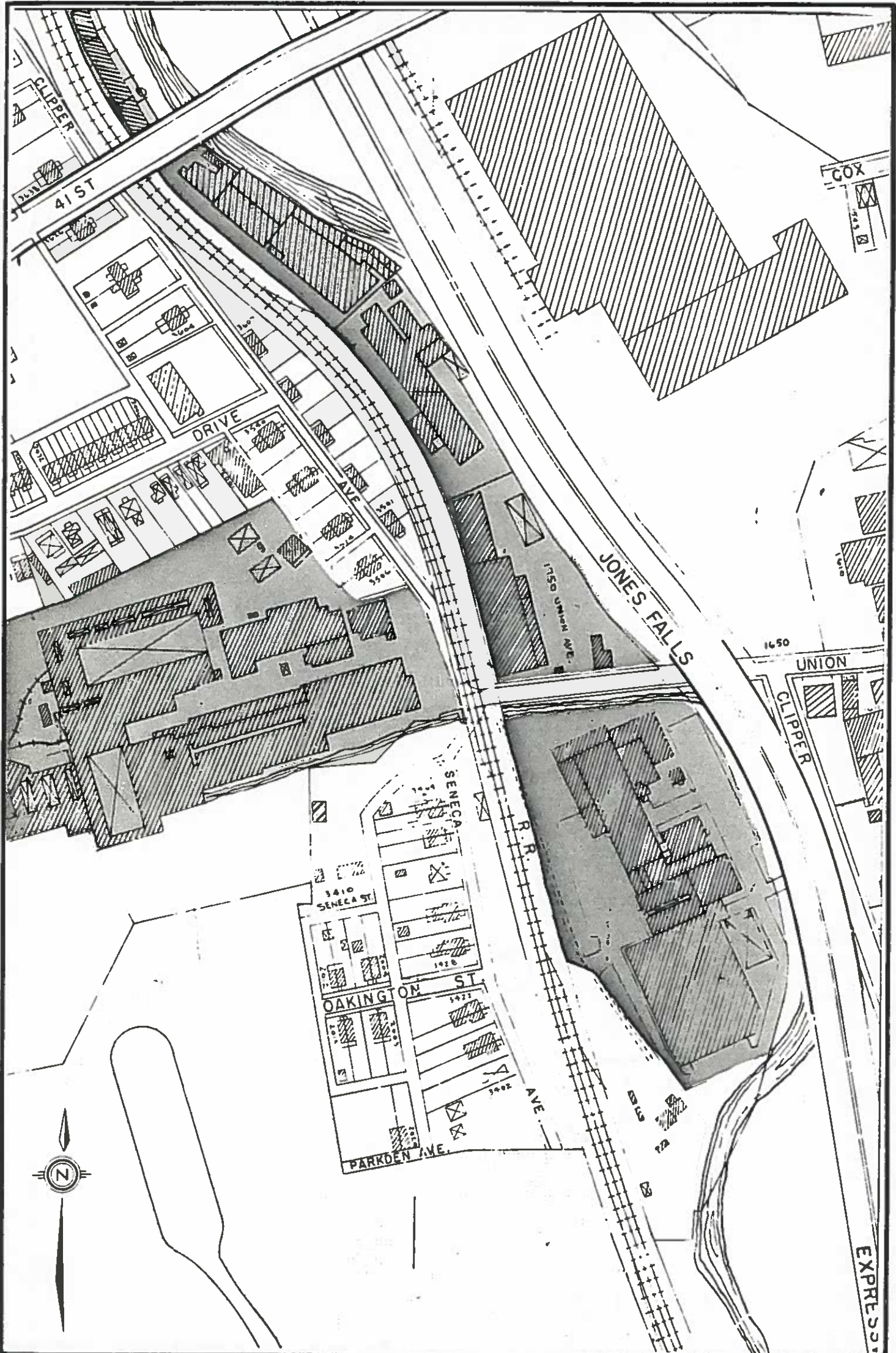
**DECEMBER
1981**

JONES FALLS WATERSHED - JONES FALLS
AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-2







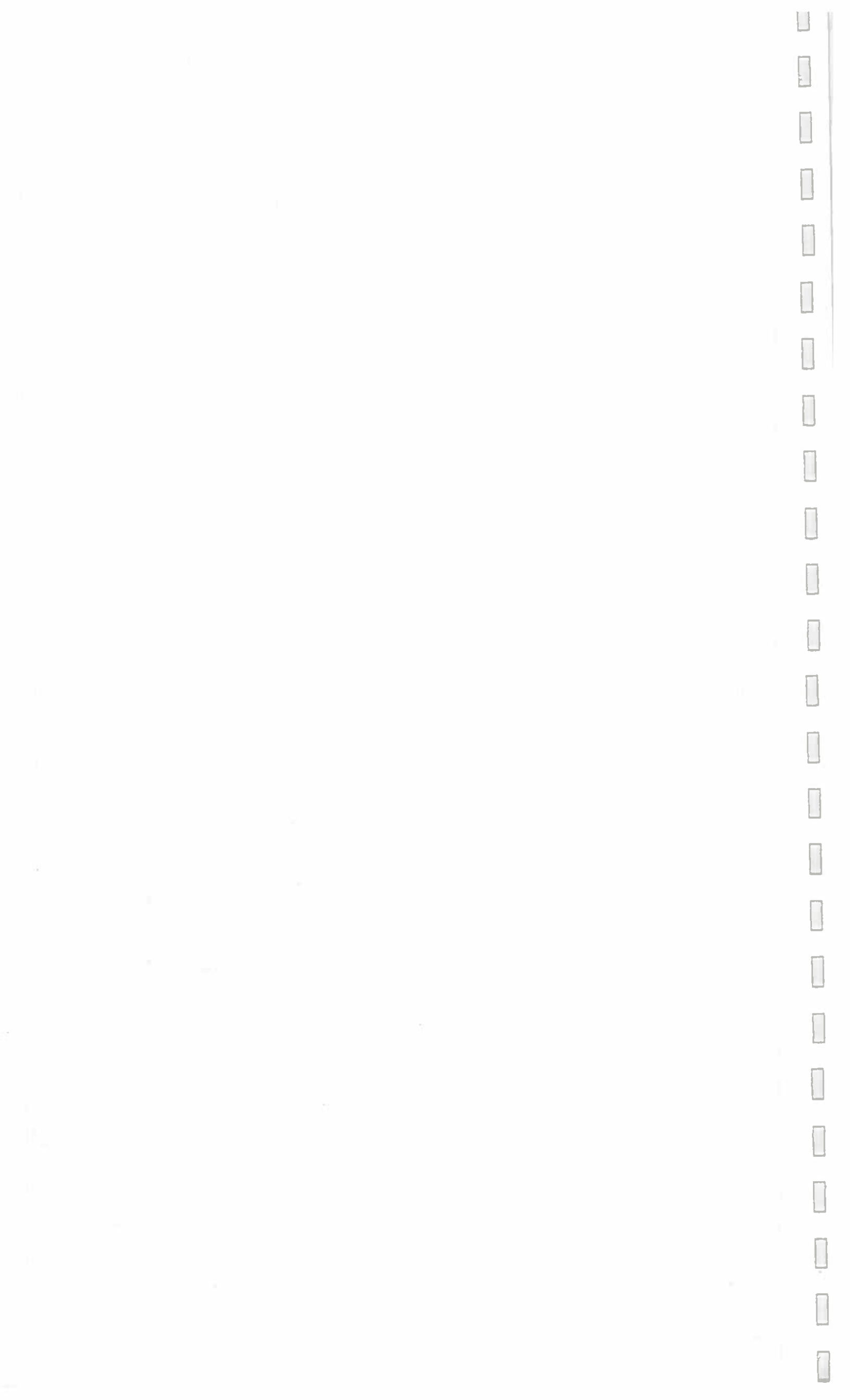
**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

**DECEMBER
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JONES FALLS WATERSHED - JONES FALLS
AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-3







BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

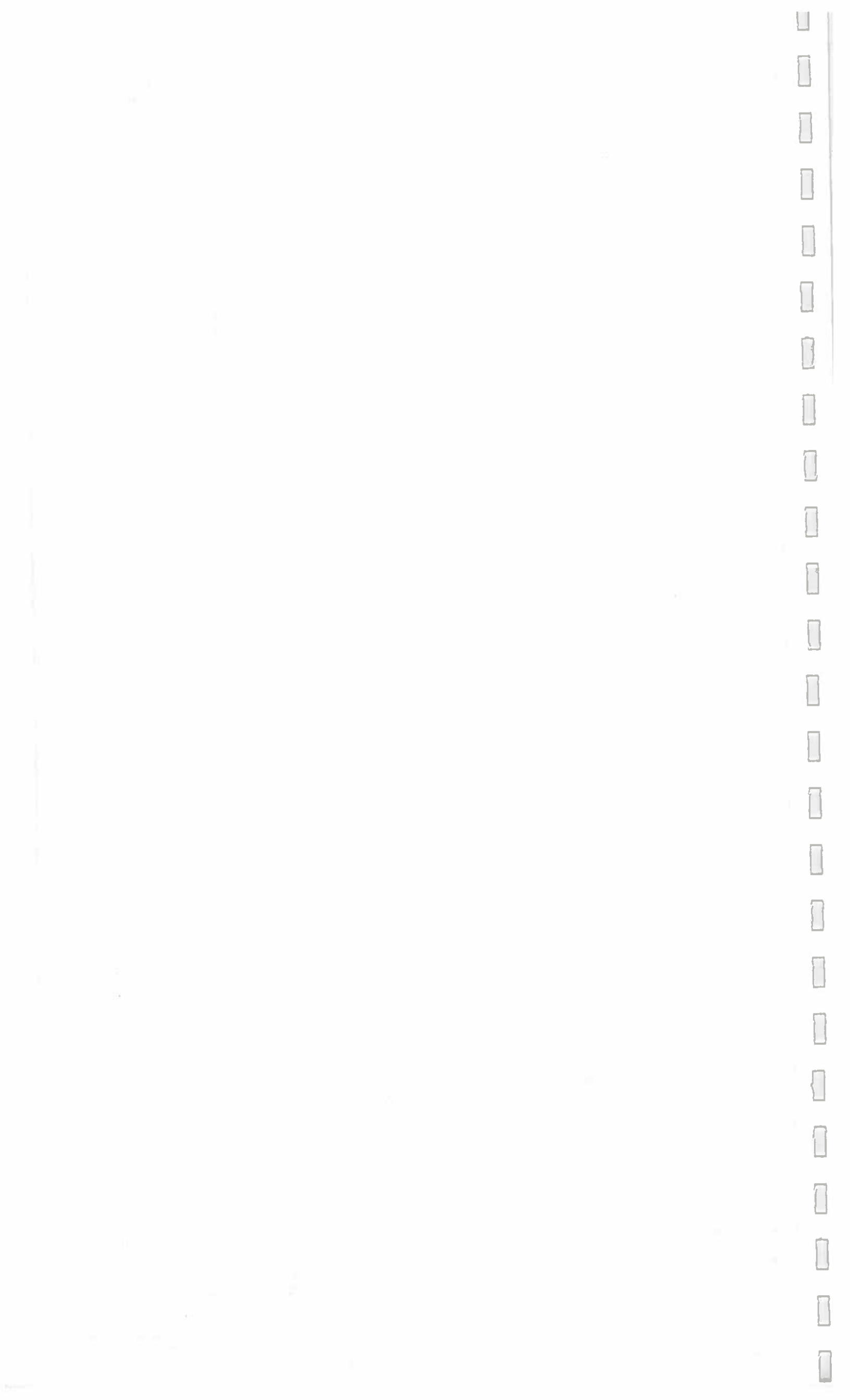
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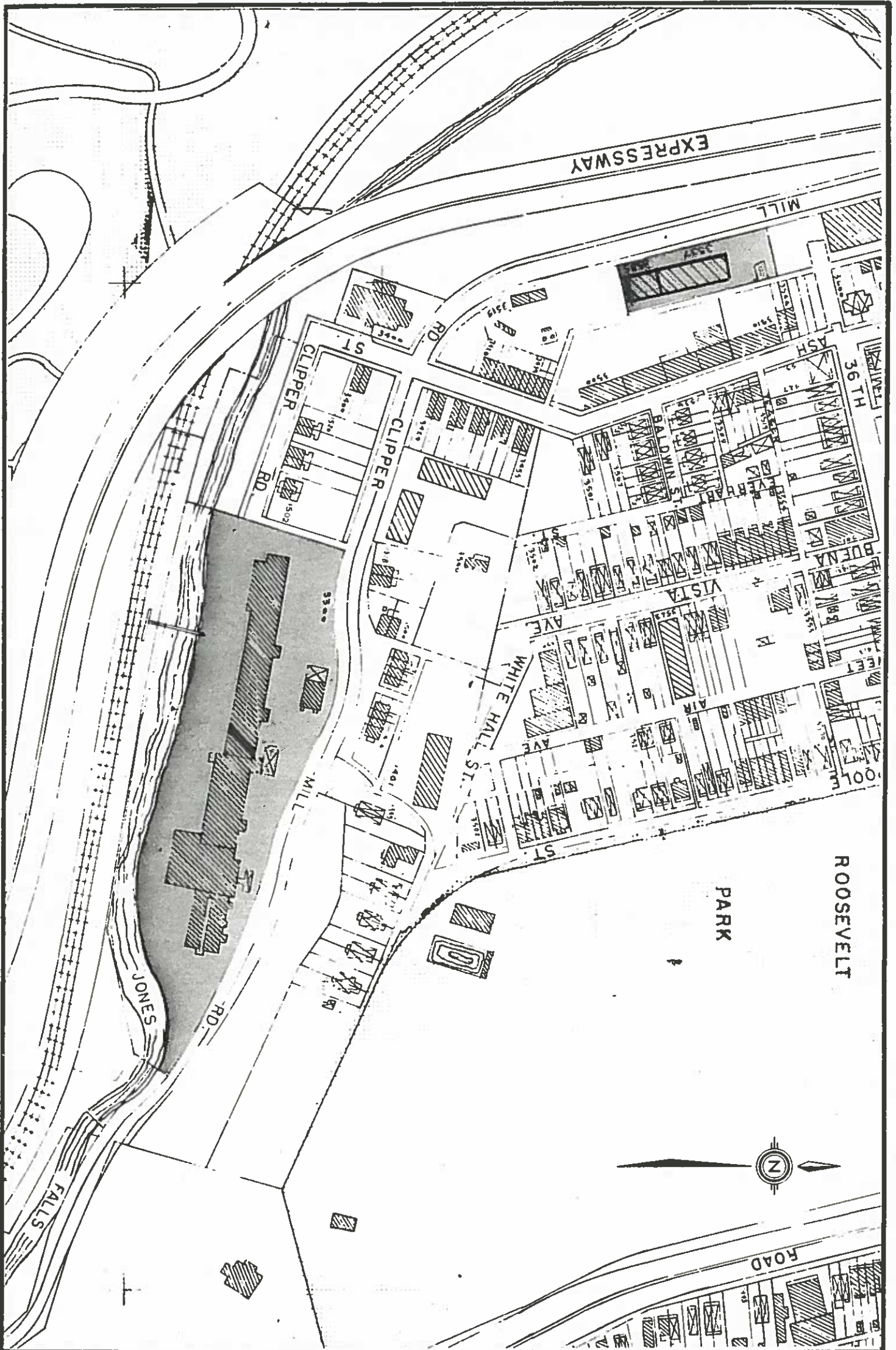
JONES FALLS WATERSHED - JONES FALLS

AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-4







BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

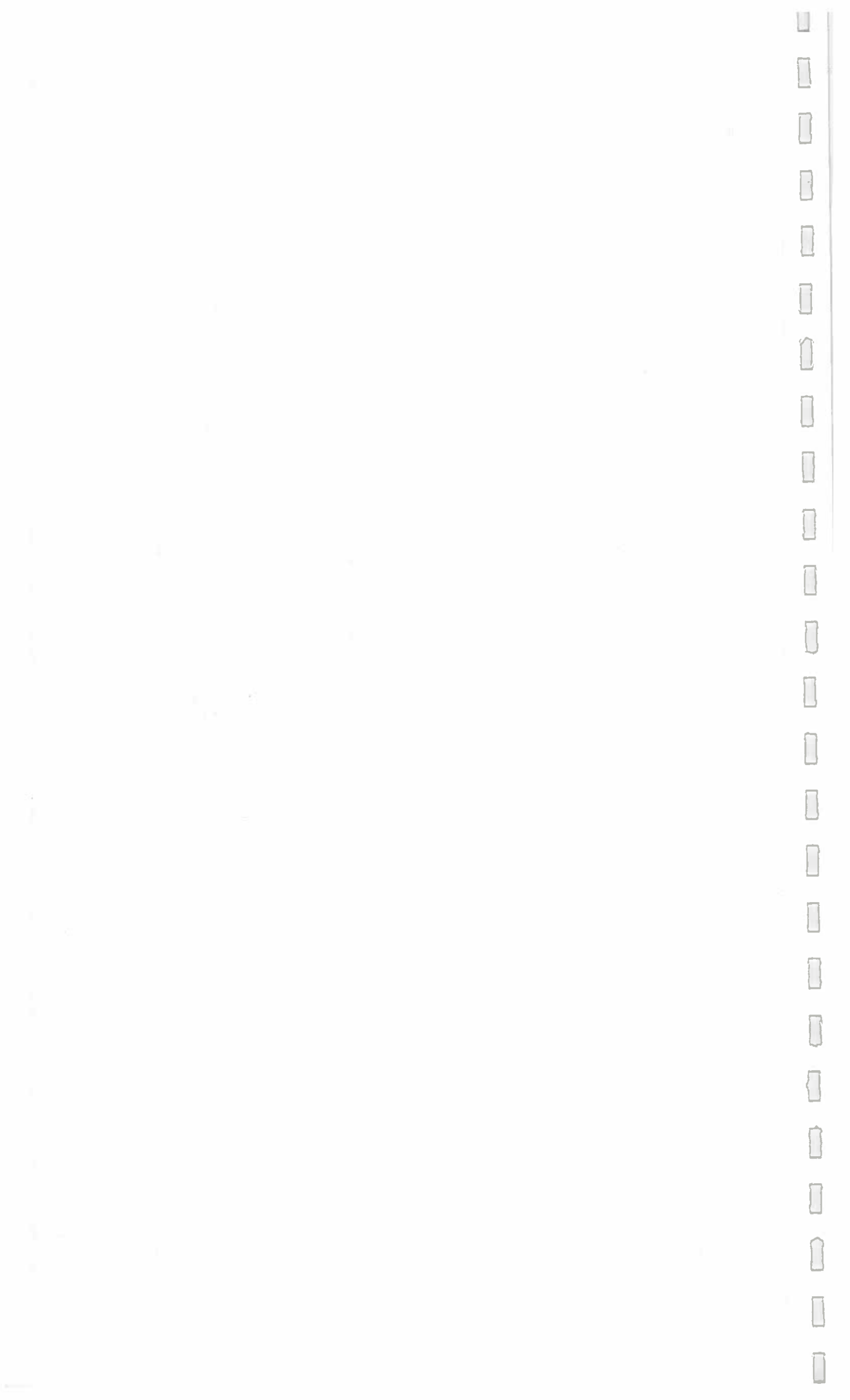
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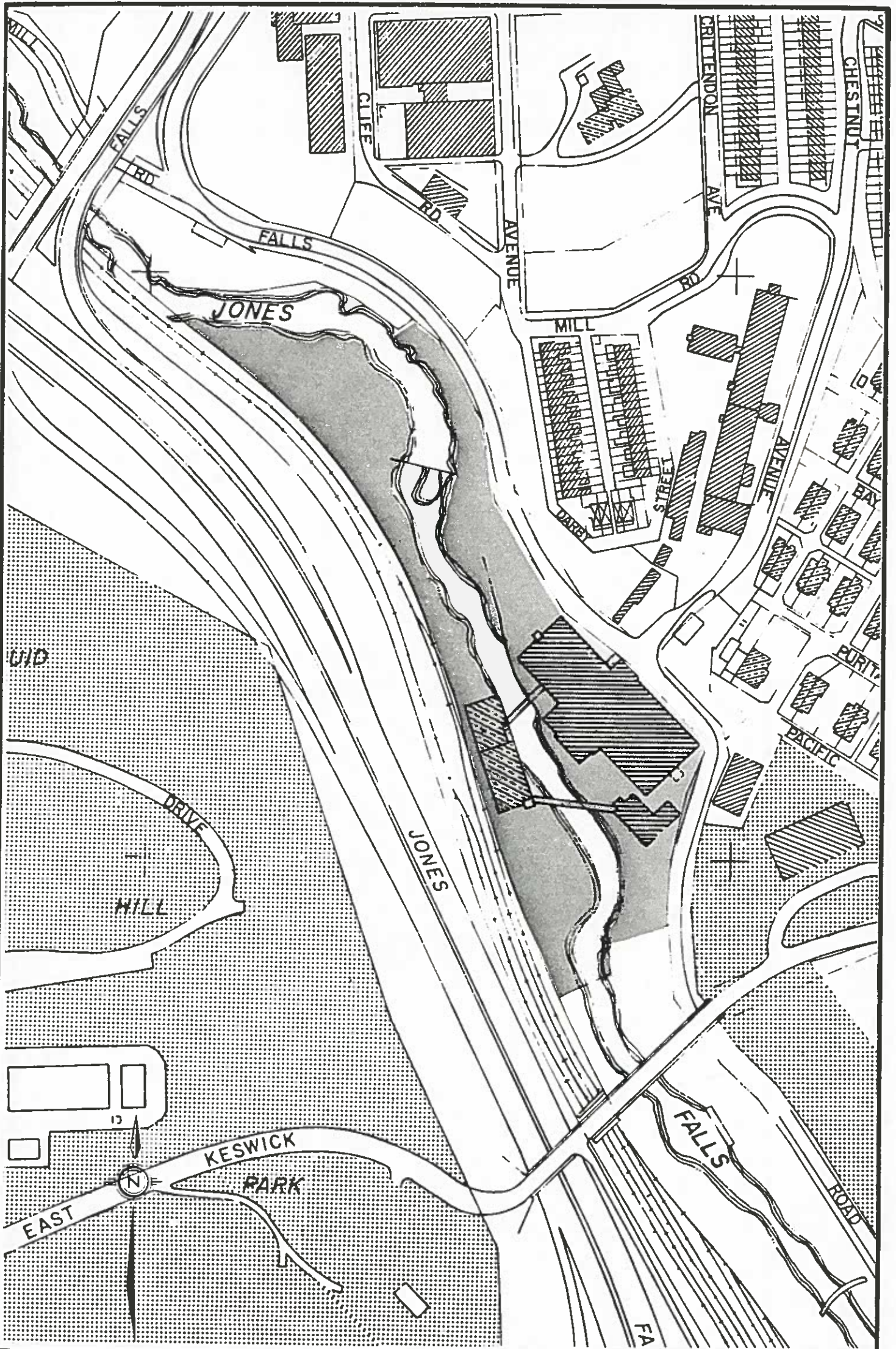
JONES FALLS WATERSHED - JONES FALLS

AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-5







BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

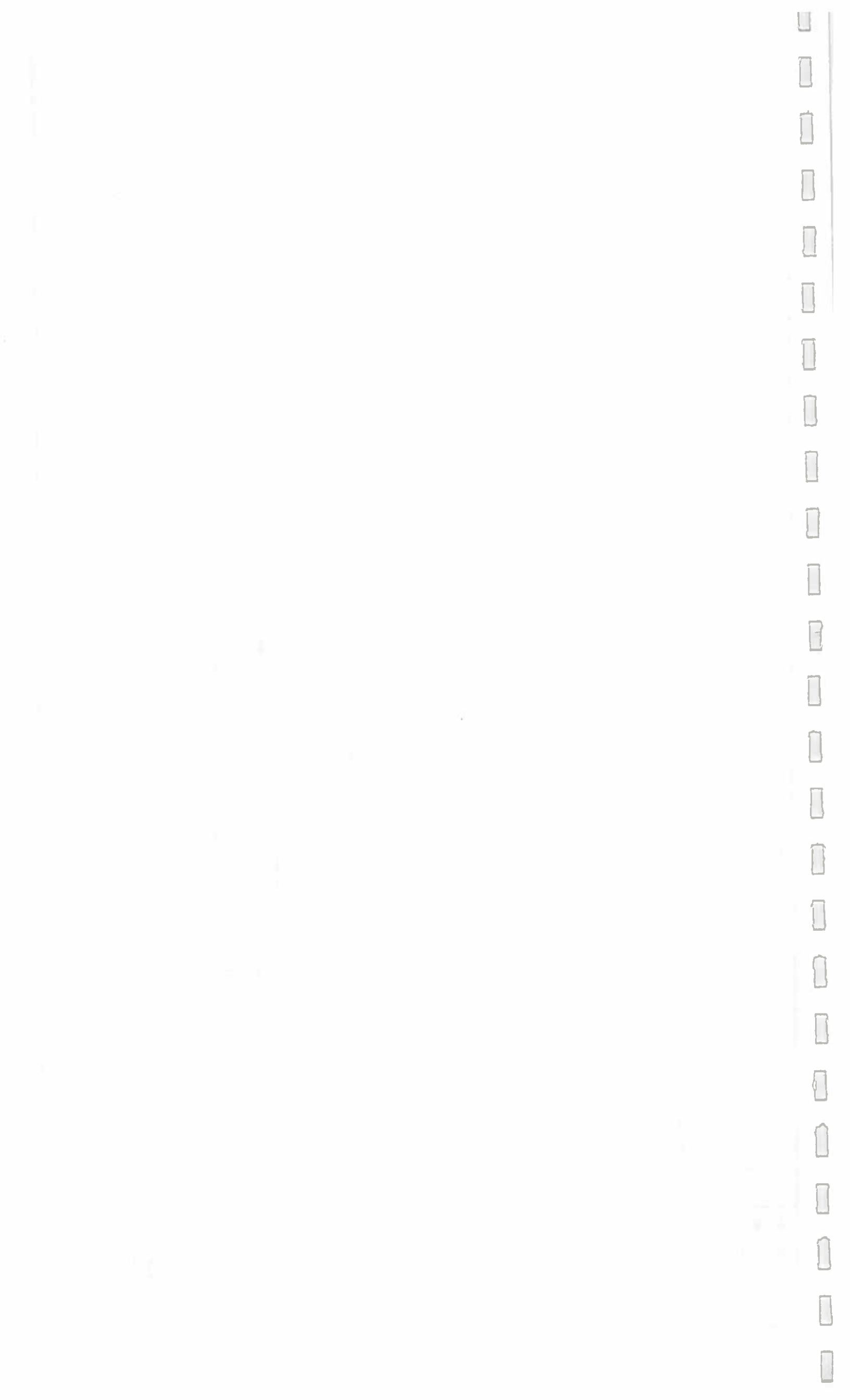
DECEMBER 1981

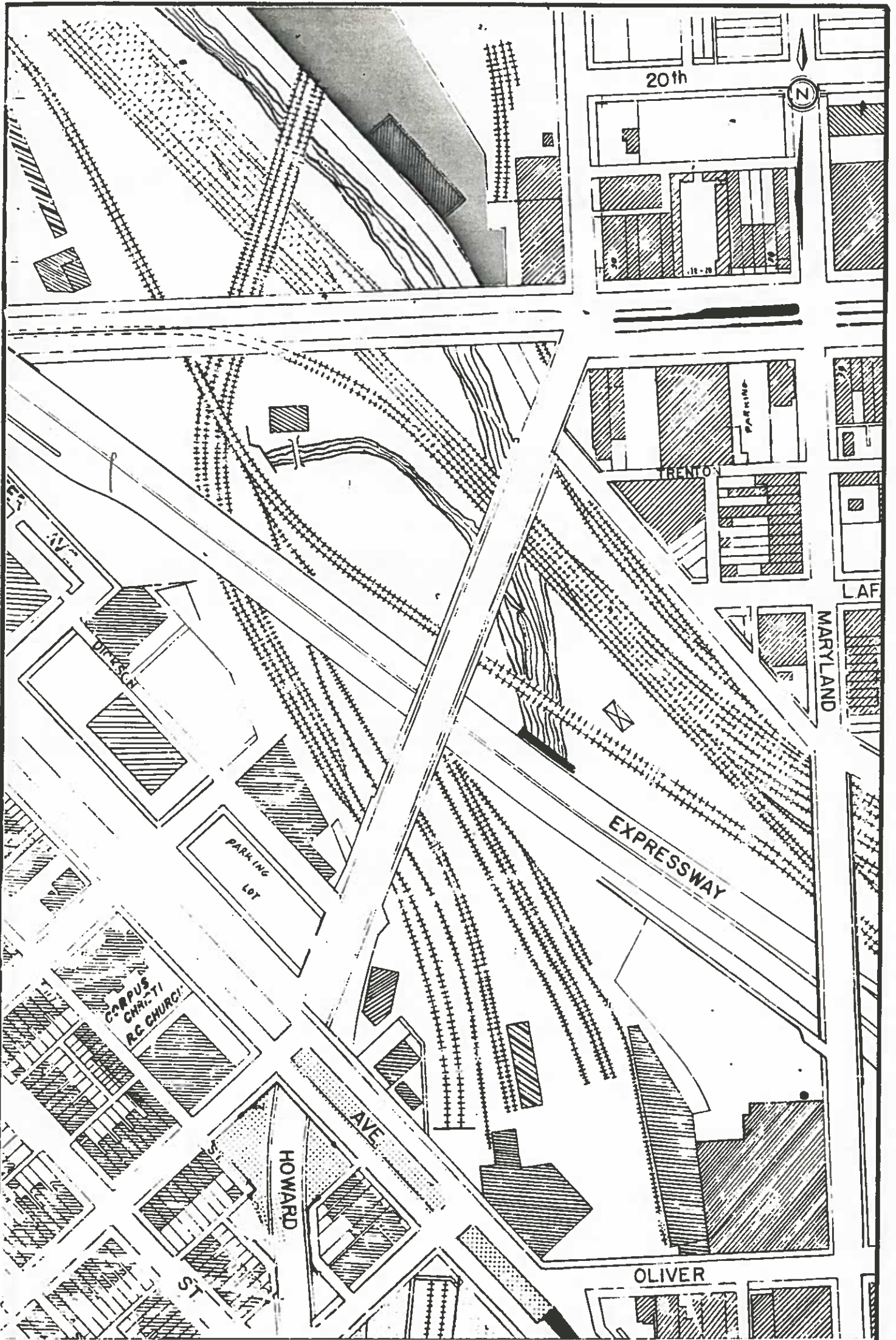
JONES FALLS WATERSHED - JONES FALLS

AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-6







**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

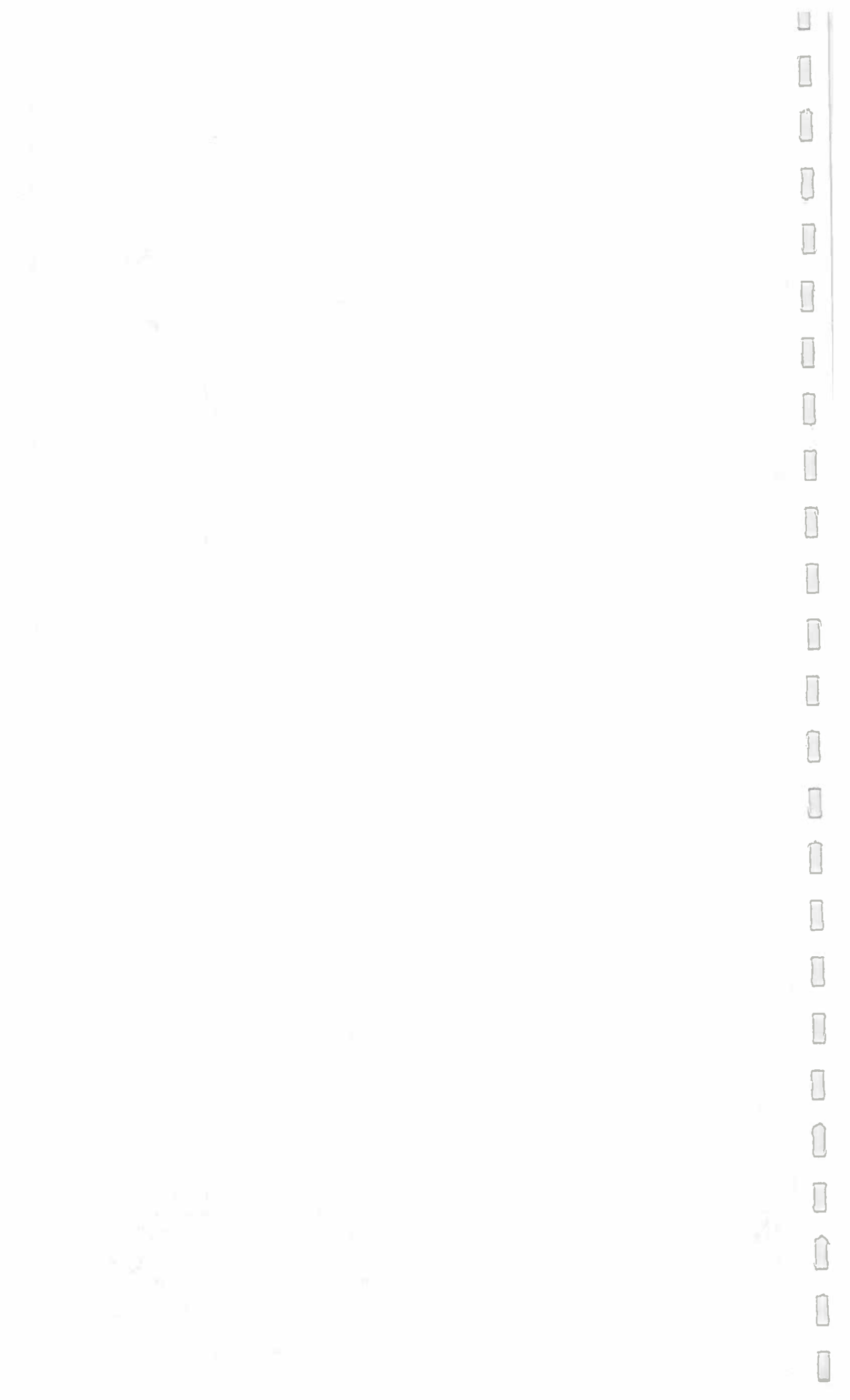
**DECEMBER
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JONES FALLS WATERSHED - JONES FALLS

AREAS ELIGIBLE FOR FLOODPROOFING

MAP 5-7





LEGISLATION

City building codes will be revised to prohibit new residential structures. Several areas in the Jones Falls watershed will be affected by the recommended building code revisions. The intent of these changes in the Jones Falls is to insure that existing and future uses do not conflict with other program elements of the comprehensive floodplain management plan. For example, after acquiring homes on the Jones Falls, it then becomes necessary to insure that nearby undeveloped parcels in the 100-year floodplain are not converted to residential use. The prohibition of new residential development is, therefore, a long-term provision which enhances the acquisition element of the plan.

Similarly, the elevation of new non-residential structures reduces the flood threat where the prohibition of non-residential use is not feasible. This is the case in the industrialized portion of the Jones Falls, where available land for factories and warehouses is limited. Elevating new structures above the level of the 100-year flood will significantly reduce physical damages. It must be remembered, however, that the safety of employees will still be an important consideration.

The prohibition of residential development in the 100-year floodplain will affect the main stem of the Jones Falls from North Avenue to the City line. Western Run will also be affected from its confluence with the Jones Falls to Labyrinth Road.

FLOOD INSURANCE

The National Flood Insurance Program (NFIP) has City-wide application. As part of a comprehensive floodplain management plan for the Jones Falls, the City will continue to encourage insurance coverage for residential and non-residential properties. The City provides information to the public concerning the location of properties in designated floodplains. New structures and substantial improvements to existing structures in the Jones Falls watershed must meet the construction standards specified in the City's floodplain building codes, which were adopted to allow the City to enter the regular NFIP. Flood insurance for non-residential properties represents the protection of several large investments in the Jones Falls valley, which is industrialized. It is recommended that the City arrange, with representatives of the Federal Emergency Management Agency, to hold flood insurance program workshops to bring policy holders and interested firms or individuals in the Jones Falls up to date on changes in the program. As part of a City-wide effort to increase participation in the NFIP, a letter will be sent to all identified floodprone properties, advising the recipients of the availability, benefits, and costs of flood insurance. This form of publicity for Flood Insurance has proven successful in the past.

Flood insurance is a very important element in the City's comprehensive floodplain management plan. The highly urbanized nature of portions of the Jones Falls floodplain makes many other management alternatives impractical. For example, the construction of a dike or levee is undesirable because of environmental as well as economic impacts. Since the Corps of Engineers' Metropolitan Streams Report found such an alternative to be non-cost-effective, there would be no federal participation in such a project.

Alone, however, flood insurance cannot lead to long-term wise management of the Jones Falls watershed. Insurance must be part of a broader program of floodproofing, acquisition, stream maintenance, enforcement of City ordinance, and an effective early warning system for flood events.

EARLY WARNING AND EVACUATION SYSTEM

Operation S.W.I.F.T., as described in the Baltimore City Floodplain Management Plan Analysis, is the City early warning and evacuation plan for severe weather conditions. This plan will help to reduce risks to life and property damage in the Jones Falls Floodplain. Flood-prone homes, as well as businesses and factories, have been identified, along the Jones Falls and Western Run, for early warning and evacuation procedures in the event of a flood. The Baltimore City Police Department will be provided with a list of susceptible homes and non-residential buildings prone to flooding. The Police are responsible for notifying residents and property owners that a flood warning has been issued. Contingency plans for floodproofing, such as the placement of flood shields and sand bags, and the removal of valuable objects from lower floors, can then begin as time allows. In addition, the evacuation of threatened structures will proceed under direction of the Police in an orderly manner, to prevent traffic problems, and keep motorists off of flooded streets.

SWIFT will also utilize a series of maps, developed by the City Department of Public Works, to monitor and close, if necessary, roads which are prone to flooding. Several recent deaths during floods have occurred as motorists became trapped by rapidly rising water on City streets and highways. The Bureau of Highways, with assistance from the Department of Transit and Traffic, will perform street closings. The major streets prone to flooding in the Jones Falls are listed in the Appendix.

The Appendix contains the Standing Operating Procedure for Operation SWIFT. A map is included to show the location of the Police and Fire Stations in the Jones Falls, as well as the areas considered high priority in SWIFT.

There are four stream gauges and two rain gauges located in the Jones Falls watershed, which, combined with weather service predictions and updates, and gauge information from Baltimore County, will form the data base for decision-making in SWIFT. The stream gauges are located on Western Run at Bancroft Road and Lochlea Road, and on the main stream at the Kelly Avenue Bridge and downstream near Ash Street and Clipper Mill Road near the Jones Falls pumping station. The rain gauges are located at Fire Company #45 on Glen Avenue, and at Fire Company #21 on Roland Avenue. These gauges form a network with other gauges throughout the City and in the County, and are all monitored during Operation SWIFT.

Planning for flooding from dam failure is a special need in the Jones Falls Valley, and requires some mention of the status of the Dam Safety Program. Lake Roland Dam, located about one-half mile outside the City limits in Robert E. Lee Memorial Park, has been identified as a high-hazard (Class I) dam. The Phase I Report of the National Dam Inspection Program, prepared in 1979, classified the dam as an intermediate size, high hazard dam with a recommended spill way design flood of 100% the probable maximum flood. The dam was evaluated in this preliminary study to be in generally fair condition. However, due to a seriously inadequate spillway, the dam is categorized as "unsafe, non-emergency." The high hazard classification is based upon downstream population density, rather than on the physical condition of the dam itself.

The Phase I report recommended:

- 1) Additional hydrologic and hydraulic studies to more accurately determine spillway adequacy, and dam improvements needed to provide sufficient discharge capacity. The Phase II report to perform this work is currently in progress.
- 2) Repair and maintain reservoir drain slide gates and lifting mechanisms.
- 3) Develop a formal flood surveillance and warning system.
- 4) Develop a more thorough inspection and maintenance program at the dam facility.
- 5) Repair dam and spillway abutments to secure the slopes and capping stones.
- 6) Remove trees growing on abutment slopes and between stone block joints of the water supply outlet structure.

Failure of the Lake Roland Dam would result in substantial property damage and loss of life. Assuming that dam failure occurs as the result of heavy flood flows. Operation SWIFT would already be in effect. This would mean notification first of persons located in the 25-year floodplain, or the floodway of the 100-year storm on the Hones Falls. The second warning would be to all persons in the 100-year floodplain. Evacuation would be initiated in the event that monitored stream gauges and general weather and road conditions indicated that flooding is likely to continue. The Lake Roland Dam is monitored during these heavy storms as well.

Although the basic components are already in place for handling a dam failure situation, several improvements could be made. First, notice of warning and evacuation prompted by imminent threat of dam failure must be readily distinguished from procedures for a regular flood. Second, the signal for evacuation must come from trained dam observers, and the information must be quickly and accurately relayed to police in the evacuation area. Third, all potentially affected citizens should be formally notified of the special evacuation signal and procedures to be followed, in the event or threat of a dam failure. This should be done with public meetings augmented by written instructions to be followed in the event or threat of a failure.

Following completion of the Phase II report, the City will have better data on the extent of flooding in the event of dam failure. This information will be developed into a list of addresses for notification, to be supplied to the Police Department. Maps with evacuation routes will be developed as well. The implementation of recommended improvements generated in the Phase II report should lessen the threat of dam failure. However, it is always prudent to be prepared where so many lives are concerned.

MINOR STREAM CHANNEL IMPROVEMENTS

There are many segments of stream in the Jones Falls watershed where shoal and debris removal, and streambank protection would be beneficial in floodplain management. Although this type of cleaning and stabilization will not prevent flooding during the relatively infrequent yet severe storm events, these measures would help to safely pass the peak discharge from less severe and more frequent storms which often cause localized flooding problems.

Under the Tropical Storm David Disaster Recovery Program, funded by the Federal Emergency Management Agency, approximately \$3 million has been spent on repairs to the main stem, Western Run and Stony Run in the Jones Falls drainage area. Repairs included stream cleaning and shoal removal, streambank and utility protection, culvert repairs, and other minor channel improvements. Gabion installation has been the predominant method used for streambank and utility protection. In some areas, it was necessary to deepen and widen constricted channels where channel capacity had been lost due to excess sedimentation and deposition. Other repairs were made to damaged storm drain outlets, wingwalls, concrete channel liners and existing retaining walls.

The areas repaired in the Tropical Storm David Recovery Program are shown generally on Map C. This Federally funded program has enabled the City to repair those portions of streams where damages from the storm posed a threat to human safety, or where the damage affected public property or utilities. There remain, however, segments of stream in the Jones Falls drainage area in need of repair, but ineligible for funding under the Federal program. These areas are shown generally on Map .

Much of this work consists of making repairs to already improved stream channels, where little or no maintenance has been performed. In some places, trees have cracked concrete blocks on the banks, or grown up through the concrete in the streambed. Large accumulations of sediment and debris clog sections of the channel. In the northern end of the Jones Falls stream channel in the City, a sediment trap is in need of cleaning and rehabilitation. These conditions exacerbate any flooding in the area by restricting the flow of water downstream and by damming up at bridges and culverts. In addition, there are areas in need of slope stabilization to protect threatened roadways, public and private lands, and water or sewer line protection.

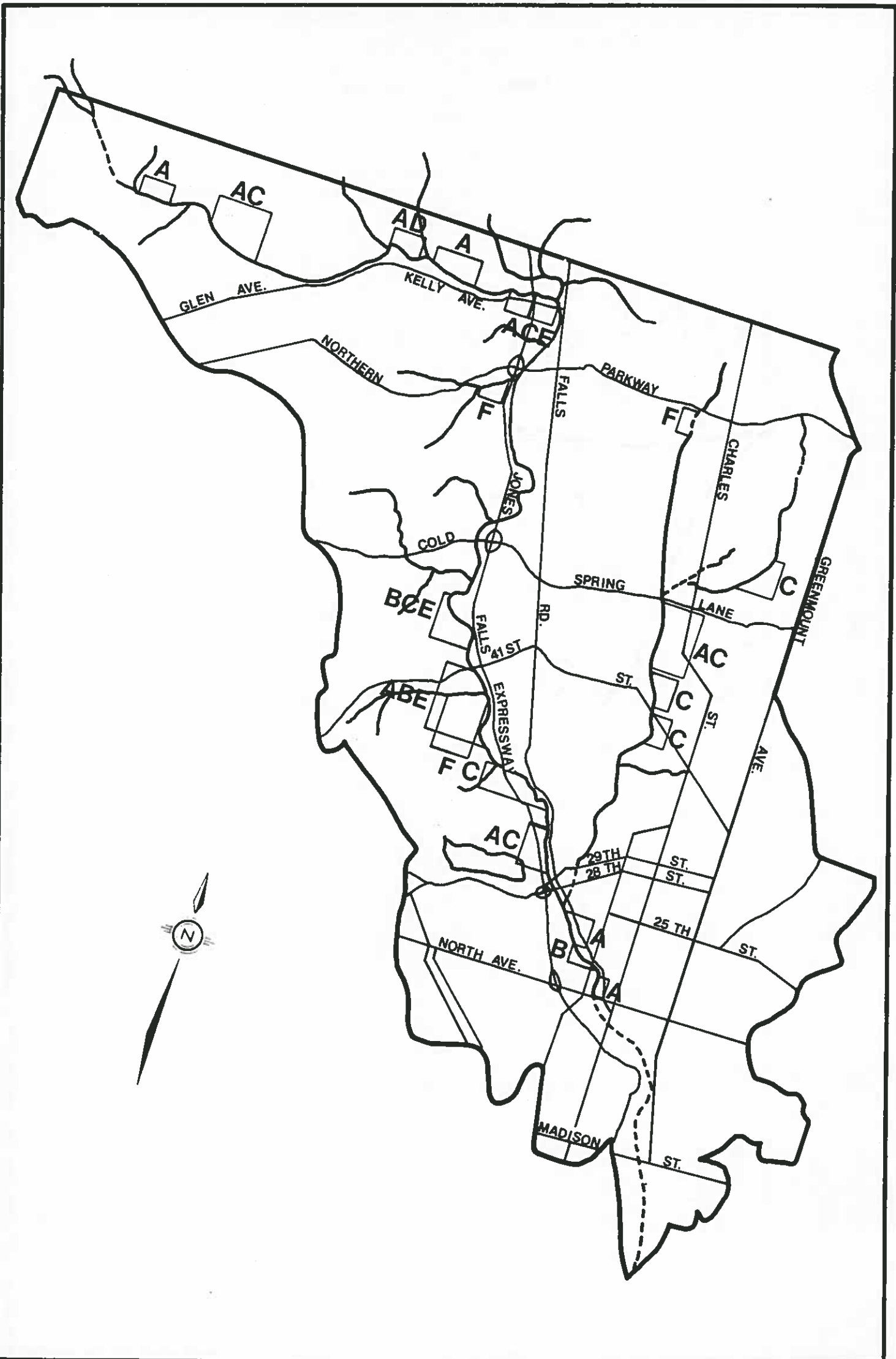
The performance of needed repairs, clean-up and minor improvements will require a considerable capital expenditure. An estimated \$2 million will be needed to clean and restore the Jones Falls. This should be programmed into the Baltimore City Capital Improvement Program over the next several years, utilizing, if available, matching funds from the State. In addition, stream maintenance and regular storm drain and inlet cleaning should be reinstated as operating budget items in the Department of Public Works.

A program of minor stream improvements will have several benefits. First, localized flooding from minor storms may be alleviated, particularly in developed areas adjacent to open stream channels where flow is constrained by bridges, or where culverts have been placed and are prone to blockage. Second, a systematic and thorough program of shoal removal, channel restoration and streambank stabilization may contribute to a reduction in the cumulative flooding problems downstream, by enhancing the passage of flood flows without obstructions. This will be particularly beneficial when combined with the removal of structures from the floodplain. Enhancing the peak discharge is especially important in the lower portions of a watershed. A restraint in this respect in the lower Jones Falls is presented by the underground conveyance system into which the Falls flows at North Avenue. It is imperative that these conduits be kept clear of debris.

In addition, a hydraulic study of the conduit system is needed to determine the actual capacity of the system (see "Areas Needing Further Study").

A third benefit of minor stream improvements in the Jones Falls will be improved water quality and appearance of the stream valleys. Erosion control will decrease turbidity and sedimentation. The proper installation and maintenance of gabions and wire matting will allow revegetation of stabilized streambanks with grasses and wildflowers, so that aesthetic objectives can be achieved as well. The removal of debris also has obvious water quality and aesthetic benefits.

Finally, a program of minor stream improvements in the Jones Falls watershed will complement and complete the work begun under the Tropical Storm David Recovery Program. In areas where Federal funding requirements precluded work from the program it is necessary to use alternative funds to perform the stream repairs. In addition to a capital program, this work should be included as an operating budget item, to insure that streams remain clear and in good condition. In this way, the Jones Falls and its tributaries will be cleaned, restored and maintained in a comprehensive and ongoing manner, to help reduce flooding damages and enhance water quality.



**BALTIMORE CITY
FLOODPLAIN MANAGEMENT PLAN**

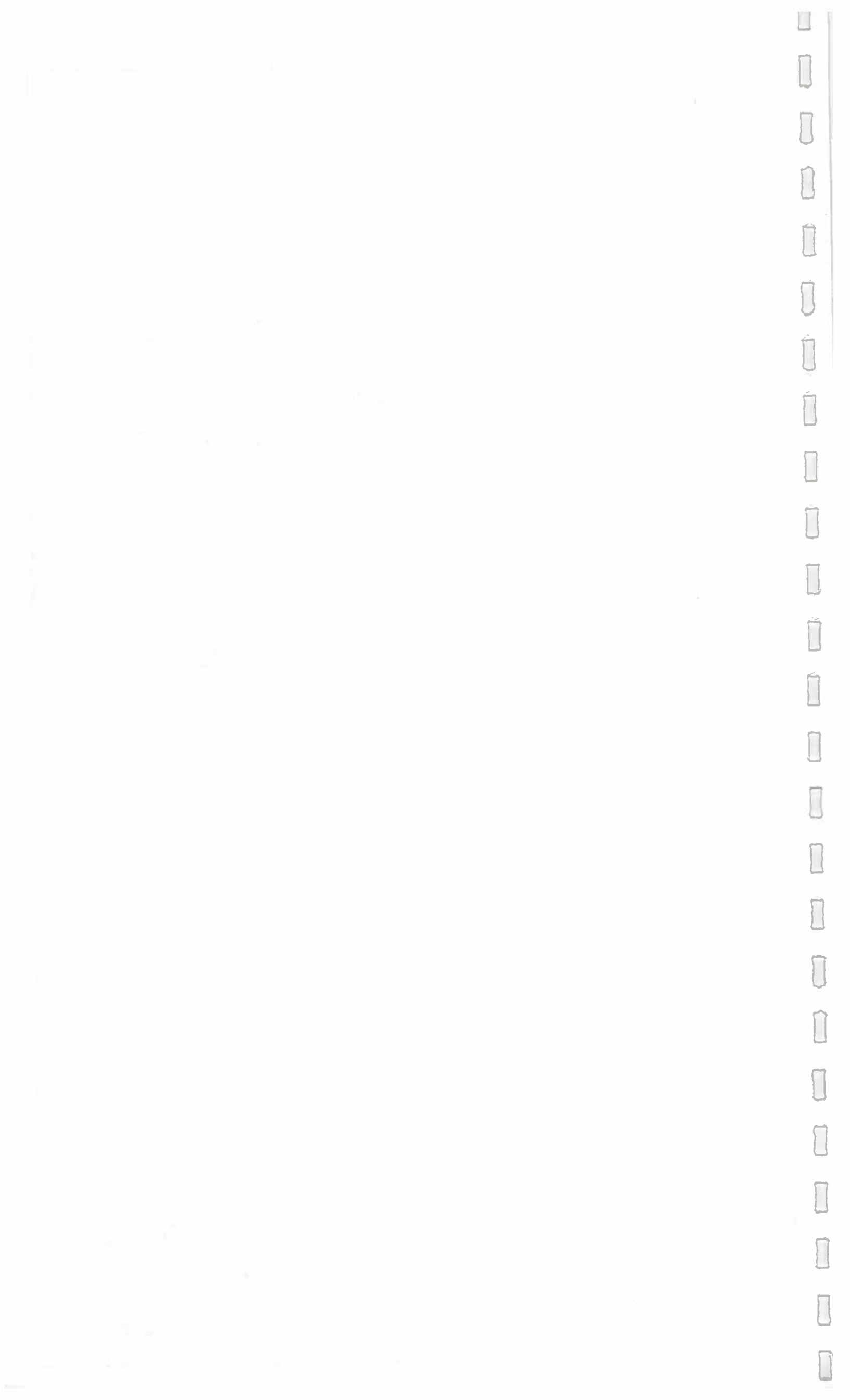
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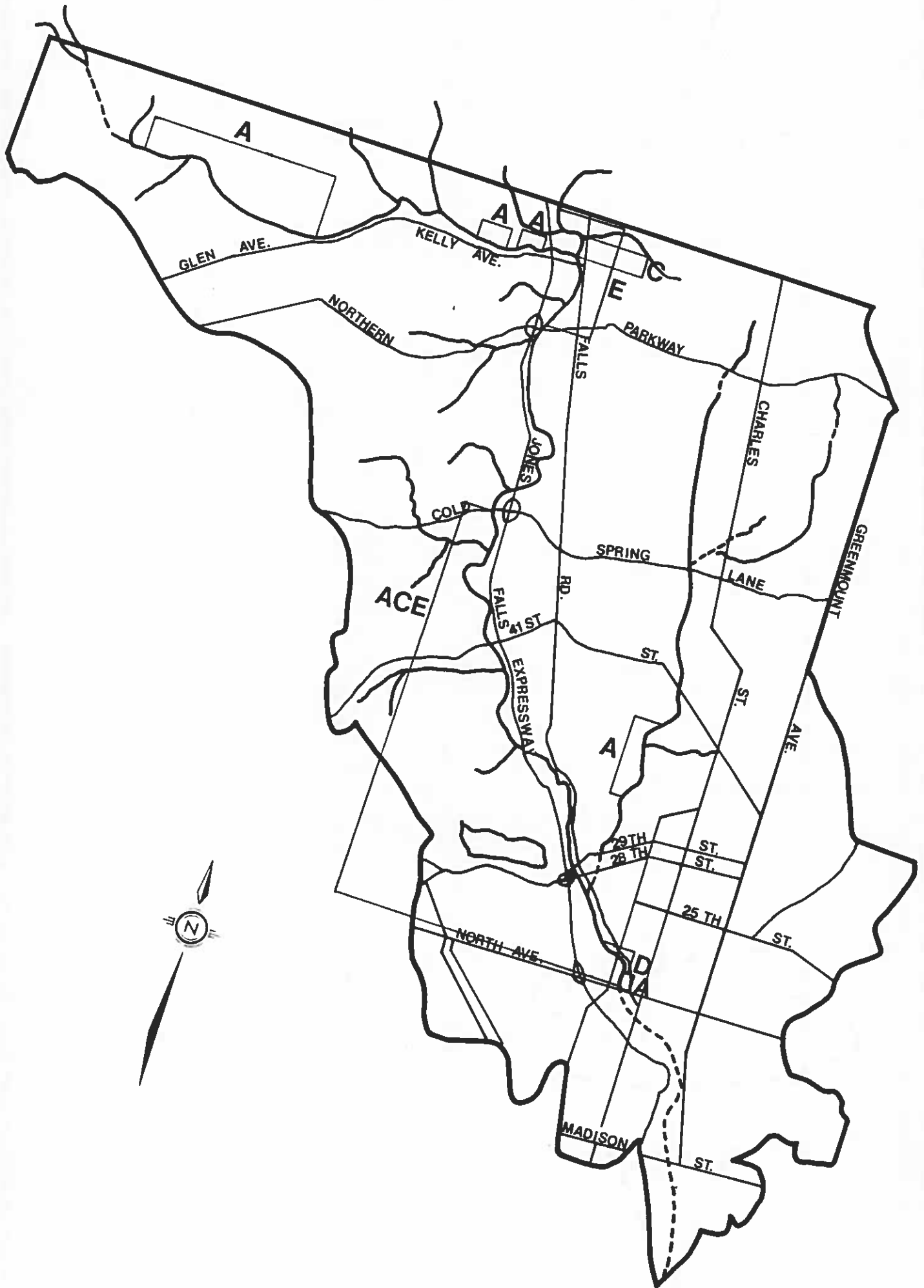
JONES FALLS WATERSHED

MAP 6

COMPLETED AND PROGRAMMED STREAM IMPROVEMENTS







BALTIMORE CITY FLOODPLAIN MANAGEMENT PLAN

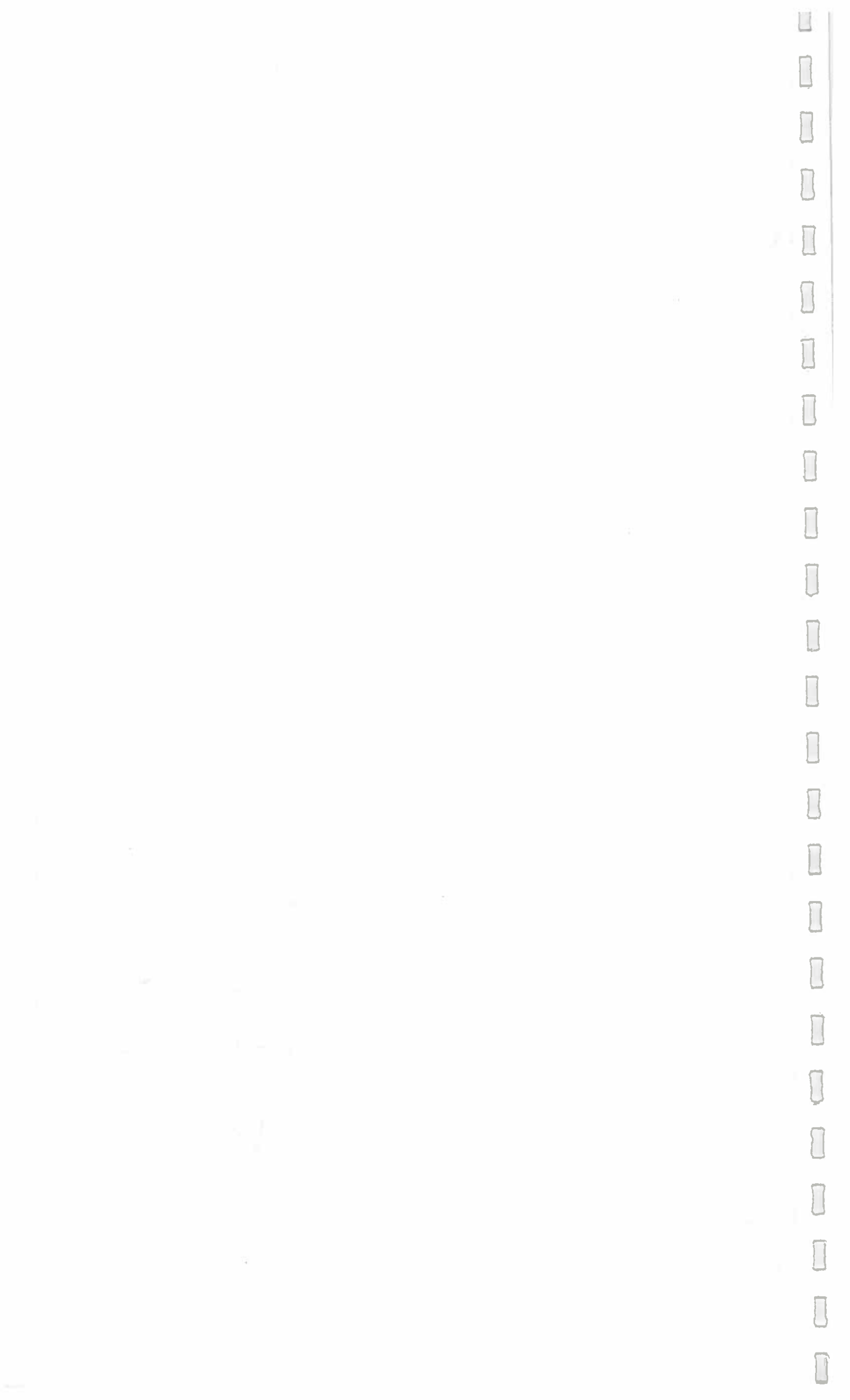
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JONES FALLS WATERSHED

AREAS NEEDING STREAM IMPROVEMENTS

MAP 7





AREAS NEEDING FURTHER STUDY

There are portions of the Jones Falls watershed which have not received adequate study upon which to base the full implementation of floodplain management strategies. One of these is Stony Run, a tributary which flows roughly south and parallel to the main stem of the Falls, until their confluence near 29th Street. The other is the enclosed portion of the Jones Falls, from North Avenue to its outlet into the Inner Harbor next to Pier 6. More detailed hydrologic and hydraulic information is needed to accurately delineate the floodplaining and predict water surface elevations.

Jones Falls (North Avenue to the Harbor)

This lowest segment of the Jones Falls is the most densely urbanized portion of the entire watershed. Land use in this area is a mixture of industrial, commercial, residential and institutional. The Falls enters 4 conduits under the North Avenue bridge, travels in these pipes about 186 feet to pass under railroad tracks, emerges for about 250 feet, then enters the Jones Falls conduits which carry the stream to the Harbor. According to the Flood Insurance Study (1977), flood flows from a 100-year storm would pond around conduit entrances and flow overland to the Harbor, generally following the route of the Fallsway. The report notes that predicting overland flood flow depths and flood boundaries is difficult due to the existence of conduits of varying sizes, flows that may exit and re-enter storm drains and irregular topography.

The method used to delineate flood water depths for the purposes of the Flood Insurance Study was to use historic flood information, field analysis and computation estimates made at selected cross-sections. The boundary of the 100-year floodplain was delineated using topographic maps and the above mentioned flood depths.

Given that the lower Jones Falls is a principal flooding problem in the City of Baltimore, and that the rest of the watershed has been or is being studied in greater detail, it is recommended that an appropriate hydraulic model be utilized to accurately determine flood depths and the floodplain boundaries. This is needed to accurately assess downstream effects of upstream hydrologic modifications, to determine flood insurance rates which more accurately reflect flooding risks, and to develop better warning and evacuation plans for the downtown area. The model should, if capable, take into account the effects of tidal surges. The 10-, 25-, and 100-year storms should be modelled.

Stony Run

Stony Run is a tributary of the Jones Falls, which flows through predominantly residential and institutional sections of the City. Portions of the stream are in closed conveyance, while other portions flow through parkland, providing recreational benefits.

Flooding damages have occurred in the past to some homes and shops along the Run. The stream in the vicinity of Wyndhurst Drive causes flooding damages to a small shopping center during severe storms. In spite of these damages, little is known about the flooding characteristics of this drainage area.

The Jones Falls Watershed Plan recommends that a hydrologic/hydraulic model be developed for Stony Run, to determine flood depths and floodplain boundaries for the 10-, 25-, and 100-year storms. This will form the basis for identifying flood-proofing areas, mini-stream channel improvements needed, evacuation plans, and perhaps some acquisition and relocation.

