Kates, R. W., 1962, Hazard and Choice Perception in Flood Plain Management, University of Chicago, Department of Geography Research, Paper No. 78.

CHAPTER III

THE STUDY: STRATEGY, SITES, AND METHODS

In this chapter, the analysis moves from the general to the particular. It shifts from a consideration of national flood problems to the floods of Big Creek at LaFollette, Tennessee. It moves from hypothetical decision makers to the actual decisions of 110 persons residing or working in LaFollette.

The research strategy called for a major study at LaFollette, supplemented by a series of reconnaissance studies at Aurora, Indiana; Darlington, Wisconsin; Desert Hot Springs and El Cerrito, California; and Watkins Glen, New York. Descriptions of some relevant geographic, social, and economic factors for each area follows, along with details of study method including the extended, intensive, interview.

The Strategy of the Study

As originally conceived, the study was viewed as complementary to a series of related studies undertaken by the Department of Geography of the University of Chicago to examine the practicability of various alternative adjustments to flood hazard. It would continue the probe of attitudes, knowledge, and experience begun in the Roder and Burton studies, and it would attempt to compare these attitudes with those held by technicians and scientists better informed as to flood hazard.

The strategy of these combined investigations called for two sets of simultaneous field observations. Establishments[1] in the flood plain would have potential flood damages assessed under a variety of assumptions. At the same time intensive interviewing

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[1]The terms establishment and managers follow the scheme of White, Natural Resource Journal, p. 25. In this study an establishment is a ground floor, functional land-use unit such as a residential, business or public and quasi-public structure and its surrounding lot. Structures occupied by a number of separate functional units are designated as a separate establishment for each use and the lot is pro-rated among the establishments. Businesses that occupy several structures form only one establishment. The set of flood plain establishments forms the universe of the companion study cited in n. 2, page 30.

of the managers[1] of flood-plain land would help establish measures of their knowledge, experience, attitudes, and responses towards flood hazard. The damage data provide the core material of the companion study;[2] the interviews the core of this study.

The area for the major study site was chosen on the basis of the following criteria: (1) hydrologic, topographic, and engineering data had already been developed for the site; (2) the number of establishments on the flood plain was small enough to permit a complete damage inventory to be made as well as to provide a variety of land use; (3) the site had little prospect of receiving protection from a flood control project;[3] (4) responsible local leaders in the study area were willing to provide needed cooperation.

The net effect of these criteria was to center the choice of site on the Tennessee Valley where the Tennessee Valley Authority had already developed the extensive supplementary technical data required. Further application of the criteria, particularly variety of land use and the negative prospect for protection

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[1]The managers in this study are, for residential establishments, the actual residents, be they owners or renters; and for commercial establishments, the owner or manager of the business occupying that structure. (Managers of public or quasi-public establishments have been grouped with commercial managers throughout the study.) The set of flood plain managers forms the universe of the respondents for the interviews conducted for this study.

[2]The companion study is that study that was designed by Gilbert F. White to examine the practicality of various alternative adjustments to flood hazard. The data of that study including its compilations of the best technical and scientific knowledge relevant to flood hazard at each site as well as its detailed expert judgments provide in part the standard against which the knowledge and judgments of the interviewed managers are measured. In turn, the writer will subject the "expert" standards to abstract tests of the reasonableness and reliability of its assumptions.

By being part of the study group, the writer had the unique (albeit occasionally schizophrenic) experience of observing and making "expert" technical judgments and at the same time comparing these decisions to those made by managers interviewed in the field.

The companion study will appear as a University of Chicago Department of Geography Research Paper tentatively entitled Choice of Adjustment to Floods.

[3]The thinking behind these criteria is fairly self-evident except for the requirement of a site not having protection in prospect. The reasoning in this case went something like this: It has been long observed that flood prone communities have a great deal of difficulty in giving serious attention to alternative measures of flood damage reduction when either awaiting or requesting federal flood protection works. Further, some alternatives are most applicable only where conventional engineering works cannot satisfy a test of economic feasibility. Since the focus of the study is primarily on alternative measures, it was felt that more might be learned in a situation where engineering works were not likely to be installed.

narrowed the study site to LaFollette, Tennessee.

The reconnaissance sites were chosen to provide a wide range of situations of climate, land use, flood hazard, and adjustment in which to compare the damage and attitude data from LaFollette.

Study Sites: The LaFollette Area

Geographic and economic characteristics.--LaFollette, Tennessee (est. 1961 pop. 7,200)[1] lies at the base of the Cumberland Plateau some forty miles north of Knoxville. Cumberland Mountain towers 800 feet above the town, pierced only by the gap of the Big Creek, whose flood plain is the focus of this study. The Big Creek drainage basin (26.2 square miles) is "T" shaped, with the horizontal member formed by the junction of Big Creek and Ollis Creek just above the gap. The combined stream then turns sharply right and emerges through the gap to flow across the grain[2] of LaFollette to its junction with Norris Reservoir just below the town. Its flood plain is the major area of level land in a town marked by the low parallel ridges, so characteristic of the area.

LaFollette was laid out in 1892 by Harvey M. LaFollette, whose foundry was a principal source of income until its closing in 1923.[3] With an economy intimately related to the declining coal industry, the city has been the center of a depressed area for many years. Since the early 1950's unemployment has been chronic (11.2% in 1960)[4] and the present opportunities are mainly limited to shirt-making plants (primarily employing women) and the trade activities of LaFollette as the major town in Campbell County. Although the center of a county of out-migration (net loss of population 18.7% in the 1950-60 decade),[5] LaFollette

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[1]Estimated by writer and includes area annexed after 1960 census.

[2]The predominant trend in this section of the ridge and valley province is northeast-southwest.

[3]LaFollette Municipal Planning Commission, LaFollette Land Use Survey and Analysis (Knoxville: Tennessee State Planning Commission, 1961), pp. 5-6.

[4]U.S. Bureau of the Census, U.S. Census of Population: 1960 General Social and Economic Characteristics, Tennessee, Final Report PC (1)-44c (Washington: Government Printing Office, 1961), p. 202.

[5]U.S. Bureau of the Census, U.S. Census of Population: 1960 General Population Characteristics, Tennessee, Final Report PC (1)-44b (Washington: Government Printing Office, 1961), p. 28.

itself showed a large increase in population due to rural in-migration from farms and mining camps and a recent annexation which added an estimated 926 persons to the population.[1]

Social characteristics.--One outstanding characteristic of the population of LaFollette appears to be homogeneity. (Comparative data on age, education, income, and employment status can be found in Table 4.) The impression formed by the study group who worked in LaFollette was that this white, Anglo-Saxon, Baptist community was as homogeneous a community for its size as one might find in the United States.

Compared to the national population, the people of LaFollette are, on the average, substantially older, poorer (and unemployed), and less educated than the mean of their fellow Americans.

LaFollette is governed by a five-member City Commission, one of whom serves as Mayor. Other governmental agencies potentially involved in aspects of water management are the LaFollette Municipal Planning Commission which works in conjunction with the Tennessee State Planning Commission, the Board of Public Utilities which manages the municipally owned water and electric systems, and the Campbell-Claiborne Counties Area Redevelopment Committee which is the designated agency working with the Federal Area Redevelopment Administration.

The future prospects for LaFollette.--The future of LaFollette, considered in the light of historical trends, is not particularly bright. One of the first areas to qualify under the Area Redevelopment Act, the net impact of federal aid is uncertain.[2] Population in-migration has probably reached its peak, the fertility ratio is low,[3] and the experience in attracting industry is not encouraging. Present efforts at industrial development have brought low wage, female labor-oriented industry and this trend will probably continue. LaFollette can provide a satisfactory future for its present ageing population, but with its poor schools and lack of amenities, it has not been able to retain its young people, whose infusion of vigor is a necessary if not sufficient condition for growth.

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[1]Estimated by East Tennessee Office, Tennessee State Planning Commission.

[2]At present 110 area workers are being retrained in vocational trades and federal aid for water supply and sewage projects has been granted. To the writer, it is dubious if measures of this type can solve any of the area's basic problems, but they can make LaFollette a more pleasant place in which to live.

[3]U.S. Bureau of Census, PC (1)-44b, p. 27.

TABLE 4

SELECTED POPULATION CHARACTERISTICS OF LAFOLLETTE AND UNITED STATES[a]

Characteristic	U.S.	LaFollette		
		Total	Commercial Respondents	Residential Respondents
Age:				
% Heads of household:				
Age 45 or greater	53.9	n.a.[b]	65.1	76.3
Age 65 or greater	16.7	n.a.	10.1	28.9
Education:				
% Heads of household:				
0-8 years school completed	41.2	67.8	14.7	70.2
9-12 years school completed	41.1	19.5	43.0	24.4
13 or more years school completed	16.5	12.3	41.2	5.4
Income:				
% Families with:				
Less than $2,500	26.1	33.7	3.2	72.1
Less than $4,000	41.1	56.6	17.4	83.1
Less than $6,000	63.8	74.6	31.6	97.0
Less than $10,000	89.5	95.1	70.8	100.0
Employment:				
% Heads of household:				
Retired from labor force.	n.a.	43.1	....	47.4
Unemployed	n.a.		....	13.2
Employed	n.a.	56.8	100.0	39.5
Household size:				
Mean number of persons ..	3.35	3.44	....	3.25

[a]Data are not strictly comparable as they include time periods ranging from 1957-61 and are derived from a variety of sources including: Donald J. Bogue, The Population of the United States (Glencoe: The Free Press, 1959); U.S. Bureau of the Census, U.S. Census of Population: 1960 (Washington: Government Printing Office, 1961); LaFollette interview data by author and associates.

[b]N.a.--not available.

Flood problems of LaFollette.--The city limits of LaFollette are located a stone's throw from a major reservoir, Norris Lake, of one of the more regulated rivers in the world. It is thus grimly ironic that LaFollette is plagued with the whole gamut of water management problems including floods, drought, and the continuous pollution of Big Creek.

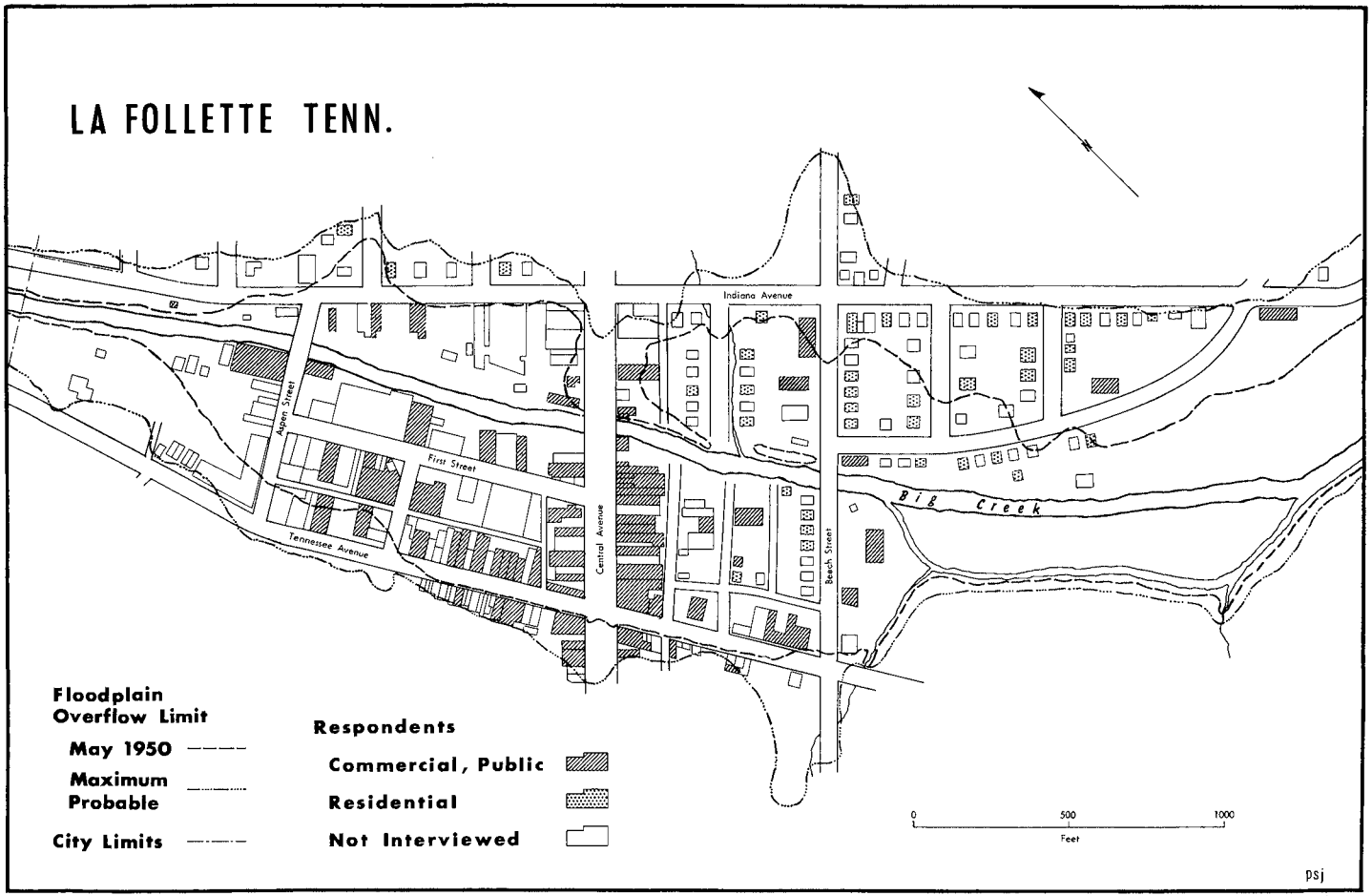
LA FOLLETTE TENN.
Indiana Avenue
Aspen Street
First Street
Tennessee Avenue
Central Avenue
Beech Street
Big Creek
Floodplain
Overflow Limit
May 1950
Maximum
Probable
City Limits
Respondents
Commercial, Public
Residential
Not Interviewed
0
500
1000
Feet
psj

Fig. 2

In the last ninety years for which some record is available, Big Creek has severely flooded twice; March 23, 1929 and May 11, 1950.[1] The flood of 1929 was the higher, but increased development of the flood plain caused the flood of 1950 to be the more damaging. The TVA estimated damages at the time to be $97,000. The constricted arch bridge on Central Avenue increases the natural effects of floods, causing an estimated 5.5 feet of heading in 1950. Floods rise rapidly off the steep slopes of Cumberland Mountain with the rate of rise in 1950 estimated to have been three feet in forty-five minutes at the upper end of town.

In addition to the flood plain inundated by the 1929 and 1950 flood, the TVA has defined overflow areas for floods that have not occurred but might be reasonably expected to occur in the future. The method used to calculate such floods will be described in the following chapter.

The largest of such future floods is called the maximum probable flood. It is defined as that flood that might be reasonably expected to occur as the result of storms that have occurred previously in the LaFollette region or might be expected to occur in the region.

The area subject to such an overflow is the working definition of flood plain[2] in this study, and is shown on Figure 2.

Land use in the flood plain.--On the Big Creek flood plain is found the greater portion of LaFollette's commercial and industrial establishments, but only a fraction of its residential establishments (see Table 5).

Most of the 87 residential structures are small frame buildings without basements. Three-fourths of these are owned outright by the residents; a fifth are without bath facilities, and two-fifths were classified by the study group as deteriorated or deteriorating. There is no statistically significant difference between the quality and variety of housing available on and off the flood plain, although there is a complete absence of high income housing on the flood plain.

Three-fourths of the business structures are over twenty years old. Brick buildings with basements predominate. There has

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[1]Flood data are from Tennessee Valley Authority, Division of Water Control Planning, Floods on Big Creek at LaFollette, Tennessee (Knoxville: Tennessee Valley Authority, 1958).

[2]For discussion of other possible flood plains, see Robert W. Kates and Gilbert F. White, "Flood Hazard Evaluation" in Papers on Flood Problems, pp. 138-142.

been some remodeling in the business district, and if it does not present an outward appearance of overall prosperity, neither does it have the shabby decaying look that one might associate with a chronic depressed area.

TABLE 5

LAFOLLETTE ESTABLISHMENTS, BY TYPE AND FLOOD HAZARD

Type	Subject to Hazard of				Total in City
	1950 Flood		Maximum Probable Flood[a]		
	Number	Per Cent of City	Number	Per Cent of City	Number
Commercial, industrial, public, and quasi-public	82	31.2	150	57.0	263
Residential	11	0.6	87	4.4	2,000[b]

[a]Includes establishments subject to 1950 flood.

[b]Estimated, other figures enumerated.

The residential establishment managers.--The residential flood plain area, primarily below the Beach Street Bridge, is home for some 320 persons. They are older, poorer, and less educated than their fellow LaFollette citizens. (See Table 4.) Consistent with the age of its head, the average household is considerably smaller than for LaFollette as a whole.

To the outsider, the flood plain area is not particularly attractive. The area is damp and the creek, an open sewer, is odoriferous. However, it would appear from the interviews that to its inhabitants, by and large, it is a satisfactory place in which to live.

The total shelter bill for over 75 per cent of the households in the flood plain was under $50 a month and flood plain location provides quick access for the aged population to the central business district and the doctor's office. Living anywhere else in LaFollette would involve some hill climbing and several of the older respondents cited the advantage of residing on level land.

For a dissatisfied minority the flood plain, with its odors and dampness, proved quite unattractive. For the dissatisfied whose outlook for the future was optimistic, residence on the flood plain was temporary, until something better came along.

For those few, who because of unemployment or inertia saw themselves without alternatives, continued flood plain residence augered a noxious and bitter future.

The commercial establishment managers.--The managers of the commercial establishments in LaFollette represent the elite of the town. From their ranks come all the city officials and members of the various boards, the pillars of the churches, and the organized leadership of all types. They are wealthier and better educated than their fellow citizens and somewhat younger than the residential managers. (See Table 4.)

These commercial managers engage in a range of business types consistent with those that are generally found in a town of LaFollette's size and trade area.[1] Three distinctive local features of doing business that were observed are: (1) Higher rates of inventory turnover than the average for towns of the size of LaFollette were found in a number of businesses. (2) Quite distinctive to LaFollette, and not to nearby towns, were the Saturday merchandising practices of street displays and sidewalk greeting of potential customers. (3) A grocery row of five establishments is clustered along one block of Tennessee Street.

Despite the chronic unemployment, businessmen were by-and-large optimistic. Since 75 per cent of them had been in business over ten years, and given the lower failure rates for that class of business,[2] their optimism would appear to be confirmed by their experience.

The interviews also indicated a strong desire (30 per cent) for relocation, preferably along the main highway south of town. In all cases, such desire was associated with space needs, parking problems, and the like, rather than response to flood hazards.

Contrast between commercial and residential managers.--The commercial and residential managers represent opposite poles of a localized continuum.[3] As an impression of the study group, the two groups of managers might be placed on opposite ends of the power

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[1]The expectation of business types given a size of town and trade area is from Brian J. L. Berry et al., "Retail Location and Consumer Behavior" to be published in Papers and Proceedings, Regional Science Association, Vol. VIII (1962).

[2]In 1960, of 7,386 retail business failures in the U.S. only 16.3% were firms in business over ten years. U.S. Bureau of the Census, Statistical Abstract of the United States: 1961 (Washington: Government Printing Office, 1961), p. 497.

[3]In terms of absolute difference, the length of such a continuum would be considerably less than that of the average of towns of this size.

structure, and of another imaginary continuum labeled social energy. If there are latent well-springs of social energy in LaFollette, it is monopolized by the business community. On the other extreme, old and retired, or prematurely retired by the vicissitudes of an ailing industry, are the flood-plain residents. They appear to be content to bestir themselves little, and to last out their days in a resigned, but quietly dignified manner.

Study Methods in LaFollette

Two sets of observations were made in LaFollette; the damage measurements and the intensive interviews.

The damage observations will be described in detail in the companion study, and the interviews will be described here.

The pre-interview data.--By the time one of the interviewers entered an establishment in LaFollette, a number of things had already occurred. The prospective respondent had been informed by letter of the interviewer's coming and this had been reinforced by local publicity in the LaFollette Press. The reason given for the interview was that it was to aid "a study in urban geography . . . in order to learn more about the ways in which land and buildings are used particularly in areas adjoining Big Creek." There was no mention of floods or the flood plain as such, as a test of flood hazard concern was included at the beginning of each interview.[1]

If the manager of an establishment was particularly busy, an appointment had been secured in advance. The study group had no difficulty securing responses and there were only two cases of antagonism preventing completion of interviews.

The interviewer was also prepared with pre-calculated elevations for every establishment giving the floor level and the heights of various size floods. In some cases, preliminary estimates of the size of inventory had been made as well as an assessment of the value of the house and furnishings. Finally, the interviewer had a sixteen-page questionnaire whose content varied depending on whether a commercial or residential manager was being interviewed.

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[1]At the outset, ten of the commercial managers learned the full purpose of the study in their roles as local officials. The study group had been quite candid with them in order to secure the needed local cooperation. As the study progressed, it became more widely known that the study was related to floods. Questionnaires were checked against increasing knowledge of the study's purpose and there appeared to be little difference in the answers received. There were few respondents evidencing a high "flood hazard concern" and these showed little sign of inflating their concern in response to some interest that they might have attributed to the interviewers.

The interview.--The questionnaire was loosely structured. The emphasis in the interview was placed on probing and understanding the respondent's answers rather than the uniform administration of interview schedules.

However, certain tests such as those dealing with concern for flood hazard and with flood frequency computation ability were administered in comparable fashion. A few questions were given priority and others were left to the interviewer's judgment during those interviews where time or the respondent's patience appeared limited.

The substantive material of the questionnaire is outlined in Table 6, and the complete interview for commercial managers is shown in the Appendix. Questions used in the supplementary reconnaissance studies are also indicated and their use is described in the following section.

The interview ranged from thirty minutes to an hour and a half, with the median interview taking forty-five minutes. Another thirty minutes were spent in inspecting the premises for the damage measurements. Including the damage calculations and interviewer's notes, an average of three hours were expended on each interview. Interviewers averaged three interviews per day. In all, 241 damage observations and 110 interviews were obtained by the five-person study group in eight weeks (see Fig. 2).

Preparations for the interviewing included pre-testing the questionnaire in the flood plain of the Little Calumet River in northwestern Indiana; jointly conducted interviews in LaFollette followed by comparative evaluations; and constant comparative discussion throughout the study. While there was evident the traditional bugaboo of comparability, exacerbated by the nature of a loosely structured interview, the findings do not rest solely upon the statistical testing of uniformly obtained answers. They depend heavily upon the understanding of behavior obtained by the interviewers as the day-to-day responses to the questionnaires were discussed and analyzed.

The Reconnaissance Studies: Strategy, Sites and Methods

Strategy and methods.--The reconnaissance studies extended the insights developed at LaFollette to a variety of situations in other parts of the country. The reconnaissance studies provided a range of flood hazard in areas with differing socio-economic characteristics. At each site answers were sought to the following questions: (1) Are the damage estimation methods developed in LaFollette applicable elsewhere? (2) How does information and

attitudes towards flood hazard vary from those held by the managers in LaFollette?

TABLE 6

TYPES OF DATA COLLECTED IN THE INTERVIEWS

Type of Data	Type of Interview		
	Commercial	Residential	Reconnaissance[a]
Structure			
Description of structure	x	x	x
Tenure, rent, mortgage	x	x	x
Attitudes to structure	x	x	..
Location			
Description of location	x	x	x
Attitudes to location	x	x	..
Business			
Type and size of business	x	..	x
Time horizon for business	x	..	x
Attitudes to business	x	..	..
Respondents			
Family data	..	x	..
Head of household data	x	x	x
Attitude towards fate and planning	x	x	..
Personal time horizons of respondent	x	x	..
Church and club membership	x	..	..
Communication and discussion channels	x	x	..
Socio-economic data	x	x	x
Floods known about or experienced.	x	x	x
Attitudes towards floods and flood hazard	x	x	x
Alternative adjustments to floods			
Adjustments installed and perceived	x	x	x
Evaluation of alternative adjustments	x	x	x

[a]Partial data only.

The first question is the property of the companion study. To answer the second question flood plain managers at each site were sampled and interviewed with a series of questions abstracted from the standard questionnaire (see Table 6). These were so designed to provide the needed comparability on certain key questions of attitudes, socio-economic, and structure data.

The reconnaissance sites.--The location and general appearance of the reconnaissance sites is shown in Figure 3. A brief description of each site will conclude this chapter.[1]

Aurora, Indiana.--Aurora (1960 pop. 4,119) provides the opportunity of observing in a town with a long history of flooding (73 floods in 129 years) and an absence of protective works the types of adjustments made to a well-known hazard.

It is built on a small terrace of the Ohio River and Hogan Creek, some 26 miles below Cincinnati, Ohio. Aurora is an old river town, whose industries no longer require riverine access. Her population has been declining although neighboring areas, as part of the Cincinnati metropolitan area, have seen considerable industrial expansion.

Within the flood plain inundated by the 1937 flood of record (with depths of up to thirty feet) are the bulk of Aurora's industrial and commercial establishments and a considerable number of residences.

Darlington, Wisconsin.--Darlington (1960 pop. 2,347) like Aurora has frequent flooding, but with modest growth providing pressure to expand into an undeveloped portion of the flood plain. Attitudes to flood hazard are complicated by the existence of a P.L. 566 watershed protection project that includes the town.

Darlington lies in a bend of the Pecatonica River in southwestern Wisconsin. The flood plain narrows through the city averaging not more than six hundred feet in width.

It is the county seat of a prosperous farming area. About half of its business section and a dozen residences lie in the flood plain.

Floods are frequent from the 275 square mile drainage area, the most recent being in 1961. The 1950 flood of record inundated some of the business establishments to depths of 8-9 feet.

Desert Hot Springs, California.--Desert Hot Springs (estimated pop. 3,800) combines the situation of a rapidly expanding residential community and the highly erratic flooding of an arid area.

The town is located on an alluvial fan on the slopes of the Coachella valley, 10 miles north of Palm Springs. There is no manufacturing industry in this resort town and community for retired "senior citizens." The average yearly rainfall is four inches a year. Floods are flash floods, products of intensive highly localized rainfalls that produce in minutes heavy masses of

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[1] More detailed descriptions will be found in the companion study.

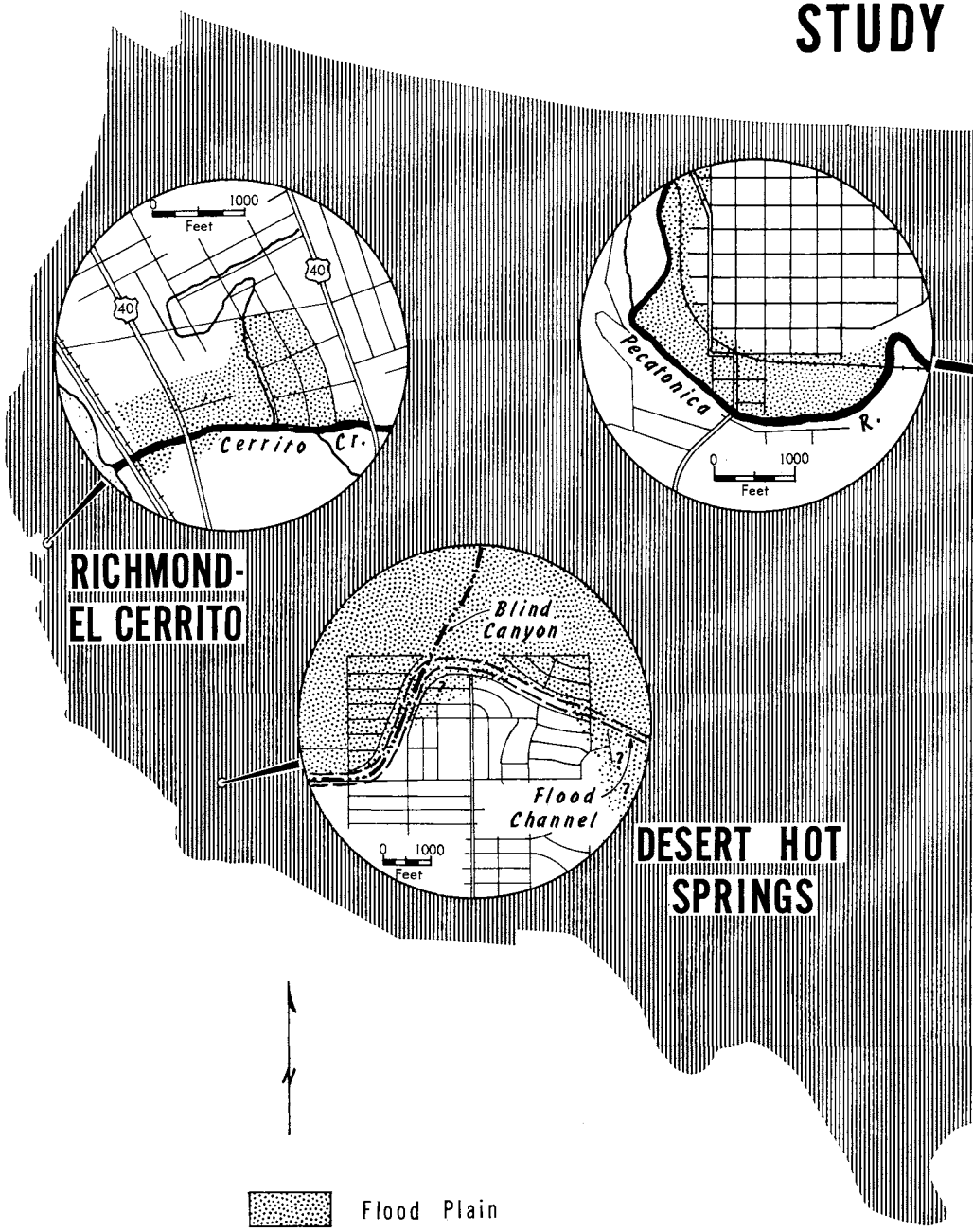
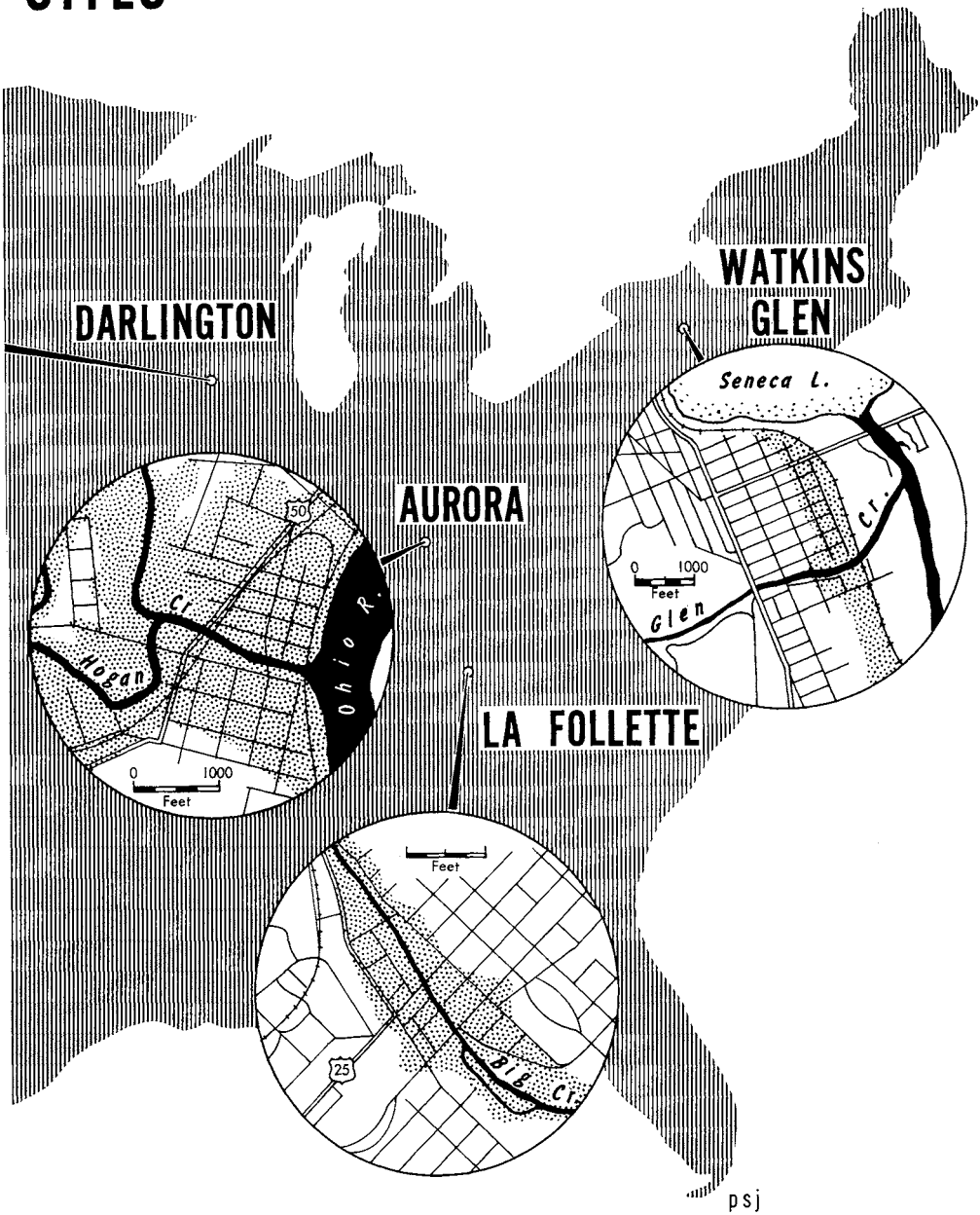

STUDY
0 1000 Feet
40
40
Cerrito Cr.
RICHMOND-
EL CERRITO
Pecatonica R.
0 1000 Feet
Blind Canyon
Flood Channel
0 1000 Feet
DESERT HOT SPRINGS
N
Flood Plain

Fig. 3

SITES


DARLINGTON
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Ohio R.
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25
Big Cr.
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sediment pouring down the steep ravines and out onto the alluvial fan. These floods are extremely erratic, and vary in intensity, location, and time of year, although they often occur in the summer.

Desert Hot Springs is expanding at a heady pace from its original square mile. Partial protection exists in the form of a flood channel to pass flows from the mouth of Blind Canyon, but development is placing a growing number of residences in the path of potential floods from other dry washes.

Cerrito Creek, California.--Cerrito Creek presents a familiar flood situation of a small watershed in a suburb of a major metropolitan area subjected to moderate but steady pressure of flood plain utilization.

The Creek rises in a three-square mile drainage area in the Berkeley hills on the east shore of San Francisco Bay. Its lower 3,000 feet overflows onto a 55-acre plot which is divided into an industrial area in the city of Richmond (1960 pop. 71,854) and El Cerrito (1960 pop. 25,437).

The flood plain includes three large industrial sites, four smaller industrial plants, some 17 apartment buildings (14 of recent vintage), and a 10-acre vacant tract. The 1958 flood of record placed two feet of water in the industrial area. A preliminary Corps of Engineers benefit-cost study rejected a program of protective works for the Creek. There has been some local channel clearing and diking, the efficacy of which is doubtful, and in any case limited.

Watkins Glen, New York.--Watkins Glen (1960 pop. 2,813) provides a complicated flood hazard picture, having experienced a flood greater than the maximum probable flood and ostensibly protected by channel improvements likely to fail but at an uncertain time and place.

Located at the head of Seneca Lake, largest of the finger lakes of western New York State, Watkins Glen is traversed by Glen Creek which emerges from a magnificent canyon site of a state park.

The 1935 flood of record covered most of the town but was the product of an unusual impoundment and surge and is not likely to be repeated. A definition of the flood plain is further complicated by the existence of protective works in the form of an artificial channel works, however, that, in the considered opinion of the Corps of Engineers, are subject to partial or complete failure. In the flood plain that might be inundated by a total failure of protective works are some 73 structures, all but one being residential or residential structures converted to commercial use.

The population is steadily declining and needed improvements on the channel fail to show a favorable benefit-cost ratio.