FALLOUT SHELTER COMMUNICATIONS STUDY

Submitted to

OFFICE OF CIVIL DEFENSE - DEPARTMENT OF DEFENSE

Contract No. OCD-OS-62-123

December, 1962

By

GAUTNEY & JONES
CONSULTING ENGINEERS
WASHINGTON, D. C.

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PREFACE

In connection with the national fallout shelter program, the need was evidenced to design a fallout shelter communication system which would meet the communication requirements of shelter management and of the sheltered populace itself. The principal problem then was to identify the essential communication requirements; i.e., the information exchanges required to manage and sustain the surviving populace, and propose a communications system that would fulfill these requirements.

The present study addresses itself to this problem in the form of a prototype investigation using Montgomery County, Maryland, as a representative community.

ACKNOWLEDGMENTS

Substantially contributing to this study were two consultants, Dr. Albert Somit, Professor of Public Administration, New York University, and Dr. Charles Hyneman, Indiana University. Their suggestions and advice relative to the preliminary drafts of the study and as well as their editorial assistance were most useful.

We are particularly indebted to Mr. Charles E. Fritz, Institute for Defense Analyses, Washington, D. C., who reviewed the draft, furnishing specific suggestions and criticisms which were especially helpful. Special credit is also due to Mr. Henry Brown, Office of Civil Defense, Washington, D. C., and to RADM G. Roy Hartwig, USN(Ret.), Deputy Director of Civil Defense, Montgomery County, Maryland, who reviewed the manuscript with ensuing helpful comments.

During the course of the investigation, useful discussions were held with Dr. Roy Gunter, RCA, Burlington, Massachusetts; Mr. Emil Bend, American Institute for Research, Pittsburgh, Pennsylvania, Dr. George Baker, National Academy of Sciences–National Research Council, Washington, D. C.; Mr. Laurence Siegel, RCA, New York, New York; Dr. Benjamin Weybrew, Naval Medical Research Laboratory, New London, Connecticut; Mr. William Warren, System Development Corporation, Santa Monica, California; and Motorola Representatives, Chicago, Illinois.

In connection with technical matters relating to the leased telephonic network, Mr. Horace Hampton, Director of Government Communication Services, and Mr. Robert Benson of the Chesapeake and Potomac Telephone Company provided valuable information.

CHAPTER I

INTRODUCTION

1.1 Statement of the Problem

The proposed shelter communication system described in this report is in response to the negotiated contract No. OCD-OS-62-123 between Gautney & Jones, Consulting Engineers, and the Office of Civil Defense of the Department of Defense.

As set forth in Article I of the contract the scope of work is as follows: A study is to be conducted which shall define and determine the intra and inter-emergency shelter information requirements and suggest ways and means of meeting them which can be embodied in preattack shelter plans. In so doing the following tasks are to be undertaken:

A. Identify the types and volume of information the shelter communications system must carry.

B. Determine time requirements to transmit, receive and relay representative types of shelter messages.

C. Identify the nature of a feasible intra and inter-shelter communications network which will include such installations as equipment, power, radio wave lengths and procedural requirements.

D. Investigate currently available communications resources in representative communities and identify feasible means of their utilization under emergency shelter conditions.

E. Analyze preferred methods of integrating individual shelters, shelter sectors, shelter districts, communities, regions, State and Federal shelter systems into a total shelter communications network.

F. Analyze cost and effectiveness of the various proposed solutions.

G. Suggest new design requirements which might improve proposed solutions.

1.2 Assumptions

The determination of shelter communication requirements and the ways and means to fulfill them have been carried out under a set of assumptions, arrived at after due consideration of the terms of the contract and discussions with Office of Civil Defense officials. These assumptions, while not suitable for some conceivable attack situations, are believed valid for those situations thought most likely to be encountered.

The primary assumption for this study is that of a fallout condition only, wherein the entire community is sheltered in fallout type shelters and is not subjected to blast and thermal effects. Further, the sheltered population is to be confined for a period of approximately two weeks, after which time the radiation levels are presumed safe for entry into the post-attack environment. It is fully realized that this assumed period of confinement will vary as to the circumstances of fallout intensity. Assuming, however, a full-scale thermonuclear war with many ground bursts, and extensive fallout, two weeks is a reasonable average time period.

The communication network to be established insofar as this study is concerned is that dealing with the population and county government of Montgomery County, Maryland, in the form of a prototype investigation. This community was chosen principally because it possesses both urban and rural characteristics and thus lends itself to reasonable comparisons with other communities, whether urban or rural. The urban population is substantial, and being adjacent to the city of Washington, D. C., is further representative of metropolitan communities. Finally, the County has an active civil defense program (including plans for the construction of an underground Emergency Operating Center) the information from which was helpful in developing a shelter communication system.

From the basic assumption of fallout conditions only, a number of corollary considerations evolve, some of which will be noted immediately and others in conjunction with later discussions. It is important to emphasize here that the study deals with a problem that has never been experienced, and envisions shelter communication and management systems that have never been tried. Insofar as practicable, the proposed system has included the existent and planned communication and civil defense facilities of Montgomery County. It is also assumed that the fallout community shelter capacity will be sufficient to shelter the approximately 350,000 people of Montgomery County, although it is recognized that, at the present time, only a fraction of the population can be sheltered in government approved and adequately stocked shelters.

Circumstances controlling this investigation made it appropriate to devise a communication plan and network for approximately 700 shelters of 500 population units each. Rarely, of course, would there be such a distribution, since many shelters would house considerably more people and others considerably less. Unless, however, the deviations from 500 people per shelter are unusually great, the proposed inter-shelter communication system would remain applicable, subject to appropriate modifications necessary only for intra-shelter communications.

In connection with the basic assumption, it is also assumed that warning of the nuclear attack will be sufficient for the population to reach individual shelters. Ideally a vital part of a nation-wide fallout shelter program would be a program of shelter assignments wherein under normal circumstances each individual would, upon warning, go to his respective assigned shelter. For example, school children would remain in schools (ideal if schools are fallout protected); mothers would go to the nearest neighborhood shelter; and fathers and other workers would go to shelter nearest their place of business. For night-time attacks, plans should provide for increased capacity for surburban shelter sites. In this study a daytime, weekday school year period has been chosen as the time for a nuclear attack. If an attack occurred during such a period it would probably maximize the demand for communication facilities, particularly with respect to family separation.

Even under the foregoing ideal shelter arrangements, numerous problems of shelter-taking would arise, including cases where people refuse to take shelter and possible instances of panic behavior. This investigation, however, assumes that these and other problems incident to taking shelter would be relatively minor. With respect to the system of pre-designated shelter assignments, it is also assumed that there are sufficient cadres of trained shelter management personnel in most of the shelters to assure effective

discharge of the command and control functions necessary to implement and operate the proposed shelter communication system.

Finally, it is recognized that it will be necessary for some County government functions to be performed outside the shelters during the two-week confinement. Such acitivity would be restricted to limited periods because of the hazards of radiation exposure and thus would likely take place during the middle and latter portions of the two-week period. Assuming, for example, a one-time attack with an ensuing initial 3000 roentgen/hour dose rate at one hour uniformly distributed over Montgomery County, some activity (e.g., the control of a fire) could take place outside the shelters after about two days, when the dose rate would have decreased to one-hundreth of the initial intensity (to 30 roentgens/hour). After the second day and until the 14th day the roentgen count would decrease from approximately 30/hour to 3/hour. This assumption of limited, directed operations outside shelters is an important one, as will be observed in the later discussion on the types and volume of information the shelter communications system must carry.

As previously mentioned, other assumptions incident to the investigation will be noted carefully in the course of this study. The overall problem of civil defense and the complex nature of the physical and social effects of a large-scale thermonuclear attack dictate the pressing need at all times to make clear the premises upon which the investigation is based.

1.3 Procedure for Problem Resolution

In the execution of the specific tasks enumerated earlier in the Statement of the Problem, the study has been conducted along three major lines of inquiry. The first of these has been an investigation of socio-psychological behavior associated with disaster and isolation situations and of communications requirements growing out of these situations. This phase of inquiry has included command and control considerations incident to management of population groups under conditions of severe psychological stress and the identification of functions relating to disaster recovery. The results of this work are discussed in Chapters III and IV as responses to Tasks A and B of the contract requirements.

The second and third lines of inquiry are very much interrelated and are concerned with the actual inter-shelter communications system network, designed to fulfill the communication requirements identified in Chapter IV, and the organization and management of the shelter communication system, respectively. This work is noted in Chapters V and VI and responds to Tasks C, D, E, and F. Intra-shelter communications are discussed in Chapter VII as a part of Task C.

Chapter II is a discussion of the general characteristics of Montgomery County, Maryland, and includes a description of its civil defense facilities. As the representative community chosen for the prototype study, the information contained in this Chapter should be useful for comparison with other communities with the view to determining the extent of modifications, if any, that may be required in the proposed shelter communication network. Chapter II responds in part to Task D. It is important to emphasize here that the communication, command and control concepts, which have been developed in formulating a fallout shelter communication system, are generally applicable to any community in the United

States. From a research standpoint, it was preferable to deal specifically with a known community rather than a fictitous one.

A summary and specific recommendations are outlined in Chapter VIII in response to Task G. Two appendices are included in this report as relevant supporting information.

CHAPTER II

MONTGOMERY COUNTY, MARYLAND—THE STUDY PROTOTYPE

2.1 Introduction

Since shelter communications cannot be divorced from the general body of Civil Defense operations, it is desirable to review briefly the demographic and geographic character of Montgomery County. These two considerations naturally strongly influence the nature and extent of Civil Defense activity in the County.

2.2 Geography and Topography of Montgomery County

Montgomery County is a part of the Washington, D.C.-Maryland-Virginia Metropolitan Area. It is partly bounded by the District of Columbia; and it is this contiguity with the District which determines, more than any other influence, the characteristics of the more populous areas of the County. On the East, Montgomery County is bordered by Prince Georges County which has similar characteristics. On the Northeast and Northwest, it is bordered by Howard and Frederick Counties which are predominantly rural in nature. To the Southwest, it is separated by the Potomac River from Fairfax County, Virginia, which is rapidly assuming the same metropolitan character. Farther to the Westward, it is separated by the Potomac from Loudon County, which is still largely rural in makeup.

The area of the County is 493 square miles. It is roughly rectangular in shape and is about 26 miles long (in a Northwest-Southeast direction) and about 22 miles in width. Topographically, the area is composed of low rolling hills. The elevation rises gradually in a northerly direction from practically sea level at the point where the District boundary intersects the Potomac to the Damascus area where the elevation approaches 1000 feet. There are no prominent land masses, deep valleys, or other marked terrain irregularities with the exception of bluffs at some places along the Potomac.

2.3 Population

The 1960 Census of the United States gave the County a population of close to 341,000. Of this number, less than 5 per cent are non-white according to the Census publications. By far the greater proportion of the population is concentrated in an area which does not extend more than 5 or 6 miles from the District line.

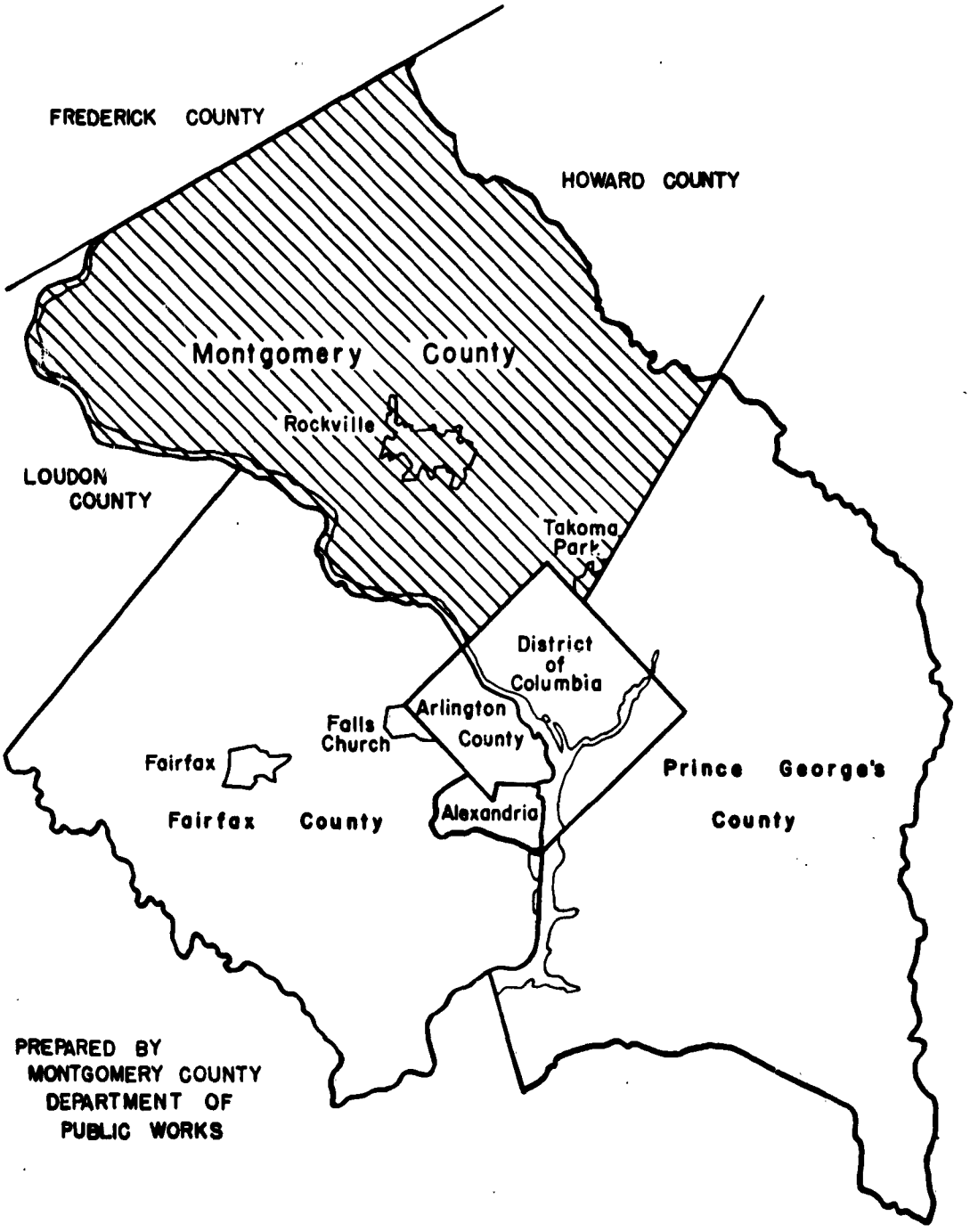
2.4 Government

Montgomery County has adopted the County Manager type of government. There are no significant departures from the usual urban-type city or county manager governmental setup. The government is vigorous and efficient, and there appear to be no important conflicts between the county administration and the elected officials.

2.5 Industry, Employment, and Fiscal

There has been comparatively little industrial development in Montgomery County although there are a number of light industrial (such as electronics) and research firms in the County. Of the 127,000

THE WASHINGTON METROPOLITAN AREA



STATE ROADS AND COMMUNITY LOCATIONS IN MONTGOMERY COUNTY, MARYLAND

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DEPARTMENT OF
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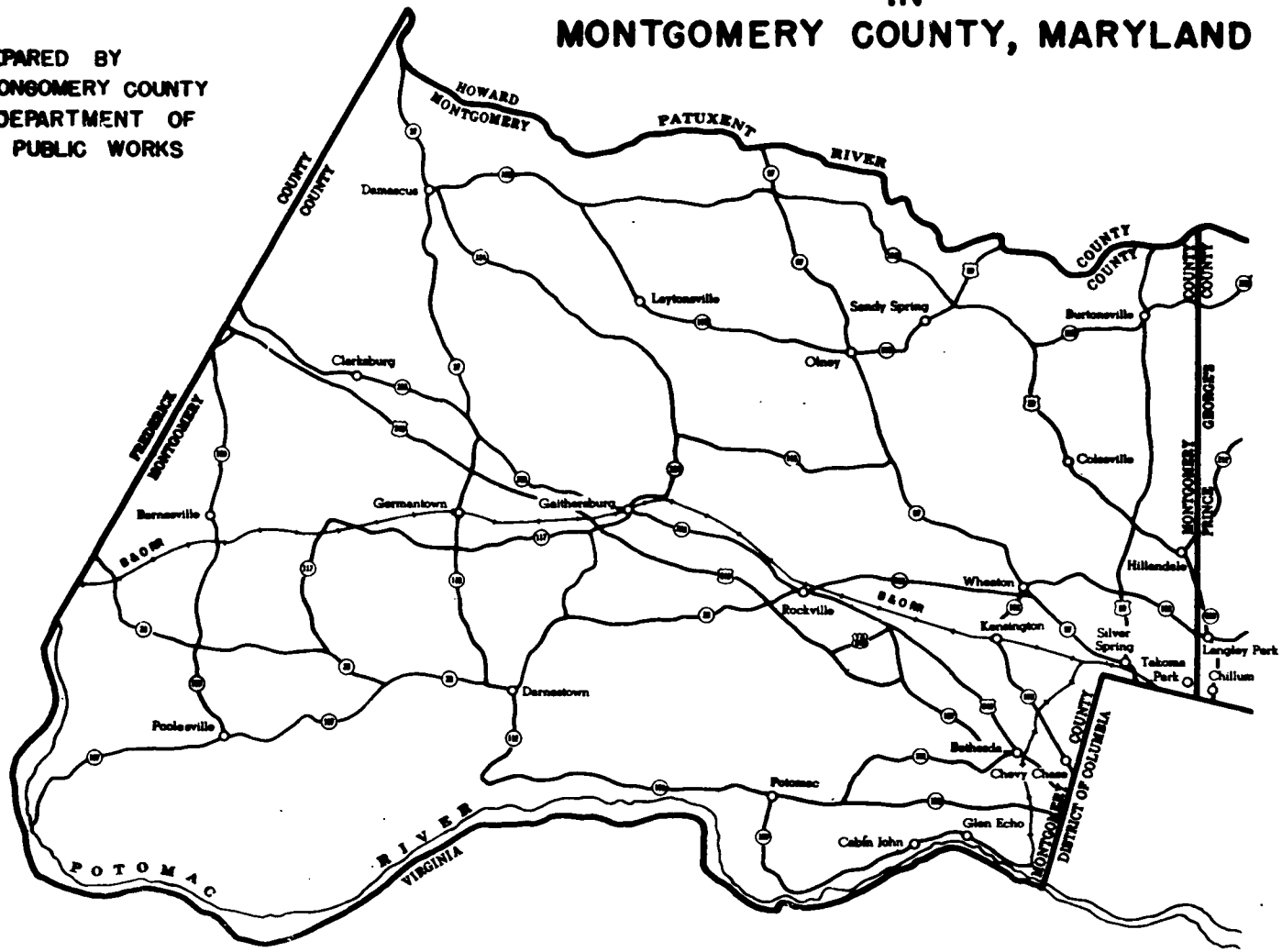

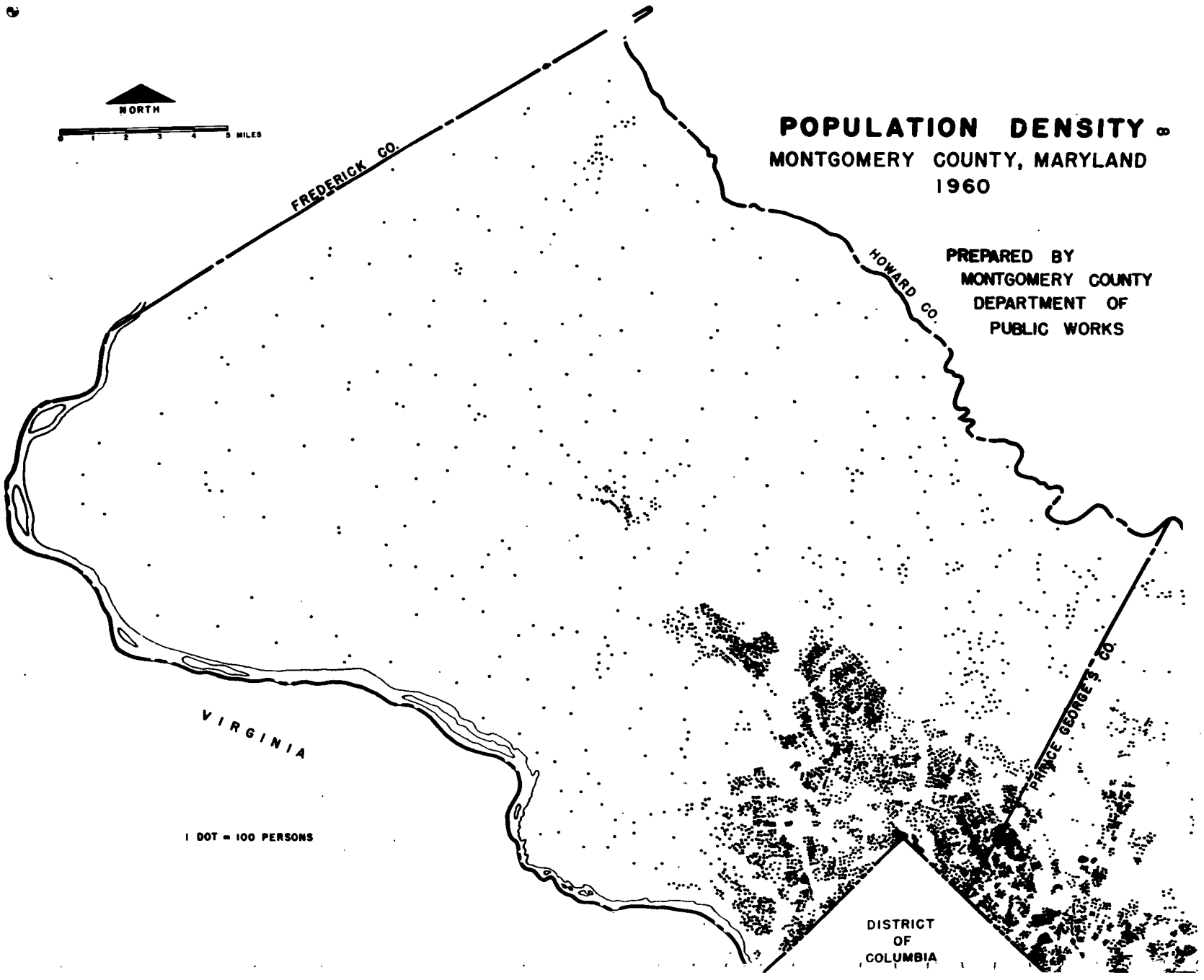

POPULATION DENSITY

MONTGOMERY COUNTY, MARYLAND

1960

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employed persons living in the County, the 1960 Census lists 43,000 as government workers. Of the remainder, 10,000 were employed by manufacturing industries, 16,000 by various retail trades, and 29,000 in public administration. Family median income for the County was high—$9,317 per year. Of the working population, 56,000 were employed in the City of Washington and another 56,000 in the County. Yearly expenditures by the County for all objects is in the neighborhood of $106,000,000(1960-1961).

The maps and tables on the following pages show graphically and in some detail the characteristics of Montgomery County summarized above.

2.6 Civil Defense in Montgomery County

Civil Defense in Montgomery County is administered by the Division of Civil Defense in the Department of Public Safety. The division has a full-time staff of six persons. This organization has been active, enthusiastic, and forward-looking.

Four years ago, Montgomery County Civil Defense became aware of the futility of the evacuation technique and began to advocate the use of shelters instead. It advocated to the County the establishment of fallout shelters in schools and has secured an OCD grant for the building of such a shelter in the Rocking Horse Road School (now under construction and to be ready in February, 1963). Upon its recommendation the County appropriated money for shelter construction in two more schools under the contemplated Federal Aid Incentive Program. It has carried out a public education program to the best of the ability of its limited staff with the result that probably 500 home shelters have been built. It has spearheaded the establishment of a communications center for the daily routine operations of the County at Rockville—and enough capacity to take on added Civil Defense requirements—in an underground blastproof shelter which can, if necessary, house the essential portions of the entire County Government.

The County Manager has primary responsibility for Civil Defense. The retention of this responsibility by him makes it possible to orient the entire County Government toward an active and efficient Civil Defense program. Indeed, the possibility of a nuclear attack affecting the County is regarded as merely another emergency which may have to be met by the County Government with its present resources (fire and police protection, etc.), together with added auxiliary personnel and material as required by the specific characteristics of a nuclear attack.

Among the additional personnel enrolled for Civil Defense are about 50 of the County's 800 Amateur Radio Service licensees. Members of the Civil Air Patrol are also enrolled for observation and communication duties.

The Deputy Director of Civil Defense, to whom the planning and implementation of the readiness program has been delegated by the County Manager, relies upon two basic sound policies. They are:

1. Encouraging the citizen to rely upon his own initiative in preparing for a nuclear attack emergency by building and stocking his own shelter and in training for the emergency.
2. Utilizing to the fullest possible extent existent County personnel and material resources to supplement and coordinate the individual citizen's efforts.

MONTGOMERY COUNTY ESTIMATED POPULATIONS BY ELECTION DISTRICTS AND VOTING PRECINCTS

TOTAL – ALL Districts		335,175
District 1 – Laytonsville (No Precincts)		1,715
District 2 – Clarksburg (No Precincts)		1,930
District 3 – Poolesville (No Precincts)		1,450
District 4 – Rockville		31,890
1st Precinct	2,640	
2nd Precinct	2,770	
3rd Precinct	3,235	
4th Precinct	5,240	
5th Precinct	3,290	
6th Precinct	4,975	
7th Precinct	5,630	
8th Precinct	4,110	
District 5 – Colesville		20,965
1st Precinct	2,945	
2nd Precinct	3,640	
3rd Precinct	4,290	
4th Precinct	5,890	
5th Precinct	2,700	
6th Precinct	1,500	
District 6 – Darnestown		2,235
1st Precinct	1,360	
2nd Precinct	530	
District 7 – Bethesda		94,280
1st Precinct	3,560	
2nd Precinct	2,090	
3rd Precinct	5,980	
4th Precinct	4,700	
5th Precinct	4,080	
6th Precinct	1,445	
7th Precinct	5,200	
8th Precinct	2,740	
9th Precinct	4,460	
10th Precinct	4,610	
11th Precinct	5,140	

District 7 – Bethesda (Continued)		94,280
12th Precinct	5,265	
13th Precinct	4,660	
14th Precinct	4,360	
15th Precinct	5,870	
16th Precinct	3,800	
17th Precinct	5,205	
18th Precinct	6,265	
19th Precinct	4,595	
20th Precinct	1,450	
21st Precinct	2,350	
22nd Precinct	2,510	
23rd Precinct	3,945	
District 8 – Olney		4,660
1st Precinct	3,215	
2nd Precinct	1,445	
District 9 – Gaithersburg		6,340
1st Precinct	3,500	
2nd Precinct	2,840	
District 10 – Potomac (No Precincts)		4,640
District 11 – Barnesville (No Precincts)		1,515
District 12 – Damascus (No Precincts)		3,700
District 13 – Wheaton		159,755
1st Precinct	4,080	
2nd Precinct	3,810	
3rd Precinct	5,100	
4th Precinct	1,555	
5th Precinct	5,230	
6th Precinct	1,415	
7th Precinct	1,760	
8th Precinct	2,080	
9th Precinct	2,600	
10th Precinct	4,780	
11th Precinct	3,995	
12th Precinct	4,650	
13th Precinct	3,850	
14th Precinct	4,380	
15th Precinct	3,650	
16th Precinct	4,260	
17th Precinct	4,470	
18th Precinct	3,655	

District 13 –Wheaton (Continued)		159,775
19th Precinct	4,390	
20th Precinct	2,545	
21st Precinct	1,990	
22nd Precinct	3,650	
23rd Precinct	4,920	
24th Precinct	2,910	
25th Precinct	2,970	
26th Precinct	4,460	
27th Precinct	3,690	
28th Precinct	3,690	
29th Precinct	5,780	
30th Precinct	5,340	
31st Precinct	5,350	
32nd Precinct	4,870	
33rd Precinct	2,570	
34th Precinct	3,120	
35th Precinct	4,550	
36th Precinct	4,230	
37th Precinct	3,350	
38th Precinct	3,335	
39th Precinct	2,325	
40th Precinct	3,630	
41st Precinct	3,295	
42nd Precinct	2,145	
43rd Precinct	2,920	
44th Precinct	2,410	

NOTE: The above estimated population figures were obtained by multiplying the number of registered voters per precinct (or district) by 2.3, which is the approximate ratio of total population to voters in Montgomery County, Maryland. Sources were the 1960 U. S. Census and the statistical compliation "Registered Voters in Montgomery County, Maryland, by District and Precinct as of May 15, 1962."

The Deputy Director is much encouraged by progress in the Shelter Identification Program. He sees presently existing shelters with capacity sufficient to house approximately one-third of the County population with a Protection Factor of 100 or better and eventually space for the entire population with a P/F of 20 or more. This is under the consideration that existing space would be used.

2.7 Organization of Montgomery County for Civil Defense

Communications is never an end in itself; it is merely a tool of management. It is an indispensable tool, however, without which an organization cannot function at all. This is especially true of emergency organizations, such as fire and police protective services, and there can be no question of the importance of communications under the circumstances where an entire population has been forced to forsake its normal places of habitation and mode of living and seek shelter from nuclear fallout for an extended period.

The form of an efficient communications system, however, is determined wholly by the nature and needs of the organization which it is intended to serve. In the case of the present problem, the proposed communication system must be set up to serve the daily needs of the County Civil Defense administration which relate to the welfare of the County population while it is housed in fallout shelters. The echelons of this shelter organization are:

County (headquarters at Rockville)

District (the present 13 Election Districts)

Area (combinations of Precincts in heavily populated Districts)

Precinct (the present 87 Voting Precincts)

Shelter (fallout Shelters in number sufficient to house the County's 340,000 people)

The above organization utilizes the present District and Precinct for the reason that they are known and recognized subdivisions of the County Government and, to that extent, do not require public education to acquaint the citizenry with their boundaries. The Area echelon is required as a subordinate level of command in Districts 7 and 13 between the Precinct and District. (There are too many precincts in Districts 7 (Bethesda) and 13 (Wheaton) to report to a single District Warden.)

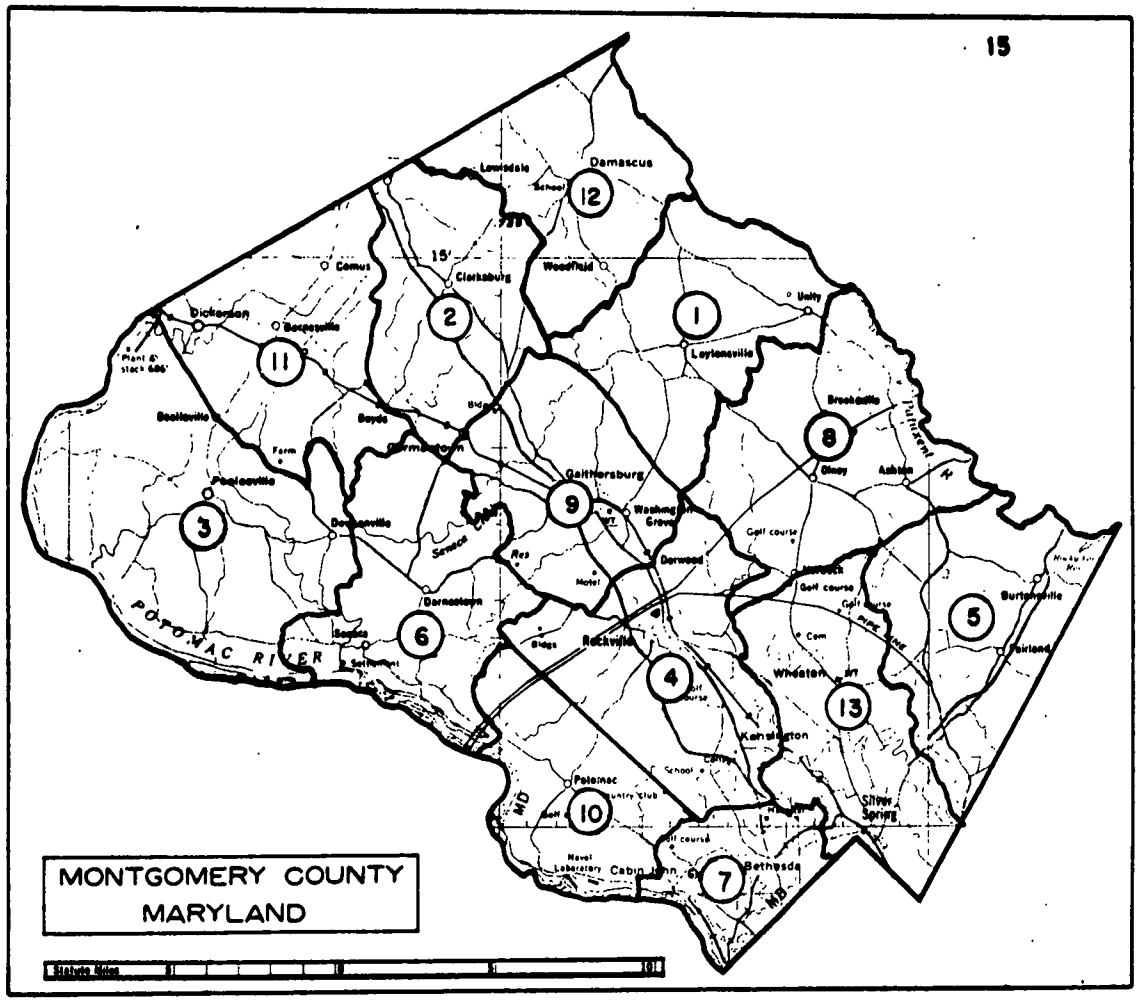
The low population density of the other eleven Districts makes division into Areas unnecessary. Of these rural Districts, 1 (Laytonsville), 2 (Clarksburg), 3 (Poolesville), 10 (Potomac), 11 (Barnesville), and 12 (Damascus) are not divided into precincts. In these Districts, therefore, there will be only one headquarters (District) and no organizational breakdown between the "District" and "Shelter" echelons. On the other hand, Districts 4 (Rockville), 5 (Colesville), 6 (Darnestown), 8 (Olney), and 9 (Gaithersburg), have been divided into Precincts reporting to District Headquarters without any intermediate echelon. The map on the following page shows the Civil Defense Districts in the County. The organizational breakdown of the County is shown in more detail in the maps in Section V.

Since actual fallout shelters have not yet been established in Montgomery County, we are, for the purposes of this problem, assuming that shelters will be established at optimum locations throughout the

County in numbers sufficient to protect the entire population of the County. We are assuming that each shelter will have an average capacity of approximately 500 persons.

Pending the establishment of adequate shelter space for the entire population, it seems to be a reasonable assumption that the public schools will be the first large class of buildings to be hardened up for fallout protection. Because of this probability and the further very important fact that the schools are under County control and custody, it seems desirable that these buildings be utilized to house the beginnings of the fallout shelter communications system.

A school building is available in nearly every precinct. It is possible, therefore to set up the Precinct, Area, and District Headquarters message centers over most of the County in County-owned buildings. If leased telephone lines were installed, a good part of the cost could probably be offset by using them for day-to-day communications by the school system.



CIVIL DEFENSE DISTRICTS

1. LAYTONSVILLE
2. CLARKSBURG
3. POOLESVILLE
4. ROCKVILLE
5. COLESVILLE
6. DARNESTOWN
7. BETHESDA
8. OLNEY
9. GAITHERSBURG
10. POTOMAC
11. BARNESVILLE
12. DAMASCUS
13. WHEATON

CIVIL DEFENSE AREAS
BETHESDA – 7TH ELECTION DISTRICT

Area	Precincts & Populations		Area Population
A	5	4,080	18,235
	6	1,445	
	9	2,600	
	16	3,800	
	20	1,450	
	21	2,350	
	22	2,510	
B	2	2,090	27,715
	7	5,200	
	11	5,140	
	13	4,660	
	14	4,360	
	18	6,265	
C	1	4,080	25,990
	4	4,700	
	8	2,740	
	10	4,610	
	12	5,265	
	19	4,595	
D	3	5,980	21,000
	15	5,870	
	17	5,205	
	23	3,945	

CIVIL DEFENSE AREAS
WHEATON – 13TH ELECTION DISTRICT

Area	Precincts & Populations		Area Population
A	4	1,555	15,835
	6	1,415	
	8	2,080	
	9	2,600	
	20	2,545	
	21	1,990	
	22	3,650	
B	12	4,650	20,170
	15	3,650	
	18	3,655	
	23	4,920	
	41	3,295	
C	2	3,810	23,810
	5	5,230	
	7	1,760	
	10	4,780	
	13	3,850	
	14	4,380	
D	3	5,100	27,070
	16	4,260	
	17	4,470	
	26	4,460	
	34	3,120	
	38	3,335	
	39	2,325	
E	11	3,995	23,660
	19	4,390	
	24	2,910	
	31	5,350	
	32	4,870	
	42	2,145	
F	27	3,690	23,420
	29	5,780	
	30	5,340	
	33	2,570	
	40	3,630	
	44	2,410	
G	1	4,080	25,790
	25	2,970	
	28	3,690	
	35	4,550	
	36	4,230	
	37	3,350	
	43	2,920	

CHAPTER III

SOCIO-PSYCHOLOGICAL, COMMAND AND CONTROL, AND OTHER FACTORS GENERATING COMMUNICATION REQUIREMENTS

3.1 General

A communication requirement in the context of this study is defined as the information required by all levels of government and the populace in order to insure effective social control and cohesion and optimum utilization of surviving resources for earliest national recovery.

The role of communications in any society and particularly in our own is well known and documented and thus need not be discussed here. It is necessary only to call attention to two essential functions of communication, i.e., the exchange of information among people and the exercise of command and control.

The exercise of all types of communications in peace time is vigorous and indeed much of it is vital to the demands of our complex industrial society. The survival and functioning of a complex society depends on its rapid and automatic communication systems in a manner that is analogous to the dependence of the human body on its nervous system. Even so, existent communication systems can support only a portion of the total potential traffic. And, almost without exception, this potential becomes more fully activated during periods of anomalous activity and departures from normal routines (e.g., the infrequent snowstorm, a sonic boom, or a rumor that catches on).

Perhaps more than any other anomaly, the unexpected disaster is the supreme catalyst in vastly increasing the demands on the communication system. For every person who calls an airline office to ascertain if a particular person was aboard a downed plane, there are many others who call just because there was a chance that someone they knew may have been a passenger. This need to know is an urgent one that compels attention and requires resolution. These compulsions and demands will be magnified manyfold in a nuclear attack on the nation; which will involve not just a hundred lives aboard an airliner or five hundred in a flood or hurricane but conceivably tens of millions.

The mass assault upon communication facilities almost invariably occurs immediately after disaster. Contributing greatly to this assault are communications between individuals who are only slightly or not at all concerned with the disaster. Many of these conversations are unnecessary and serve only to jam and obstruct communication channels. The incidence of unnecessary and uncoordinated communications continue into the survival and recovery stages of a disaster when rescue, relief and other command and control agencies have greatest need for communication capacity. The larger the reach of the disaster, the more complex and the greater the demand for communications.

Dr. Harry B. Williams in his doctoral dissertation, University of North Carolina, 1956, "Communication in Community Disasters," pinpoints this problem, stating as follows:

> One of the major characteristics of the communication nets operating in the emergency period is their "openness." They are often available to different senders to send uncoordinated and

even contradictory messages. Without a structure of authority and mechanisms for coordinating messages, the indeterminacy of communication cannot be controlled. On the other hand, different receivers can act independently upon the same message, adding to problems of convergence. Different communication nets and the organizations they serve often fail to exchange information needed by each. Structural features of the system and subsystems, such as the tendency to channel communication within hierarchies or the tendency for official organizations to ignore unofficial ones, contribute to these gaps in the circulation of information.

The resultant "informational convergence" following disaster described by Fritz & Mathewson in **Convergence Behavior in Disasters** (see Appendix A) is largely a function of "(1) the accuracy and specificity of information concerning the geographic scope of the disaster and the population directly affected, and (2) the degree to which this information is rapidly gathered, evaluated and disseminated to the appropriate receivers."

Thus, experience with lesser disasters points undeniably to the need for controlled communication circuits and the adoption of communication procedures designed to render optimum exchanges of priority information. Provision for such control is inherent in a community shelter program, simply because the facilities available for carrying messages are limited. The problem for thermonuclear disaster is not one of preventing misuse of ample communications resources; rather it is one of determining communication requirements, assigning priorities, and establishing machinery and procedures which will handle messages in keeping with those procedures. Under these circumstances of controlled operations of the communication network, the vast bulk of communication inquiries stemming from individual anxiety for loved ones and from just plan curiosity would not create communication chaos.

A controlled shelter and/or varied-level governmental communications network would also lend itself to the command and control functions necessary for the wide range of survival, rescue, and recovery operations during the two-week period following the thermonuclear attack. Because the circuits are not "open" (available to anyone) and are under stringent control, they would, depending upon the efficacy of operations, handle traffic crowding the limits of the network's capability. It is worth noting that a "closed" (controlled) communication circuit with efficient operation and ensuing determinacy of communication would carry considerably more high priority traffic than would move on "open" circuits utilizing far greater communication resources.

Thus, the communication and control problems associated with thermonuclear disaster would likely be less than those that have been experienced in past natural disasters. Conceivably, as has just been noted, the resultant determinancy of communications likely to occur when there no longer exist "external" and "internal" social systems, i.e., those outside and inside the environment of the disaster, could constitute a much more efficient disaster recovery operation. The command and control agencies and their resources of workers of varied skills are, in this event, a part of the internal social system. To this extent, the individual and collective activities of both social systems, which in natural disaster tend to conflict, may augment each other in the restoration of a viable social order in the post-attack environment. Thus, if those attributes of the internal social system (the sheltered populace) of solidarity, altruism, and mutual

dependency (which have been observed in natural disaster) are combined with orderly and efficient command and control operations by those who are physically a part of the disaster environment and therefore of the same social system, then many of the problems of communication and control associated with natural disasters may not be present.

The extent to which communication control can be exercised and, concomitantly, to which communication requirements can be fulfilled will influence the degree of success that can be achieved in the maintenance of social order necessary for eventual post-attack national recovery. Of the many unknowns that will be encountered in the thermonuclear disaster, for which studies of natural disaster can draw only tentative inferences, that of human behavior in a nation-wide disaster will be the most difficult to predict. Where traditionally the disaster victim and/or community could expect ultimately massive injections of aid from the external social system, such might not be the case in thermonuclear war. It is submitted that the demarcation line between order and chaos following a thermonuclear attack is a very thin one and that the use of communications will be the primary factor in determining which shall predominate.

3.2 Socio-psychological Factors

As a starting point, due credit and attention must be given to the investigative work of the Disaster Research Group of the National Academy of Sciences in this particular field. With but few exceptions, all significant research into disaster and its resultant implications for thermonuclear war has been undertaken or sponsored by this group. The specific area of socio-psychological demands on disaster communications, however, has received relatively little attention.

Attempts to identify individual communication requirements for a sheltered population over a period of time have been confined to generalized analogies between shelter communication requirements and those of isolated groups of individuals whether in a submarine, polar region, or in prison. Doubtless, there is some validity in such comparisons; and, in any event, these comparisons offer a factual basis upon which to judge shelter communication requirement relative to socio-psychological problems. The only other source from which to draw on is the realm of the behavioral sciences, specifically concerned with disaster and war situations. Here also, however, the comparisons with human behavior to be expected in thermonuclear war must be viewed with caution.

Shelter habitability experiments, for example, while providing some kinds of useful data, afford little knowledge that is helpful in developing communication requirements in response to socio-psychological demands. One must then turn to the analogies previously mentioned and to behavior during disasters and war to glean conceptual notions of socio-psychological communication requirements during the in-shelter period following a thermonuclear attack.

If the studies of prolonged periods of isolation in whatever environment have taught anything, it is that communication with immediate family members and continued knowledge of the "normal" environment of the "outside world" contribute to morale and ensuing social order within the isolated group more than any other single factor. Withdrawal of this vital information, for example, is one of the more cruel and successful methods utilized in "brain-washing." The character of this type of information and the psychological reasons for it are well documented, and there is no need here to elaborate further. It will suffice here

to call attention to the fact that, in most instances, the groups isolated for experimental observation have been under strict military and environmental control and were trained volunteers; consequently, morale and other psychological problems associated with these groups may differ in extent and character from those of a shelter population. Moreover, these isolated groups were certain to emerge from their isolated environment to one of expected normalcy. This psychologically important expectation is not likely to obtain for the surviving population emerging from shelters.

This same compelling need to know the fate of loved ones and to gain orientation with the "outside" environment is evidenced also in disaster and war experience. It is very much related to the preservation of the fundamental social grouping of the family. There is little doubt that "shelter quarantine-breaking" would take place in numerous instances by those who did not have sufficient information and were thus compelled to initiate individual rescue action despite radiation and other hazards. Considerations of guilt are also involved, in that confinement in the shelter with no knowledge of loved ones may create within the individual the feeling of not having met his fundamental responsibilities. This response was exhibited by some of the survivors in both the Hiroshima and Nagasaki atomic bomb disasters with respect to giving (or not giving) aid and comfort to relatives or even to dying strangers. Of interest here, too, was the fact that published accounts of these two disasters dealt primarily with events as they affected family units.

The lack of information which eases personal anxiety is particularly frustrating to any subsequent role required of the survivor. Contrary to the concept of "no news is good news," there will be an imperative need to counter the wave of helplessness which results from inability to carry out instinctual acts to protect and preserve the fundamental social grouping of the family. It is submitted that the psychological responses to information, whether good or bad, are more conductive to social order and performance of recovery tasks than are the forms of behavior which prevail in the midst of uncertainty. If anything, the foregoing hypothesis may well be an understatement of what could happen in the actual event of thermonuclear war.

This socio-psychological demand for immediate knowledge of the fate of emotionally involved people and for knowledge of the environment outside the shelter is intimately connected with a range of social effects resulting from the nuclear attack. Relatively little research has been done in this area and what has been accomplished demonstrates differences of opinion, ranging from an extreme optimism with regard to social behavior to the utmost pessimism of questioning man's very survival.

Turning to the relation of these unpredictable social effects to communication requirements, there is little question that communications, functioning at all levels of the shelter communication system and at higher levels of command and control, would serve as the primary vehicle for social cohesion. Hopefully, a well designed communication control plan would counter the more adverse environmental conditions tending to encourage uncoordinated or disorganized forms of behavior which delay the process of societal recovery.

The task of determining the identity and extent of all disturbing conditions and their consequent social effects is a major one and cannot be undertaken in this study. Rather it is sufficient to recognize that

there are likely to be problems of morale, role conflict, and various behavioral deviations brought about by the physical effects of unprecedented destruction and ensuing close confinement. Leadership at all levels, exercised through the medium of communications, will be vital in resolving these problems.

3.3 Command and Control Factors

Of all factors affecting communication requirements, command and control are paramount. Indeed, they are the end product of which communications are but the means. In a generic sense, all communication traffic on a controlled network would be of a command and control nature by definition. Since decision making is an inherent part of command and control, the ebb and flow of communication traffic merely reflects the decisions and the responses to them.

In a shelter communication system utilizing controlled procedures, i.e., addressed-message traffic and stringent monitoring and dispatch control, a wide range of communication requirements would be fulfilled, all of which would be in response to command and control functions. This would be even more likely when the sheltered populace itself is inherently subject to authority and power, not only by virtue of confinement from the hazards of radioactivity but through the likely imposition of strict and austere measures. Although exceptions are conceivable, it appears that the major government sources of lawful authority would be exercised more authoritatively after nuclear attack than before.

For this study, it is assumed that county government officials have survived and, supported by shelter management, are in command and control. It is further assumed, that government officials will, from the very beginning of shelter assemblage, institute calls for information and issue instructions relating to social order and cohesion, preservation of life, and plans for the optimum utilization of the population skills for societal recovery.

In the main, disaster and war research has revealed that response to authority is adequate, even enhanced, under situations of stress. Post-disaster behavior was such as to be quite manageable with few instances of antagonism and revolt. This pattern would likely be repeated for thermonuclear disaster. As noted previously, however, the key to adequate response to authority is good leadership and communication capacity sufficient to fulfill the minimum communication requirements of the sheltered populace.

3.4 Other Factors

There are a number of other societal factors dictating communication requirements that, although generally associated with command and control, are yet important enought to identify individually. In a broad sense, these factors include those everyday activities of our complex society. Whether these activities are of a business or social nature, or routine or emergency in character, communication links are necessary to effect them.

Of course, the great majority of these everyday activities will cease during shelter confinement but by no means all of them. The spectre of our gigantic industrial machine and its bustling transportation system grinding to a halt is a rather somber one. No longer for a time would be witnessed the dynamic (perhaps static to the motorist) morning and evening rituals of seventy million workers going to and from

work. The hum of activity in a school or a hospital, or in an office building, or at a football game, or on a factory assembly line, or in a telephone exchange, would cease. A myriad of activities requiring communications would be quenched to be replaced only by those necessary for survival of the populace.

The major societal activities certain to continue during shelter confinement are those relating to maintenance of vital services, i.e., the provision of the necessities of life. In an ideal community fallout shelter scheme, the basic necessities of water, food and a habitable shelter would be provided. So many things can go wrong with the best of man's plans, however, that we must anticipate a considerable incidence of problems of shelter maintenance during the confinement period. The problem of medical service in some areas particularly could reach serious proportions. In any event, the maintenance of vital services will create a number of communication requirements.

Other major societal activities such as transportation and production will indeed come to a virtual halt. Some transportation activity would occur during the approximate two-week confinement, in connection with county government activities, radiation levels permitting. All production processes, both agricultural and industrial, would cease except for those manufacturing facilities that were protected from fallout radiation. Ideally, a number of producing plants would be engaged in manufacturing the products for which there would be desperate needs on the part of the emerging populace.

Preparations for the resumption of the nation's national and local transportation network and for the resumption of the entire productive process, including financial exchange, would conceivably be initiated sometime during the two-week shelter confinement period. Prior to the end of that period, considerable information would have been gathered and analyzed relating to the assessment of damage and the inventory of surviving resources. Key personnel at various levels of economic activity would have been identified and located to the extent that plans for economic recovery could be formulated while still in shelter confinement. These activities, of course, could be accomplished only by placing demands on communication links. Since all levels of societal endeavor are involved and some critical personnel would be located in community shelters, communication requirements incident to these recovery plans would have to be met by a shelter communication network.

Vitally involved in these kinds of preparations is the vast array of national, state, and local governmental decisions relating to all phases of post-shelter national recovery activities. Such decisions (e.g. relating to transfer of population groups to less contaminated areas and mobilization of special skills) will entail messages addressed to specific individuals in shelters. To be sure, considerable instruction of this nature would use available broadcast facilities. But for security and other reasons, much of this traffic would be addressed messages or even person-to-person conversations. Finally, of course, all those activities incident to the repair of damage, removal of debris, decontamination, etc., would place demands on communications, particularly those of local government, in the planning, coordination and execution of these tasks.

3.5 Summary

The factors affecting or generating communication requirements during shelter confinement are essentially of the same character, but of less magnitude, as those factors that generate communications in

that society in time of peace. In our own highly industrialized society, the communication resources are extensive and highly developed and commensurate usage is made of them. With but few exceptions, compatible balance is maintained with the result that the supply matches the demand. A "communication universe" is thus in existence throughout the entire spectrum of societal intercourse.

A surviving sheltered society is a quite different "communication universe," a telescoped version of the normal wherein the aperture of communication flow is restricted to pre-determined and/or controlled information. The supply of communication resources can fulfill only certain demands. The demands themselves change in character or are no longer valid in the new universe. The average telephonic 2-week call rate of 4 billion telephone calls on a usage rate of 40 telephones for 100 population (not including national government telephonic complexes), while substantial, also experiences considerable hours of unutilized circuit time, particularly at night. The proposed use (as will be described later in this report, see ChapterV) of a simple telephonic command and control inter-shelter communications network on a usage rate of one phone for approximately 350 population, manned on a 24-hour per day basis, will indeed experience a vastly different traffic pattern than that of the existent "communication universe."

In the next chapter, we will deal specifically with the factors of the shelter "communication universe" that, in our view, are the major ones in generating communication requirements of the proposed shelter communications system.

CHAPTER IV

IDENTITY OF COMMUNICATION REQUIREMENTS

4.1 Introduction

Having generally discussed in the preceding chapter the various societal factors generating communication requirements, the following will be devoted to the specification of the major communication requirements and a quasi-quantitative determination of the time required to transmit, receive and relay representative types of shelter messages. At this time attention will be directed to inter-shelter requirements, dealing later with the secondary problem of intra-shelter (Chapter VII) communications.

In the following discussion of communication requirements, some things must be said about the primary inter-shelter communication network and its operation and management. Detailed descriptions of these features are given in succeeding chapters, to which the reader should refer if any question arises out of the relatively brief treatment given in this chapter.

A few comments are necessary at this point also with regard to the methods utilized in circuit time computation. Having decided upon a leased wire command telephonic circuit as the primary inter-shelter communication means, and having devised a system for operation and management thereof, there remained the problem of realistic appraisal of circuit time for each communication requirement that was deemed necessary to fulfill. In those instances of simple reports (a number of which lend themselves to coding) reasonably accurate circuit time estimates were possible. For other situations where near-arbitrary assumptions must be relied on, the ensuing estimates of circuit time are admittedly questionable. Nevertheless, the computations are valid so long as the premises upon which they were based are accepted as a suitable forecast of what will actually happen.

Table 1, page 29, sets forth individual circuit time necessary for each type of communication requirement. In studying these calculations, it is well to keep in mind the principle of the controlled circuit, (Chapter III), utilizing a command system of priority traffic. Also, it should be recognized that the success of the proposed shelter communication system will depend to a large extent upon the presence of shelter management personnel adequate in numbers, properly trained and proportionately distributed throughout the she ter complex.

4.2 General Analysis of Table 1

The particular method which was adopted, in Table 1, for depicting communication requirements and associated circuit time requirements was utilized for a number of reasons. Chief among them was the relatively facile interpretation made possible by a one-page display. Such a presentation also lends itself readily to substantiating and augmenting discussion. There are some drawbacks to this procedure, the major one being that the table does not indicate peak circuit time loading for any specific day or part thereof. The tentative character of the predictions of time requirements, however, precluded the use of such presentation.

Referring now to Table I we observe a chart depicting ten communication requirements, numerical priority assignments for each, and associated time requirements in hours by circuit and by shelter time period. Total time requirements in hours for each circuit and for each time period are indicated as well as the percentage of total circuit time utilized in each time period. The three time period categorizations, while somewhat arbitrary, do conform to the pattern or trend of shelter traffic that is likely to take place in the approximate two-week period following attack on the United States. The first three days (Time Period 1) would be a period in which communications incident to immediate survival activities, organization and control of the sheltered population, and identification of surviving resources would be dominant. The third period—the five days prior to leaving the shelters—would logically be devoted heavily to those communications relating to preparations for the reorganization of economic activities and to nation-wide recovery operations. The middle period of six days would be characterized by all types of traffic, including post-attack damage assessment, and would see local governmental communications increase as a result of various county officials (fire, police, etc.) performing tasks outside the shelters for limited time periods. In this connection, the second period was selected to begin three days after the attack because by that time initially high fallout radiation would have decreased to levels where radiation exposure is tolerable for brief periods of time. As will be seen, the qualitative judgments which necessarily entered into the calculations prevented a day-by-day analysis of circuit time for all communication requirements.

The four circuits noted in Table I for which circuit time has been computed are described in detail in Chapter V. Reference is made particularly to the three charts, pages 41, 42, and 43, which depict the inter-relationship of these circuits. Suffice it to indicate here that Area shelter headquarters is, for the great majority of cases, made the final level for resolving problems emanating from individual shelters. This decision is based on the premise that a population group of approximately 25,000 per area would normally provide all the special inter-supporting skills necessary for the proximate 50 shelters in that area.

The two priority designations assigned to the communication requirements are similar to those generally utilized in any command circuit where judgments are made as to which category of information should be transmitted first and which should be deferred. Only when a particular circuit has simultaneous multiple demands placed on it, will the question of priority arise. Priority One information cannot be deferred as it is of an emergency nature involving either directly or indirectly the preservation of human lives. Priority Two is less urgent and can be deferred. The specific priority fixed for each communication requirement is the more likely one that would be assigned in the majority of cases. Conceivably, some of the communication requirements normally assigned Priority Two would in certain instances be sent as Priority One.

Each of the ten individual communication requirements will now be discussed with respect to justification and analysis of circuit time computation. After these comments, a summary of Table I results will be given. For each communication requirement, the circuit time has been computed for the heaviest populated region of Montgomery County, Wheaton District, population 160,000.

COMMUNICATION REQUIREMENTS	PRIORITY	CIRCUIT TIME REQUIREMENTS (HOURS)											
		Shelter-Precinct Circuit			Precinct-Area Circuit			Area-District Circuit			District-County Circuit		
		Time-Period			Time-Period			Time-Period			Time-Period		
		1	2	3	1	2	3	1	2	3	1	2	3
1 Radiation Monitoring Reports	1	0.25	0.25	0.25	0.3	0.3	0.3	0.5	0.5	0.5	1.5	1.0	1.0
2 Shelter Habitability Problems	1	2.0	1.0	1.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	1.5	2.0
3 Physiological & Psychological Individual Problems	1	2.0	1.0	1.0	4.0	1.0	2.0	2.0	1.0	1.0	4.0	2.0	3.0
4 Shelter Status Reports	2	0.25	0.25	0.25	0.3	0.3	0.3	0.5	0.5	0.5	1.5	1.0	1.0
5 Census & Skills Reports	2	0.3	0.1	0.2	0.3	0.1	0.2	0.3	0.1	0.2	1.0	1.0	1.0
6 Instructions & Information	2	3.0	6.0	10.0	3.0	6.0	10.0	3.0	6.0	10.0	3.0	6.0	10.0
7 Location & Condition Of Separated Family Members	2	8.0	←			AS TIME PERMITS				→			
8 County Government Use Of Shelter Communication Net	2	0.75	3.0	2.5	0.75	3.0	2.5	0.75	3.0	2.5	3.0	6.0	5.0
9 Economic Recovery	2	0.0	3.0	5.0	0.0	3.0	5.0	0.0	3.0	5.0	0.0	6.0	10.0
10 Official Government Conversations	2	3.0	6.0	5.0	3.0	6.0	5.0	3.0	6.0	5.0	3.0	6.0	10.0
Total Time (Hours)		19.55	20.60	25.20	13.65	20.70	26.30	11.05	21.10	25.70	19.00	30.50	43.00
Percent Time-Period Utilized		27.2	14.3	21.0	19.0	14.4	21.9	15.3	14.7	21.4	26.4	21.2	35.8

Time-Period 1 — 1st-3rd Day
Time-Period 2 — 4th-9th Day
Time-Period 3 — 10th-14th Day

Table I

Communication Requirement No. 1: Radiation Monitoring Reports

Little explanation is needed in this instance to support the necessity of radiation monitoring and its reporting. The report itself is coded and brief; thus, the total time requirements are small. For Montgomery County only selected shelters would report beyond the Precinct level to County Government Headquarters to augment the current County plan for non-shelter monitoring sites at the county fire stations. All shelters would on occasion report to the Precinct shelter and some of these reports might be forwarded on to Area shelter headquarters. These reports, initially frequent, would decrease in frequency to one per day.

Communication Requirement No. 2: Shelter Habitability Problems

With respect to shelter habitability, i.e. the physical habitability of the shelter environment itself, assumptions must be made as to percentage of breakdown of sustaining elements. If food, water, and medical supplies for a two-week (or longer) period have been stocked, and if facilities such as ventilation, air filtering, sanitation, waste disposal, etc., have been installed and periodically checked, the percentage of shelter habitability problems should be relatively low.

Such an assumption has been made for this study with full realization that there exists not only definite possibility but a reasonable probability that the number of shelter habitability breakdowns would be considerably higher. Any number of unforeseen contingencies could arise as, for example, over-crowding of a shelter with a resultant rapid depletion of food and water, or failure of ventilation blowers that had not received scheduled checks for some time, or contamination of food supplies. Whatever the cause, circuit time might be required to solve the problem whether it be a case of instructions from a technician or skilled laborer in one shelter to unskilled personnel in another, or the problem of evacuating the members of one shelter to other shelters. This latter problem could occur almost immediately upon taking shelter, where a particular shelter had the maximum possible number of people in it and instructions were required to direct the over-flow of individuals to another nearby shelter with available capacity.

The time requirements noted are those based on 20%, 10% and 20% breakdown incidents for the three time periods respectively. It is believed that the middle time period would experience less shelter habitability problems than either the first or third time periods. The first period would be one of some confusion and would witness initial shelter habitability problems not unlike the problems arising out of a new ship's first cruise. A "settling down" period of less problems would ensue, followed by an increase in problems in the third time period due to possible shortages of food, water, and other essential supplies. One hour per shelter incident is allocated in the first time period and one-half hour per shelter incident in the second and third periods. Time required per incident would likely be greater in the first period since no remedial action could take place outside the shelter. The principle of Precinct shelter headquarters and Area shelter headquarters handling most of the emergencies is used, with only a few problems reaching District and/or County headquarters level. For example, it is assumed that Precinct headquarters would be able to take care of about 75% of the emergencies and Area headquarters the remainder with only an occasional exception. The 75% capacity for handling emergencies given to Precinct headquarters is based on the human resources and skills of an approximate 3500 individuals (7 shelters/precinct) for inter-shelter support. It is

envisioned also that each Precinct headquarters and Area headquarters would have additional stocks of critical supplies and materials.

Admittedly, predictions of shelter breakdown incidents and the time requirement per incident must allow for great variations. Such parameters as specific skills within the precinct, communication management and procedures, seriousness of particular incidents, requisite human and material resources needed to bring a particular shelter back to norm, and many others would influence the amount of circuit time necessary, as it would affect demands on the command echelon. To this extent, quantitative predictions that appear for this communication requirement on Table I may be quite unrealistic. Nevertheless, acknowledging the difficulties inherent in prediction of human and physical events in an environment which has never previously existed, it is believed that the time requirements set forth can reasonably be expected to be realized to the extent that the original assumptions obtain.

Communication Requirement No. 3: Physiological and Psychological Individual Problems

As in the previous requirement, the aperiodic nature of messages relating to the physiological and psychological condition of the shelter inhabitants renders difficult the quantitative assessment of circuit time. This requirement is also in a somewhat broader category than the shelter habitability requirement, in that the range of human events resulting in incidents requiring communications to effect remedial action is wider than environmental events affecting shelter habitability. In both cases, of course, human lives are involved either individually or collectively.

For this requirement we are concerned with the incidence of different types of illness, deaths, births, psychogenic problems, epidemics, problems of social control within the shelter, and any other individual psychological and/or physiological incidents that cannot be remedied within a specific shelter. Since it is likely that there will be disproportionate distribution of doctors and other medical personnel among shelters, it is evident that a large proportion of circuit time would be devoted to medical matters.

It can readily be imagined, for example, that there will be a number of accidents incident to taking shelter by large numbers of people. The element of fear will be prevalent to an extent that at least instances of panic on a local scale may occur. Also, the realization that a nuclear attack is but minutes away or already underway could result in numerous coronary attacks. It is also probable that shock and trauma reactions on the part of some of the shelter population will require special handling techniques, especially during the early in-shelter peiod of confinement. There are many "ifs" involved in thermonuclear war and in the words of Winston Churchill, "the terrible IFS accumulate."

Be that as it may, however, if we assume normal incidence of physiological and psychological ailments for the present population and if we assume a moderate level of increase of individual emergencies due to shelter taking and shelter living proportionately distributed, the wire circuit time requirements are not unduly great. The circuit times noted are based on 40%, 30% and 40% of the shelter population experiencing individual problems that cannot be resolved within each shelter for time periods 1, 2, and 3 respectively. The same general assumptions for communication requirement No. 2 apply here also with respect to incident-time and echelon distribution for action.

The kinds and frequency of incidents likely to occur for which the importation of human and physical assets would be required to render requisite aid would probably be substantial. It is an area worthy of special investigation. Cursorily, such things come to mind as medicinal supplies for diabetics, emergency operations, complicated births, lack of anesthesia, supplies of blood plasma, extreme reactions to stress, administering of last rites, maintenance of law and order within the shelter. The list of potential events requiring communications to marshal the assets for remedial or other appropriate action just begins with these matters. It may not be possible in every case to effect remedial action. Certainly, a disproportionate occurrence of emergencies, time and area-wise, could overload a circuit with Priority 1 traffic. The design of the proposed communication system (Chapter V) gives assurance that this consequence will occur only rarely if at all.

Communication Requirement No. 4: Shelter Status Reports

The shelter status report, simply coded and taking little time, periodically informs various command echelons up the line to County government headquarters that "all is well" or otherwise. Where relief or corrective action is required in the future, the information contained in specific reports can be used as a basis for orderly planning by the appropriate command echelon. The traditional roll call, useful everywhere in peace time, will be even more so for a sheltered population. These reports, initially transmitted four times per day could be reduced to two or even one per day. Circuit time indicated provides for 25% of the reports in each time phase to be other than an "O.K." report.

Communication Requirement No. 5: Census and Skill Reports

The census and skill report is a particularly valuable one. This report also lends itself to a simple codification which facilitates transmission of considerable information over each circuit in a matter of several minutes. A proposed shelter communication manual (Chapter VIII) would specify the types of information to be sent and would also supply a suggested coded form. The skill and census report is one of numbers, e.g., total number of men, women, children, aged and number of various type skills. This information would be needed early in the shelter period as a vital means for identifying surviving national resources and, importantly, for inter-shelter support as required by the Precinct, Area, District and County government headquarters. Sufficient circuit time is also allowed for inquiries from and responses to County headquarters in order to provide additional information during all three time periods. Obviously this report would also be necessary for the multitude of recovery operations, where the mobilization of certain skills and manpower for the post-shelter phase would be needed. Assuming that governmental control is existent, the census and skill report would provide the basis for optimum utilization of manpower for the post-shelter recovery period.

Communication Requirement No. 6: Instructions and Information

There is little doubt that national, state and local governmental announcements and instructions covering a wide range of activities will be transmitted by wire line rather than broadcast. Security requirements alone may dictate this method, since the enemy will be vitally interested in any information relating to damage and extent of surviving resources. Also the nature of the information to be sent may not be in the best interests of the population to know. Rather, information, instructions, request for information, etc.,

should be sent to the various local government and/or shelter officials who are monitoring the circuits. They, in turn, could disseminate appropriate information by intrashelter means to the shelterees. Certainly there will be (assuming broadcast facilities available) broadcast information by radio and TV as well. It is conceivable that music would be a part of broadcast programming, as would other kinds of entertainment and dissemination of information that would enhance morale, reduce fears, and dispel rumors.

It is not within the scope of this study to define the types of information relating to this requirement that should be sent or withheld or limited to those with "need to know." This is an area for a seperate investigation in itself. It is apparent that negation of rumor and support of morale are involved here to such an extent that considerable attention should be given to (1) what information should be disseminated to the surviving population by broadcast and (2) what types of information should be transmitted on a controlled circuit "need to know" basis. Our view is that both categories of information will be substantial, as our estimate of the "need to know" demands on the wire circuits indicates. The increases in total time for the third time period reflects the increased tempo of instructions relevant to preparations for shelter emergence and plans for recovery operations during this period.

Communication Requirement No. 7: Location and Condition of Separated Family Members

The fulfillment of this essential requirement by electrical communications would require considerably more circuit time than the basic telephone system and radio backup (Chapter V) envisioned in this study could provide. The exchange of tens of thousands of names and associated data with respect to separated family members can be effected expeditiously only by the use of expensive and complex communication and high-speed computing equipment.

There is little question that specific informational exchanges between separated family members is a valid and important socio-psychological requirement and should be satisfied wherever possible. There are a number of ways in which this requirement can be satisfied partially, perhaps totally, dependent to great degree upon the availability of electrical communications and distance between the family members who are separated.

Before examining these methods, attention should be called to the fact that the taking of a detailed shelter census of the surviving population would be an integral and valuable surviving resources statistic for governmental use, apart from its uses to individuals interested in locating relatives, friends and other emotionally involved people. These community lists, of course, would serve as a basis for post-shelter postal service renewal. Where deaths and casualties would conceivably number tens of millions, an inventory of survivor statistics (data more detailed than that indicated in the census and skill report) would be most useful to national recovery actions. This massive bulk of information need not be transmitted to appropriate government centers of decision during the in-shelter phase but should be collected during this time.

Returning now to the local exchange of this type of information, it must be noted that in heavily populated urban areas such as that portion of Montgomery County adjacent to Washington, D. C., the problem is to effect an exchange of tens of thousands of names within reasonable time after taking shelter. While there is available circuit time for the transmission by phone of an average of 500 names and asso-

ciated data (address, name and probable locations of other family members) from each individual shelter to Precinct headquarters, the accumulation of data through higher echelons to County headquarters is too much for one wire circuit to handle. Considering that about one minute would be required to transmit and transcribe one name and associated data, it becomes obvious that the transmission of several thousand or more names over the Area to District circuit, for example, would require up to two weeks or more.

Couriers (see Chapter V), after the first three days of shelter confinement, even travelling by foot and in relays in minimize radiation hazards, could carry shelter census lists to County headquarters. From this collecting point, deliveries of lists of data on individuals about whom specific inquiries have been made could be effected by couriers to appropriate shelters.

Of approximately 92,000 households in Montgomery County some 40,000 heads of households work in Washington, D. C. and most of the remainder work within the County. About 100,000 children, ages 6 to 18, would be in school shelters, non-working mothers would be in their pre-designated local neighborhood shelters, and working heads of family in pre-designated shelters near or at place of business. One could say that if all were safe from blast and thermal affects, a simple announcement that a specific area was safe would be temporarily sufficient news to alleviate anxieties over family separation. After some 14 days in their respective shelters they would all return home but they would not be able to ascertain until that time whether or not all members were safe and well. Undoubtedly, this may be the case for many communities and may indeed satisfy the fundamental psychological demand for knowledge of the safety of loved ones.

One cannot be sure. Reflecting for a moment on the considerable efforts normally made in this country to notify next of kin in cases of missing persons or death, and the great care taken in publishing names of disaster victims prior to this notification, one has serious doubts as to the patience and forbearance of shelter survivors with regard to this matter. Also of relevance is the fact that the extent of need for this type of information is strictly a matter of individual concern, which would likely vary considerably from one individual to another. Since in many situations the attack effects and survivor patterns will be complex in heavily populated areas, the problem of reuniting separated family members initially through communication and ultimately in fact will be a difficult one.

In any event, there is circuit time available to transmit as much information as is feasible relative to the safety of loved ones. In some instances of particular hardship and a manifestly desperate need to know, efforts should be made to satisfy these needs. Great care should be exercised, however, in this entire matter of dissemination of information bearing on the survival of individuals and/or communities. The elements of rumor and morale are involved here to a critical degree, such that every effort should be made to dispel the former and enhance the latter. Finally, there is an inherent factor of ghoulishness in disaster reporting which must be avoided.

Particularly adapted for transmission of large volumes of information within relatively short time is facsimile transceiver equipment. It requires only simple wire circuits. Using the simplest of equipment, it is believed that facsimile could fulfill the basic requirement of family informational exchange. The Precinct

shelter level and higher echelons would have this equipment and, economy permitting, even individual shelters would be so equipped.

The clerical and collative tasks would make substantial demands on time, but this is desirable since the more people who are occupied in doing something constructive in a shelter the better the morale. So much other information could also be carried over a facsimile circuit that the system merits careful consideration as a part of the shelter communication network. Specific procedures related to the operation of this circuit and methods of informational exchange at various echelon levels would be set forth in the proposed shelter communication manual.

This study does not at this time make a categorical recommendation for the use of facsimile, high-speed teletype or any other type of equipment to satisfy this requirement. The entire question of exchange of information incident to this requirement needs further study. Relevant recommendations are discussed in Chapter VIII.

Communication Requirement No. 8: County Government Use of the Shelter Communication System

This requirement will be discussed only briefly because of the near-impossibility of predicting how much demand will be placed on shelter circuits by County government communications that cannot be satisfied by other means. The latter are discussed in Chapter V. Suffice it to state here that County government communication resources would at times have to be augmented by the shelter communication network.

Control of fires, decontamination, rescue operations, and initial operations in preparation for the control of population movement during the post-shelter phase would require radio and wire communications in effecting necessary action. In the first time period remedial action would be negligible if undertaken at all, as even reconnaissance of the environment outside the shelter during this period would be severely limited. With continued decrease in radioactivity levels during the second and third time periods, these and other outside shelter operations would increase substantially, making it necessary for some traffic to be relayed over the shelter communication network.

The estimates of circuit time shown in Table I are tentative at best and completely unrealistic at worst. Perhaps the only firm assumption made here is that the County government communication network planned for Montgomery County would fulfill the great majority of overall communication needs. The increase in District-County circuit time reflects the accumulation of reports to County headquarters and instructions from County headquarters via the shelter network to those areas where County government communications cannot reach.

In this connection, circuit time would also be utilized in the location of County officials (police, fire, etc.) in shelters other than their designated functional shelters which normally would have County government communication resources, e.g. fire and police stations and public works depots.

Communication Requirements No. 9 and 10: Economic Recovery and Official Government Conversations

These two requirements will be discussed simultaneously, since they have the common quality of being person-to-person telephone conversations which are not related to shelter management or shelter activities.

Requirement No. 9 relates to all those matters having to do with preparations for economic recovery while No. 10 is concerned with exchange of official information between key government personnel. An example of the latter might be conversations between a Governor and certain members of the State legislature, any of whom might adventitiously be in any shelter. As to activities relating to the former requirement, it is conceivable that a high government source may wish to contact the president of a critical manufacturing concern, e.g., a drug firm, in connection with preparation for post-shelter production. In this connection, there could be included in the census and skill report the names of those key individuals in pre-designated critical industries, utilities and commerce.

Whatever the system used, both communication requirements appear to be valid ones and would therefore require circuit time. Comparatively little time has been assigned, due largely to inability to find, within the time available for study, either record of experience or predictions on which to base estimates. The only study noted with relevance to this matter was that of Rowan and Kincaid (Appendix A) which recognized the serious difficulties brought about by loss of business firm headquarters and/or loss of executives.

The arbitrary allowance of but one hour per day on each circuit may not be sufficient, particularly for the County-District circuit where most if not all this type of traffic would be transmitted. No time is allowed in Time Period 1 for requirement No. 9 inasmuch as this period would more logically be devoted to immediate shelter problems. An additional hour per day is allocated to the District-County circuit in Time Period 3 because it is conceivable that this traffic would originate outside the County and would be directed to various individuals located in County shelters. Of course, this assumes that existent communications from Rockville to locations outside the County continue in operation.

Whether the exchange of information of the type just described can be deferred until after the two-week shelter period is a moot point. Undoubtedly, some of it can be deferred; but our view is that much of it may be crucial for critical decision making and should be exchanged during shelter confinement. In any event, this matter requires further study.

4.3 Summary

The foregoing analysis of communication requirements and the requisite time to fulfill them has demonstrated the need for no more than a single circuit leased wire telephone net as the primary means for a fallout shelter communication system. Operated and managed as a command and thus controlled circuit, the total time allocation for any time period does not exceed 36 per cent (District-County, Time Period 3) of the total time available.

With a resultant excess of time capacity, excellent reliability of this system under fallout conditions only and a two-way radio backup (see Chapter V), the proposed shelter communication system appears to be most adequate. Moreover, the potential of the system is such as to allow for substantial error in circuit time calculations and some decrease of efficiency in management of the system caused by lack of trained personnel at some points in the system.

A notable deficiency in the proposed system is its inability to fulfill the requirement relating to separated family units. Facsimile has been suggested as a relatively inexpensive electrical means. This

method, however, if instituted would utilize considerable circuit time, particularly on the single District-County circuit.

Although an average of less than 25% of the two-week period has been allocated for carrying traffic over the leased wire circuit, it is acknowledged that peak overloading could occur at any time due to disproportionate distribution of shelter emergencies. Even for a command circuit, overloading is possible and can be avoided only by having a number of back-up communication channels available. We believe these instances of peak overloading will be rare; and, if occurring, the radio backup could be utilized to resolve such situations.

CHAPTER V

THE INTER-SHELTER COMMUNICATIONS SYSTEM

5.1 Foreword

The communication system outlined in this chapter is designed for the specific purpose of providing communication channels to enable the authorities in charge of the shelter system to carry out their mission.

It is **not** the purpose to set up a communication system to take the place of the communications facilities normally available to the population of Montgomery County or other areas of this country. Such facilities are the postal service, the ability to travel in order to talk face to face with other people about any subject which we think is worth the trouble, the radio and television broadcasting stations, the public telephone system, and the public telegraph system. Under the conditions immediately preceding and following a nuclear attack, with the population assumed to be in fallout shelters, these communication facilities will not be available or at least will be severely curtailed and there will be no economically feasible way to replace them for the assumed shelter period. A communication system which is geared to the bare necessities of maintaining the physical and mental health of the population, and law and order, in our opinion becomes the maximum which can be expected under the postulated conditions. Such a system is proposed in this report.

Again, it is emphasized that the proposed system is designed for communications, not between members of the public at large, but between the **authorities** who are entrusted with the care and well-being of the population during the stated emergency. The economics involved forbid the establishment of any system which would satisfy anything approaching normal personal or business communications requirements during the shelter period.

Even the operation of the system will be different from the public communications system normally used. While telephony (wire or radio) will be employed, conversations between principals will not be the rule. Instead, written messages will be handed to the operators at the point of transmission. The sending operator will read the messages to the receiving operators who will copy them down and have them delivered to addressees.

While it is not the purpose of this report to lay down guides for the organization necessary for the proper administration of a system of fallout shelters, it is obvious that such an organization must exist, since a communications system can have no purpose but to carry information between organization echelons or between two physically separated places within or between organizations. If a well-designed, well-understood, and well-established organization does not exist when the emergency comes into being, utter and deadly confusion will prevail and no communication system, no matter how comprehensive, will be of any great use.

Again, at the risk of being unduly repetitious, the communication system proposed herein is designed to serve the needs of the shelter organization **as a whole** and not the needs or desires of the individuals who are temporary members of the shelter population. The satisfaction of individual needs and desires,

unless they become acute enough to endanger the well-being of the individual or other individuals, must await emergence from the shelters and some degree of resumption of the normal way of life.

5.2 Use of the Term "Warden"

For lack of another convenient term the word "warden" is used to a considerable extent in the portions of this report which follow. It should not be taken as an officially approved designation nor as being a part of any official terminology. It is merely a substitute for the more cumbersome term "person in charge of the area" (or district or precinct, or whatever the case might be.)

5.3 Communications Circuits Required with Specific Reference to the Montgomery County Shelter System

The sections which follow are intended to set out the specific communications facilities, both wire and radio, which will be required to carry the traffic load previously arrived at.

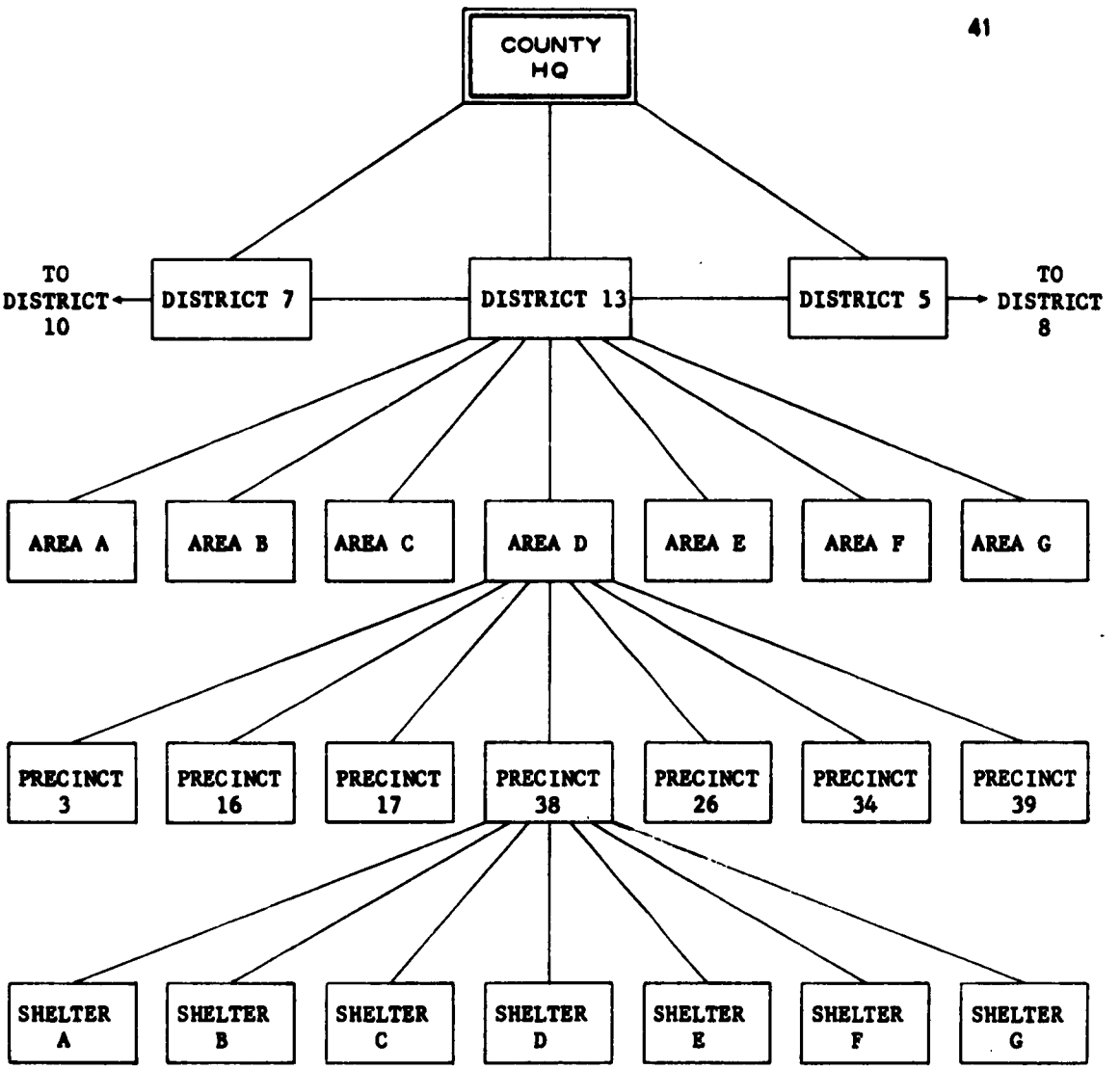
The system recommended is one which will carry, **with the greatest feasible reliability, communications essential to the control and welfare of the population of Montgomery County while it is housed in fallout shelters pending, during, and after an enemy attack with nuclear weapons.** The phrase "greatest feasible reliability" takes into account two elements. The first relates to the availability of tried and tested communications facilities. The second relates to the economics of the matter. The system recommended is, to some extent, a compromise between these two factors.

We do not believe, however, that any dangerous degradation due to this compromise is present in the system which we propose. The wire line circuit capacity of the system has a factor of approximately three times the estimated actual load. All data available to us indicate that the wire line portion of the system would have only a very small failure quotient during the two-week period specified. The effect of such failure as does occur can be minimized by the use of radio, assuming always that radio silence has not been imposed.

According to our best judgment on communication requirements, only one electrical communication circuit is needed to carry the load between any two points in the system. On this basis we propose one telephone line (permanently leased) and one radio circuit for backup from each shelter up to the lowest control echelon, one telephone line and a radio circuit to the next higher control echelon, and so on up to County Headquarters.

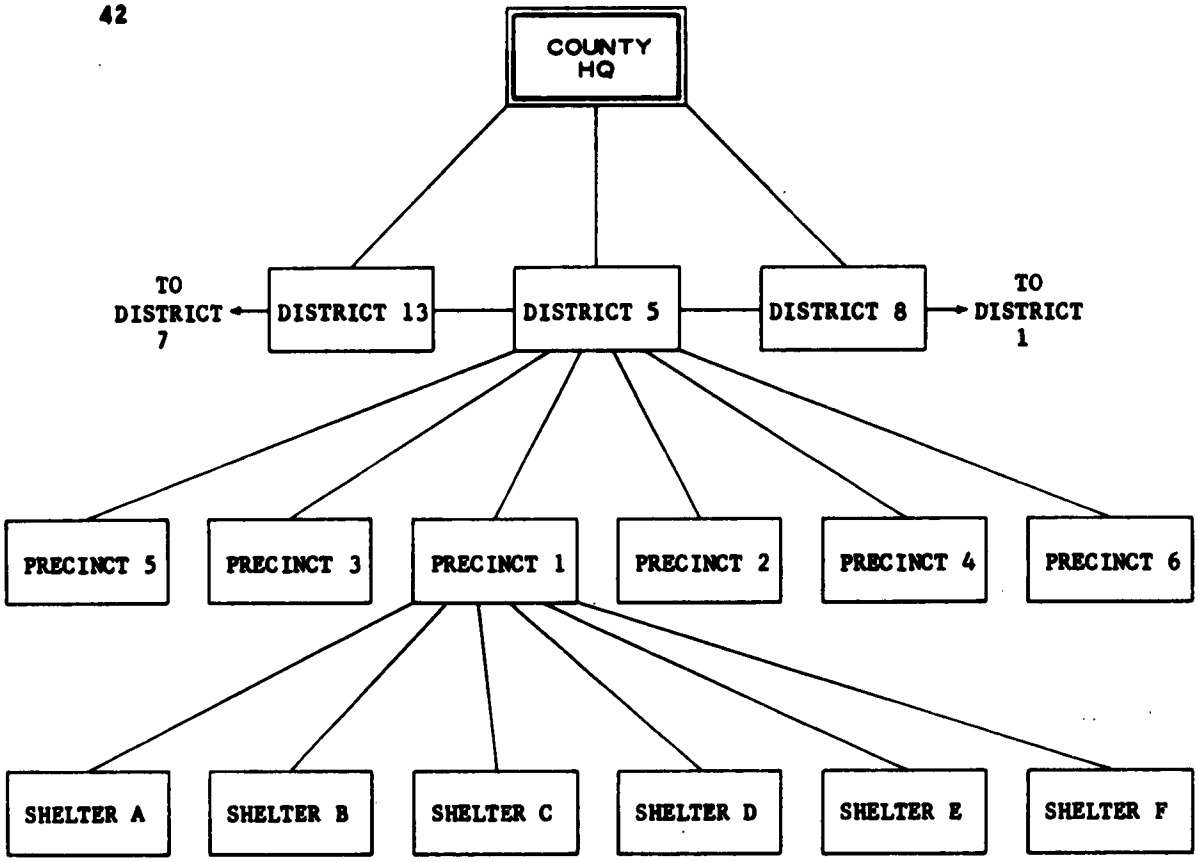
We emphasize, however, that our recommendation is based on proper discipline and control by the persons in charge of each organizational unit not only of the communications circuits, but of the shelter system as a whole. This obviously requires training of personnel and much advanced planning.

The system which we advocate here cannot be taken as a final, detailed plan for a Shelter Communications System because of the many assumed bases which we have had to use in lieu of actual factual situations which could be concretely provided for. For instance, the Montgomery County shelter program is just coming into being. Shelters in numbers sufficient to house the entire population of the County do not even appear on the horizon. Shelter areas which do appear to be available have maximum population



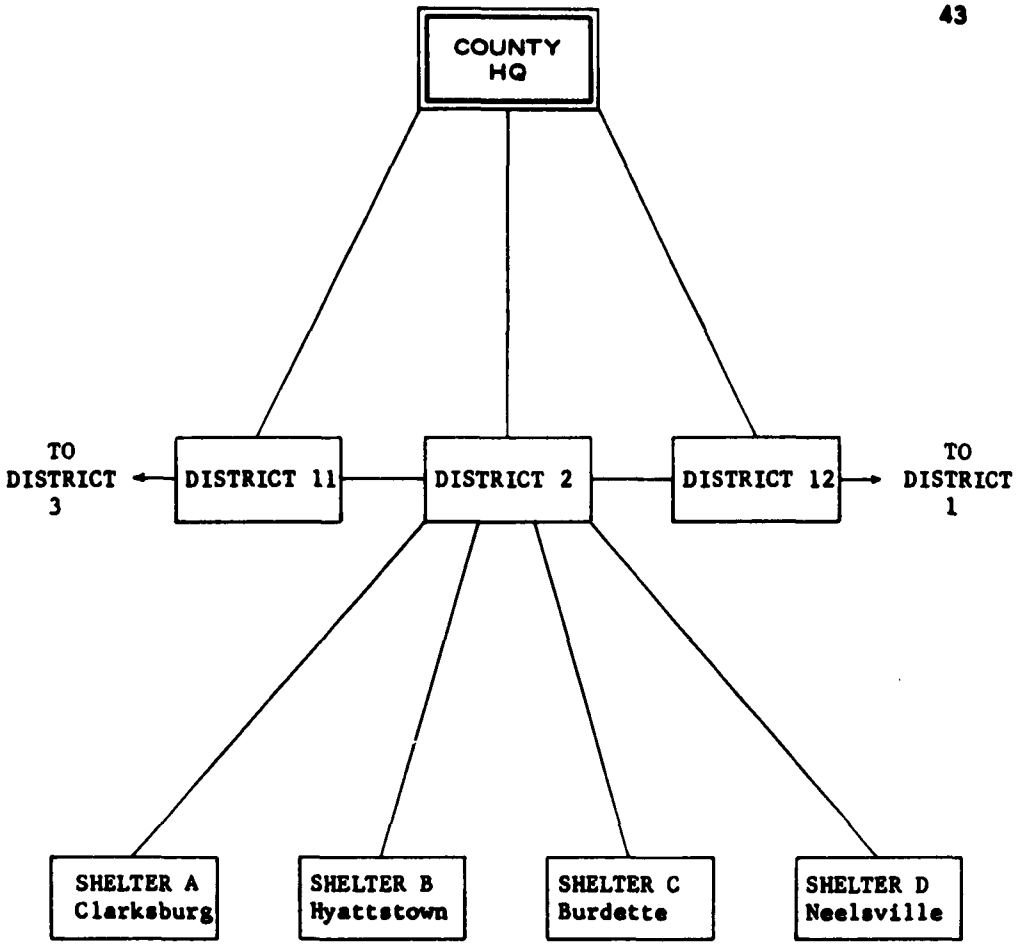
MONTGOMERY COUNTY CIVIL DEFENSE ORGANIZATION IN URBAN DISTRICTS

These are District 7 (Bethesda) and 13 (Wheaton). The above diagram shows Shelters in Precinct 38, Area D, District 13. Inter-District communication circuits are indicated.



MONTGOMERY COUNTY CIVIL DEFENSE ORGANIZATION IN SEMI-URBANIZED DISTRICTS

These Districts are 4 (Rockville), 5 (Colesville, shown above), 6 (Darnestown), 8 (Olney), and 9 (Gaithersburg).



MONTGOMERY COUNTY CIVIL DEFENSE ORGANIZATION IN RURAL DISTRICTS

Districts of this type are 1 (Laytonsville), 2 (Clarksburg, shown above), 3 (Poolesville), 10 (Potomac), 11 (Barnesville), and 12 (Damascus).

capabilities of from the minimum of fifty persons to several thousand. The fact is obvious that the fifty person shelter might have different communications plant requirements from one of 3,000 persons capacity. Another factor which we cannot now evaluate is shelter location. Shelters in locations easily accessible to refugees from areas outside the County might have different requirements from those located in areas removed from main travel routes.

The above and similar factors have made it necessary to settle upon an assumed shelter population of 500 persons, inasmuch as it has been indicated to us that this might be considered to be an optimum size for buildings constructed for shelter purposes.

In applying the plan suggested here to shelters of large population capacity, or those situated in unusual locations, it might be necessary to increase circuit capacities. The general plan can, however, be adapted to almost any set of circumstances.

The portion of the plan which deals with plant needs for the Montgomery County Shelter Communication System is based on command locations which seem to be logical possibilities. The same is true of individual shelters to the extent to which their locations are specified in the plan. When a comprehensive shelter system is set up, other choices of locations will be made. It is our considered opinion, however, that plant requirements will not change substantially except as population changes may occur.

Exact shelter locations are not important in determining radio plant needs but can importantly affect wire line requirements in some instances. In the heavily-populated areas of the County, the lowest echelon (Shelter to Precinct) needs can be calculated sufficiently well by using average distances (assumed) from Shelter to Precinct Headquarters locations. In the thinly-populated areas Shelter locations can be postulated on the basis of population centers and Precinct HQ locations can be assumed. The wire line mileage is important only from the cost standpoint in most instances and charges are based on a minimum airline distance of one mile.

The Sections immediately following discuss with more particularity the considerations involved in connection with wire-lines and radio and set out in concrete form the communications plant requirements.

5.4 Telephone Communication for Fallout Shelters

We propose that specially-engineered wire lines be the primary shelter communication system. There are a number of reasons for this. Among them are

1. Wire lines are inherently reliable and free from electrical interference.

2. In case of attack, it may be necessary to impose a total prohibition against the use of radio to prevent the interception of useful intelligence by enemy satellites, space, air, or undersea craft, or agents located in this country.

3. Telephone plant facilities may be expected to remain intact under any set of conditions which would leave the average fallout shelter habitable.

4. Adequate telephone plant facilities are available over nearly the whole Montgomery County area.

5. The distribution of telephone lines is such that a gridded type of system can easily be set up.

6. The average person can be trained to operate a telephone circuit in less time than would be required in the case of radio. This advantage is slight, of course, since operators will be needed for the radio facilities for mobile and wire line backup use.

7. The high initial cost of full radio facilities is avoided.

8. The administrative problems of maintenance are avoided.

The chief objection to wire lines is the continuing high cost. This could be offset in a rather unsatisfactory manner by getting permission from subscribers in shelter buildings to run extensions from their lines to shelter areas. Such an expedient would be undesirable for a number of reasons. Among them are

1. The need for switching from the subscriber's office to the shelter area.

2. The cost of running and maintaining the extension.

3. The fact that circuits obtained in this manner would have to run through central exchanges. There are objections to this which will be discussed below.

Leased lines are recommended, chiefly because of greater reliability. While the local exchanges and exposed lines will remain intact under attack conditions which will leave shelter locations usable, discussion with telephone company representatives indicates that fuel for emergency power may not in all cases be available to keep exchanges in operation for the postulated 2-week shelter period. If leased lines are acquired for the shelter system, shelter emergency power supplies can be used.

A further advantage to leased lines is that they can be utilized in many cases for routine County Government purposes, thus lowering the net cost to the County.

5.5 Proposed Wire Line Circuits (See Specimen Organization Charts on Pages 41, 42, and 43)

1. County HQ to District HQ.

It is proposed that lines from twelve of the thirteen Districts (District 4, Rockville, will have its HQ in the EOC) terminate in the EOC at Rockville. Repeaters will be installed where necessary due to the length of the line. Provisions will be made for switching incoming calls to operating positions when formal messages are to be handled or to appropriate other positions when direct telephone coversations are indicated. Power for these circuits will be taken from dry batteries maintained by the telephone company. Magneto ringing instruments will be used.

At District HQ, the lines from County HQ will terminate in a switchboard except in Districts where three lines or less will come into District HQ. In those cases, key switching will be provided to connect down to the area circuits, to adjacent District circuits, or to extension instruments at District HQ, should the latter be provided.

2. District HQ to Lower Echelon.

In those Districts where Area level echelons are set up, a line will be furnished to each Area. These lines will terminate in switchboards, except in cases of three lines or less, to provide connection (a) to any Area in the District, or (b) to extension instruments in Area HQ, if such extensions are provided. No grid circuits will be provided at the Area level. Magneto-ringing, battery-powered instruments will be used in Districts which are divided into areas in the Area-to-Precinct circuits and Precinct-to-Shelter circuits.

3. Area HQ to Precinct HQ.

Area-to-Precinct circuits will terminate in switchboards at each end of the circuit. These switchboards can be used to connect District HQ with a specific Precinct HQ and to cross-connect Precincts within the Area. Instruments will be of the type specified in (2) above.

4. Precinct HQ to Shelters.

Precinct-to-Shelter circuits will terminate in switchboards at Precinct HQ and telephone instruments at the Shelter end of the circuit. Telephone instruments will be of the same type as those in other echelons.

5.6 General Remarks on System Proposed Above

The above-outlined telephone system is, of course, capable of innumerable variations which would raise the capacity of the system, render it more flexible, or perhaps make it simpler to operate. Such "improvements," however, would always raise the cost and many of them would lower reliability and complicate maintenance. Batteries could be eliminated, for instance, by the use of a central power loop, thus permitting compatible circuits from County HQ all the way down to the individual shelter. Repeaters could be installed wherever needed to provide "commercial" quality service. We believe, however, that the simplest system which will do the job is the best system.

The use of sound-powered telephone instruments has been suggested. We do not believe, however, that such instruments should be used in any part of the system, since, at best, they would serve only over short-distance lines and battery-powered telephones would have to be used over the longer runs. Further, the use of sound-powered telephones would practically preclude occasional linkages across echelons.

5.7 Extensions in Shelters from Public Telephone Systems

An important reason for recommending a full leased-wire communication system is the possibility of failure of power supply at the telephone exchanges. However, most of the exchange power plants should remain operative for several days or longer through use of emergency gasoline engine driven generators with local fuel supply. Reduced useage due to the subscribers being in shelters will also help by reducing power supply demands.

The basic full leased-wire communication system is essential, however, and very necessary as a hardened backbone network. Where possible it is nevertheless recommended that regular exchange

facilities be used to supplement the leased-wire facilities by installing a regular dial telephone in shelter communication areas. If the shelter is part of a building normally used for other purposes, an extension from one of the building lines may be arranged. This would reduce operating costs to the cost of the extension line. Local telephone companies can doubtless suggest other possibilities.

Consultation with the local telephone companies is also recommended when planning shelter locations and construction. Access to the public telephone system facilities over and above the leased lines of the shelter system may become very important during the shelter period. This is especially true for headquarters locations. Such headquarters locations will undoubtedly have vital functions in the reconstruction period and these functions will in many cases have to be carried out without supplementing existing communications facilities. Materiel supplies will be very critical and reinforcement of communications facilities will be severely limited. Looking ahead and planning shelter and shelter control installations near already existing facilities may be very helpful when the need for them develops.

5.8 Radio Communications for Fallout Shelters

As stated earlier in this chapter, we are of the opinion that wire line telephones offer the best means of electrical communication for fallout shelters. The reasoning behind this conclusion need not be repeated here.

Radio, however, obviously provides the only feasible means of electrical communication to and between vehicles, parties working outside of shelters, couriers, and the like. In such cases radio becomes the **primary** means of communication and must be provided for. Further, despite the inherent reliability of wireline communications, their small but significant natural failure factor make it imperative that they be backed up by another means of communication if at all possible. Radio will provide this necessary backup.

There are other important considerations. One such consideration is the matter of cost and availability. The maintenance of a wireline shelter communication system year after year may constitute a drain on community revenues which will not, as a practical matter, be tolerated. It is unnecessary to mention here tax levels, the demand for funds for immediate and visible needs, and the general resistance to higher taxes. Radio equipment is in the hands of the public in enormous quantities. With the exercise of judicious effort by local Civil Defense authorities privately owned radio plant can be utilized to set up a communication system (at very small cost to the community) which may admittedly be somewhat on the makeshift side but will be far better than no system at all in the type of emergency which is the subject of this study. A second consideration is that, given radio equipment, communications systems can be improvised to meet situations which could not have been foreseen and covered by wireline installations, as when a headquarters shelter becomes uninhabitable, for instance. Such improvisation with wirelines on short notice would be impossible in many instances. No attempt will be made here to suggest improvised radio communications systems, however, since possible variations are infinite. The systems proposed in this report may be used as general guides. Applicable FCC Rules and a statement of their policy are included as Appendix .

5.9 Radio Operational Requirements

It is anticipated that the usual three general types of radio operation will be required in shelter communications systems. These are, of course, (1) point-to-point, (2) base-to-mobile, and (3) mobile-to-mobile. As examples, point-to-point use would include communications between headquarters of the various command levels in the county. Base to mobile would include the well-known uses such as the dispatch and control of police, fire, radiological monitoring, and supply vehicles when their activities were related to aid for and control of shelter populations. Mobile-to-mobile communications would include on-the-spot direction of teams engaged in their various activities. Ideally, each of these modes of operation should be possible with the same equipment; and this report will recommend that equipment of the greatest possible compatibility be used.

5.10 Choice of Radio Facilities

There has been considerable apprehension expressed from time to time over the apparent lack of radio facilities. (The term as used here is intended to refer to such things as frequencies, equipment, power, and the like.) This study concludes that there is no inherent lack of such facilities. Radio frequencies are available over a wide region of the spectrum, radio equipment is available in a multitude of varieties and cost ranges. Power and other parameters impose no particular drawbacks. The problem, we conclude, lies rather in the choice and acquisition of the proper facilities.

In setting up any radio system, the first problem usually considered is that of frequency availability. In this country the radio spectrum is administered jointly by the Federal Communications Commission and the Interdepartment Radio Advisory Committee. To oversimplify, the first group (the FCC) is concerned with the control and administration of the non-Federal Government use of radio; the second (IRAC) is charged with similar duties for the Federal Government. Again to oversimplify, the frequencies administered by the FCC will generally be available for Civil Defense use with the exception of those used by certain radio services, which will unquestionably be pre-empted by the military in case of war. (Those certain not to be available for Civil Defense are Amateur (except possibly RACES), Aviation, and Marine.

The FCC divides the radio services into three general groups: (1) Broadcast, (2) Common Carrier, and (3) Safety and Special. This study concludes that the facilities provided by the Safety and Special Radio Services will be most useful for shelter communications, with important specific uses being made of the Broadcast Radio Service and, only in rare cases, the Common Carrier Radio Service.

The Safety and Special Radio Service group consists of the Amateur, Aviation, and Marine Radio Services, which, as stated above, presumably will **not** be available for Civil Defense use (with the possible exception of the RACES segment of the Amateur Radio Service), and the Public Safety, Industrial, Land Transportation, Citizens, and Disaster Radio Services, all of which **will** be available for Civil Defense use in case of a war emergency. This does not mean, of course, that all of the resources of those services will be available for **shelter** communications since there will be numerous other demands. Neither does it mean that all frequencies allocated to those services can be feasibly utilized in a shelter communications system since FCC Rules in some services are restrictive in ways which would prevent tests, drills, etc., or make them impracticable in given cases.

One area in which the FCC Rules are restrictive is that of "eligibility" for a license. In the Safety and Special Radio Services mentioned above, eligibility is set out in terms of the industry or other group to which the potential licensee belongs. For instance, in the Land Transportation Radio Services, eligibility is confined to persons or organizations which operate public transportation facilities. Obviously, Montgomery County could not be licensed in the Highway Truck Radio Service, for instance, since it does not operate a common or contract carrier truck line. On the other hand, the County could enlist the voluntary services of a truck line or certain other licensees for Civil Defense communications purposes. This possibility will be explored elsewhere in this report. It is recommended, however, that the "backbone" of the shelter communications system be set up in radio services where the County itself can hold the license.

There are a number of such services. They are the Police, Fire, Highway Maintenance, Special Emergency, Local Government, Business, Citizens, and Disaster Radio Services. Montgomery County is now licensed in the Police, Fire, Highway Maintenance, and Local Government Radio Services. With so many possibilities available, from the standpoint of licensing eligibility, the choice of a service or services can be made on the practical bases of frequency suitability, power, equipment cost and availability, the character of other licensees in the service, and perhaps other considerations.

5.11 Characteristics of Radio Services Available to Montgomery County for Shelter Use

To a large extent, all of the Radio Services mentioned in the preceding paragraph operate in the same frequency regions and use the same or very similar equipment. With the exception of the Special Emergency, Citizens and Disaster Radio Services, all have allocations in High, Very High, and Ultra High Frequency regions of the spectrum. The exceptions are that the Special Emergency Radio Service has no UHF allocation. Citizens Radio operates only in the 27 Mc and 460 Mc regions, and Disaster only in the band 1750-1800 kc. The choice of frequency region, therefore, can be made without regard to radio service and can be based on the propagation characteristics desired.

5.1 Factors Governing Frequency Choices

The greatest distance required to be covered in Montgomery County will be from Rockville to Poolesville which is less than 15 miles. The terrain is such that practically a line-of-sight path is available over this route. (Rougher terrain might require different treatment.) Thus, County Civil Defense Headquarters at Rockville should be able to communicate with Poolesville on any of the available frequencies without resorting to unduly high antennas, relays, or other complicating expedients. Other District Headquarters locations are closer to Rockville, and there are no intervening land masses which should cause difficulty. Frequency choice, therefore, does not depend upon path characteristics.

On the other hand, there are reasons for limiting the range of shelter communications. One reason is that of interference, especially sky-wave interference. The total number of frequencies available is naturally limited, and interference could still further limit the total amount of traffic which could be handled over the system. Another reason for limiting the effective communications range of shelter transmissions is that of security. It is conceivable that enemy space, air, surface, or undersea craft might approach close

enough to the land areas of the United States to intercept shelter communications and thereby obtain useful intelligence data. Naturally, the longer the effective range of shelter transmissions, the greater the likelihood that it would be necessary to shut them down because of possible enemy interception.

Still another factor would be the size and complexity of the required antennas. Within limits, the higher the frequency, the smaller the antenna and the greater are the possibilities of using antennas with both directional and horizontal gain characteristics. Obviously, it would not be possible to use directional antennas at some stations (e. g., County Headquarters to District Headquarters) without using multiple antennas; but horizontal gain antennas could be used in all cases, with the desirable results of reducing power requirements and reducing the possibility of enemy aerial or satellite reconnaissance. In many cases directional antennas could be used to obtain the same desirable results (from District to County Headquarters, for instance.)

The above discussion indicates the use of frequencies in the VHF & UHF region, if possible, for most shelter operations. From the practical standpoint, however, there are still other considerations. One of these is the availability of equipment, both now and in the future. Equipment designed for use in the 27 Mc region of the Citizens Radio Service is both plentiful and reasonable in price. Its power, range, physical configuration, and general adaptability with regard to power sources, interchangeable use in base and mobile stations, its present wide distribution (there are about 300,000 licensees in the Class D Citizens Radio Service) are all points in favor of this equipment source. However, we have already concluded above that 27 Mc is not a desirable frequency region for shelter communications. UHF equipment, on the other hand, is scarce and expensive. Such UHF equipment as does exist consists almost altogether of the usual type of base-mobile transmitters and receivers which cost in the neighborhood of $700 to $1,000 per installation—a figure which is far too high for extensive shelter use. Portable and hand-carried equipment is almost non-existent. We have been informed, however, by a prominent manufacturer that suitable UHF equipment has been designed and can be produced if there is a demand for it. UHF is recommended, therefore, between District and Area Headquarters. For such a purpose it should be ideal.

The use of VHF for shelter communications between Area and Precinct seems to be desirable if the equipment cost considerations can be resolved. The use of frequencies in this range for fire, police, and industrial communications is widespread and much equipment is available, although in a price range which is still too high for shelter use. The best possibility would seem to lie in the development of 150 Mc equipment of the same general character as the previously mentioned equipment so widely used in the Class D Citizens Radio Service. The same manufacturers, given the proper incentive, should be able to produce similar equipment for operation in the VHF region at a cost only slightly higher than that for 27 Mc. We have surveyed a number of manufacturers in this regard. One manufacturer has estimated a cost of about $300 for a two-frequency, one-watt unit.

5.13 Transmitter Power Requirements

As stated before, the maximum distance coverage requirement for Montgomery County would be from Rockville to Poolesville (County-to-District HQ), a distance of 15 miles. At 10 watts transmitter (antenna) power, with a 15 db cardioid antenna at Poolesville, a more than ample signal on 950 Mc should be re-

ceived at both ends of the Rockville-Poolesville circuit. The actual signal strength should be 20 microvolts or more. This, of course, should be sufficient under all conditions.

A maximum of about 3 miles will be required between urban district and area headquarters and, in most instances, considerably less. In the rural areas the distance might rise to 6 miles in extreme cases. Since it is anticipated that Area Headquarters will be required to control mobile units, directional antennas will not be practical at Area Headquarters. Horizontal gain antennas can be employed, however, with worthwhile coverage increases and reduction in power supply requirements. Under such conditions a conservative signal strength of 15 microvolts can be obtained on 450 Mc frequencies (disregarding transmission line losses) at 3 miles, using a 3-watt transmitter with both transmitting and receiving antennas 20 feet high. For base-mobile use, signal strength would drop to about 5 microvolts at 3 miles—still ample. For mobile-to-mobile operation a range of about 2 miles could be expected.

At ranges such as these, frequency, within wide limits, seems to have little effect on signal strength unless there are obstacles in the transmission path. Since such obstacles will be present in all urban areas, it would be desirable to use a lower frequency band than that recommended for District-to-County headquarters communications. Therefore, frequencies in the 150 Mc region are recommended for precinct-to-shelter headquarters communications.

For precincts to shelters, distances of more than 2 miles would be very rare. Calculations show that 1-watt transmitters working into 20-foot unity gain antennas should provide ample coverage. Actual installations will vary as to coverage, of course; and antenna height should be regulated so as to keep the interference range as short as practicable. Again, frequencies in the 150 Mc range should be employed.

Communications within precincts would use the same 150 Mc equipment except that each precinct ought to be furnished one or more 27 Mc transceivers, operating in the Citizens Radio Service, for communications with individual private shelters. This latter recommendation is based on the knowledge that many thousands of 27 Mc Citizens Radio transceivers are in the hands of the public and that they should be ample for occasional private shelter-to-precinct operation. Their usual power of about 3 watts will be sufficient in practically all cases.

5.14 Radio Services for Fallout Shelter Communications

The term "Radio Services" as used here means the various services as defined by the Rules of the FCC. As stated before, with no more than minor exceptions, we consider it essential that the shelter communication system be set up under parts of the FCC Rules where the County is eligible to be the licensee. These are Public Safety, Citizens, Disaster, and one Sub-Part of the Industrial Radio Service (the Business Radio Service for use in connection with County school operation).

Under Part 10 of the FCC Rules (Public Safety), the County is already licensed in the Police, Fire, Highway Maintenance, and the Local Government Radio Services. All of the County's present radio systems may be used for Civil Defense purposes, including shelter communications. However, the first three services, Police, Fire, and Highway Maintenance, can be assumed to have their capacities saturated in connection with their normal missions (adapted, of course, to nuclear attack conditions) and will not be available

for shelter communications except in extremities. The Local Government Radio Service, however, under the FCC Rules, Section 10.553, may be used "... to transmit communications essential to official activities of the licensee." This would include drills and test transmissions.

The County is eligible for licensing under Part 19 of the FCC Rules (Citizens Radio Service), and Citizens Radio 460 Mc frequencies will be considered for the County Headquarters-District Headquarters circuits. It should be noted here that operation in the 460 Mc Citizens Radio frequency region bears no resemblance to operation in the 27 Mc region. Almost without exception communications in the 460 Mc band are of a high quality, and the almost uncontrolled hodge-podge of communications of the 27 Mc Citizens Radio band is entirely lacking.

The Disaster Communications Service (Part 20 of the FCC Rules) was set up to deal with, among others, situations of the kind contemplated in this study. However, frequencies were allocated in the band 1750-1800 kc only. Frequencies in this region are considered unsuitable for shelter communications due to their vulnerability to interference (by other stations on the same frequencies, atmospherics, and man-made electrical noise). There are, however, some interesting possibilities for special uses of one or more frequencies in this Service. These possibilities will be discussed later on in this chapter.

The Business Radio Service (Sub-Part L of Part 11 of the FCC Rules) can be used by the County in connection with its operation of the public school system. Frequencies are available in this Service in all the ranges required for shelter communications. If the County were licensed in this Service, it could use the Service for all types of traffic in connection with operation of its school system but for no other part of the County's business except in emergencies.

The Radio Service chosen for fallout shelter communications obviously must provide the required frequency choices. It should also be usable for day-to-day County Government operations. The Citizens Radio Service on 460-470 Mc would be usable for County-to-District communications but, as before discussed, would not be desirable in the lower echelons due to high costs and present lack of suitable equipment. Further, for routine operations it could not be directly interconnected with circuits operating in other services. (See FCC Rules Section 19.61(a).)

The Radio Amateur Civil Emergency Radio Service provides two 540 kc bands in the 150 Mc region. These frequencies could be utilized except for the fact that the County could not be the licensee and that the County could not use for other purposes equipment set up on RACES frequencies. There is also the recognized possibility that the Armed Forces will immediately pre-empt all Amateur Radio Service frequencies if hostilities should occur.

Everything considered, therefore, it seems likely that the local Government Radio Service would provide the best facilities for fallout shelter radio communication. Frequencies are available on 150 Mc, 450 Mc, and 950 Mc. Systems set up on frequencies in this Radio Service could be used routinely for the conduct of County business, thus serving the double purpose of keeping the system alive and working and at the same time amortizing the County's investment in the radio equipment.

5.15 Number and Type of Radio Installations

The number of shelters will be the basic factor in determining how many stations will be required. In view of our assumption that eventually the entire county population will be provided shelter space and our further assumption that shelters constructed for that purpose will house an average of 500 persons, simple arithmetic indicates that about 680 shelters will be required. This means that a minimum of 680 radio installations will be needed. One-watt transceivers designed to operate from either storage batteries or the 110-volt A. C. lines will be used. These will work into the 94 precinct headquarters stations. (Some of these will be designated as Area or District Headquarters as well.) Three-watt transceivers operating on 450 Mc will serve the 23 Area Headquarters stations, which will work into the 13 District Headquarters stations. The latter will use 950 Mc 10-watt equipment to work into County Headquarters. In addition to the above, each of the 94 Precincts will have at least one 27 Mc transceiver of 3 watts power licensed to the County in the Class D Citizens Radio Service for communication with private fallout shelters. (A complete equipment tabulation is shown at the end of this chapter.) All transmitters and transceivers will be made to use both an attached antenna and an outside antenna, mounted if possible, in the clear on the side or top of the shelter building. Actual radiated power will be reduced to the minimum required for reliable communications in each installation. Each installation will be engineered for optimum performance.

5.16 Equipment Requirements, Quantitative

The table on Page 58 shows estimated equipment requirements for the Montgomery County shelter system. The quantities shown are considered to be minimum and are intended to carry only the load of a second-line communications system. Certain needed items are not shown, inasmuch as they are equipments which are in the hands of the public in large numbers. It is assumed that Block Wardens will check among their shelterees for items such as portable television sets and additional broadcast receivers (especially the small all-transistor, battery-operated types) and arrange with the owners for their pickup and delivery to the shelters when the warnings are sounded. Outside antennas should be provided for broadcast and television reception since it is unlikely that satisfactory reception can be had from antennas enclosed in the shelter areas. Wardens should also check their areas for Citizens Radio and portable Amateur Radio equipment and arrange with the individual licensees for its transportation to shelter areas when necessary. As stated before, only a minimum number of equipments is shown in the attached table; and augmentation by other equipment of useful types will be highly desirable. It goes without saying that all transmitting equipment should be collected and held in the shelter communications area and its use rigidly controlled by the Shelter Warden or his Deputy for Communications.

5.17 Circuit Capacity of the Radio System

It must not be assumed that the radio system proposed above can by any means totally replace the wire-line radio system. There are simply not enough frequencies available to provide enough capacity unless a radio system of such complexity as to be out of the question both from the standpoint of reliability and cost is installed.

The limiting factor is interference between the stations in the system. When the system is installed power outputs must be kept as low as possible while still providing an adequate signal at the receivers

and the available frequencies should be assigned among the various stations with the idea of reducing interference to the least amount practicable.

The radio system is, as a matter of fact, designed only to cope with random failures in the wire-line system. It can take over a considerable number of circuits from the wire-line system at probably close to full capacity. As the number of active radio circuits grows, however, interference will tend to limit the time each circuit can remain active, thus cutting down its capacity.

5.18 Special Purpose Radio Communications

The County Director of Civil Defense will have many occasions to transmit messages to the entire population of the County or to a substantial portion of it. If these messages are of sufficient importance, they should, of course, be transmitted over the regular wire or radio channels so that their receipt can be assured. In many cases, however, messages need not be acknowledged and can be broadcast to the County population or whatever portion of it they might be addressed to. There are a number of Broadcast Stations, both AM and FM, in Montgomery County, some of them near County Headquarters at Rockville. It is recommended that the Director of Civil Defense make arrangements with the management of one or preferably a number of these stations for use during the shelter period. Control lines would have to be run to County Headquarters and an operating position established. Certain changes in the broadcasting station plant might be required so that it could be operated unattended.

As an alternative to the use of a broadcast station, a station could be set up in the Disaster Radio Service (Part 20 of the FCC Rules). A power availability of 500 watts (input) should easily cover the entire County. As Disaster Radio Service frequencies are in the band 1750-1800 kc, ordinary broadcast receivers can easily be converted to cover the selected frequency. Such a station could be set up at County Headquarters where it would be available at all times for use in an emergency. It would be under the complete control of the County, power would always be available, and the question of control lines would not arise. The possible imposition of radio silence must, of course, be taken into account in connection with this suggestion. The limited number of frequencies available to this Service would preclude nationwide use.

5.19 Utilization of Other Communications Systems

The FCC Rules almost universally make provision for the use of communications systems, regardless of the purpose for which they are licensed, in connection with the safety of life and property. As a matter of fact, Parts 11 and 16 (Industrial and Land Transportation, respectively) specifically state that radio stations licensed under those Rules may be used for business purposes **only** on condition that no interference is caused to communications related directly to the safety of life and the protection of property. Services which are not normally permitted to intercommunicate are universally permitted to do so when necessary for the protection of life or property. One requirement of the Rules, however, is that such stations must be operated under the control of the licensee. Another general requirement is that Civil Defense use of such systems is limited, in **drills and exercises**, to the fulfillment of the mission for which the system was licensed (e.g., a Highway Truck Radio Station may be used only to direct or control the movement of trucks

which may, of course, be engaged in Civil Defense missions.) The only notable exception is the Taxicab Radio Service. Stations licensed in the Taxicab Radio Service may be used to handle Civil Defense traffic which is not related to the movement of the taxicabs. It is also recognized that the Amateur Radio Service Rules require that priority be given to emergency communications and that amateurs can give valuable help in cases of emergency. The Radio Amateur Civil Emergency Radio Service was set up for the purpose of providing communications in cases of disasters of all kinds. As before stated, however, the probable pre-emption of Amateur frequencies (possibly including RACES), by the Armed Forces and the suspension of all amateur activity would seem to make it undesirable to give the Amateur Radio Service a key place in a shelter communications program. The utilization of amateurs as operators and technicians is another matter.

As can be seen from the above, it is possible to set up a fairly comprehensive Civil Defense communication system by utilizing already-licensed private systems. It has actually been done in a number of cases, one of them being that of Onondaga County, New York. It is considered hardly practicable, however, to set up a **shelter** communications system on the above basis. We consider it essential that the Director of Civil Defense have complete control over the communication system, that he know that each station will be located where it will be needed if the emergency should arise, and that he have available operating personnel responsible to him. This is the kind of system which we advocate.

5.20 Physical Separation of Communications Centers

It is considered that the communications area must be separated from the general shelter habitation area. This is necessary to protect equipment, to prevent unauthorized access to communications facilities, and to permit communications personnel to properly carry out their duties.

Proper administration at each organizational level in the shelter system will demand that space be set aside for the use of the shelter administrators, to store supplies, and to keep equipment. The communications center should be a part of this area if at all possible so that shelter administrators will have ready access to the communications facilities.

5.21 Battery Power Supplies

It is proposed that all radio equipment be operated from lead-acid storage batteries.

It is assumed that all shelters will draw power from the public mains as long as it is available and that they will also have emergency gasoline-driven 110 V. A. C. generators to furnish a reduced amount of power if the public supply fails. Such failure seems almost certain before the end of the two-weeks period.

As a primary source of power for the radio equipment and for a minimum amount of power for other purposes (such as lighting) it is proposed that each shelter be supplied with a 12 V. D. C. supply taken from lead acid storage batteries.

Suitable batteries are widely available. One type, built in 6 V. units for fire-alarm service, has a capacity of 100 ampere-hours and has a built-in charging unit and a built-in charge indicator. Its nominal expected life is 10 years and its cost is $36 per unit.

It is suggested that two such batteries be kept floating across the 110 V. A. C. power supply at all times, that all radio equipment be set up for 12 V. D. C. operation, and that permanent wiring be installed for equipment connection.

The use of storage batteries in this connection becomes extremely pertinent when it is considered that many thousands of such batteries would be available in automobiles immobilized during the shelter period. If all shelter power failed, the auto batteries could be commandeered to provide an almost inexhaustible power source. In a large number of cases also, the automobile engine and generator could be used to recharge the batteries if necessary. Such use would be practicable only after the fallout level had dropped to a point where personnel could emerge from the shelters for short periods, of course.

5.22 Broadcast Receivers for Fallout Shelters

It is recommended that each shelter area be provided with a broadcast receiver as a part of the area's permanent equipment complement. A permanently-installed antenna should be erected since it is unlikely that good reception can be had from an inside antenna.

The broadcast receivers mentioned here should be capable of covering both the AM and FM Broadcast Bands and should be compatible with the program finally worked out in connection with the proposed use of broadcast stations during enemy attacks. They should, of course, be constructed with durability and trouble-free operation in mind and should be capable of operation from both 12 volt batteries, and from the 110 V.A.C. mains. Transistors instead of tubes are a must.

5.23 Adaptability of Montgomery County Plan to Other Areas

Because of the diverse character of the various portions of Montgomery County with respect to population and ecology it is believed that the plan of communications shown in connection with this study will be widely adaptable to other areas of the country.

To illustrate, Districts 1, 2, and 3 are typically rural. All have populations of less than 2000 persons. Industrially, dairying and livestock (beef cattle and horses) are important. Corn and small grains are grown. There is some income from tourists and transients generally.

Communications for these Districts provide for circuits to a District Headquarters from three or four (depending upon the actual population) shelters. The District is, of course, tied in with the next higher organizational level, in this case, the County.

District 4 takes on considerably more of an urban character. While areawise it is preponderantly rural, it contains the town of Rockville with a population of 26,000 and this portion of the plan could serve as a prototype for large towns and small cities.

District 7 contains the urban Bethesda-Chevy Chase area and has a population of 94,000. Its requirements in this field would be comparable to those of cities in the general population class of about 100,000.

District 13, Wheaton, has a population of 160,000 and its communication plan should serve as a good general guide for cities in the 150,000 to 200,000 class.

There are obvious dissimilarities between Montgomery County and other regions of the country, however. Topographically, the comparatively flat terrain differs from that of the mountainous regions less than fifty miles away. This would call for different radio requirements in those regions. Differences in industrial character, population make-up, and ability to pay for a communications system, would all have to be taken into account.

As to adapting the plan here presented to areas of greater population, such as a large city, it is recommended that the plan for District 13 be used as a building block. The Warden of that District has seven Area Wardens reporting to him. This appears to be an optimum number in view of limits on span of control, if we adhere to the idea that the Area is the top "action" level. Five to seven such districts could be combined to form the next echelon and so on.

5.24 County Government Communications During Shelter Period

Montgomery County is, as stated elsewhere, licensed by the F. C. C. to operate radio stations in several radio services for normal peacetime use. These are the Police, Fire, Highway Maintenance, and Local Government Radio Services.

Under the County's plans for Civil Defense, each of the County organizations using the above Radio Services will have an important mission during the shelter period. Their radio and wireline communications circuits will be as indispensable for their emergency operations as they are now for their day to day work. Naturally their personnel will have to take refuge in shelters until the radioactivity decays to a point where they will be able to emerge from the shelters safely.

In order to provide communications for these County personnel in connection with their official duties, it is suggested that shelters as close as possible to the Police Precinct Headquarters, Fire Stations, or Maintenance Depots be designated as Shelter Headquarters and that wire line and radio installations be made in those shelters. The wire lines could be extensions of the presently installed lines and the radio stations could be mobile transmitters held as spares for the present mobile units.

This would have two important advantages: It would give these County employees the specialized communications best fitted to their emergency assignments and would not add to the traffic load which the already minimal shelter circuit capacity would have to carry.

The shelter circuits would, of course, be available for emergency communications for any of the County's operations during the shelter period or at any other time.

5.25 Courier Communications for Fallout Shelters

In this age of almost instantaneous electrical communications we are prone to overlook what is still the most important communication system of all, namely the mailman with a pack on his back. Naturally,

SUMMARY OF COMMUNICATIONS PLANT REQUIREMENTS FOR MONTGOMERY COUNTY

District	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Switch boards	Tele-phones	B/c Re-ceivers	Popu-lation	Shelters
CHQ (Rockville)	*	3 (10w)	6	10	10	**	**	3		
1 (Laytonsville)	22	1	3	3	1	0	5	3	1,715	3
2 (Clarksburg)	26.5	1	4	4	1	1	6	4	1,930	4
3 (Poolesville)	30	1	3	3	1	0	5	3	1,450	3
4 (Rockville)	51.5	0	8	65	8	8	99	65	32,755	65
5 (Colesville)	65	1	15	36	7	6	63	42	20,965	42
6 (Darnestown)	24	1	4	4	1	1	6	4	2,235	4
7 (Bethesda)	120.5	1	27	190	23	19	280	186	92,940	186
8 (Olney)	31	1	8	8	1	1	14	9	4,660	9
9 (Gaithersburg)	22.5	1	7	10	3	2	20	13	6,340	13
10 (Potomac)	31.5	1	9	9	1	1	14	9	4,640	9
11 (Barnesville)	26	1	3	3	1	0	5	3	1,515	3
12 (Damascus)	20	1	7	7	1	1	11	7	3,700	7
13 (Wheaton)	204.2	1	52	329	44	48	464	321	160,755	321
GRAND TOTALS	674.7	15	156	681	103	88	992	672	335,600	669

* "Cost" Miles in this tabulation

** To be determined

the United States Postal Service will not be functioning during the period when the population is in fallout shelters, but a courier service can be set up as a substitute.

All authoritative sources available to us indicate very rapid decay rates for fallout radiation. (See especially "The Effects of Nuclear Weapons", Chapter IX.) This means that personal travel between the various components of the shelter system will be possible relatively soon after the cessation of actual fallout.

In Montgomery County distances are so short, assuming that streets and highways are relatively clear, that a sack of "mail" could be sent from any area in the county to Headquarters at Rockville without exposing the carrier for more than an hour. Obviously the same individual would not be required to travel the whole distance; he could stop off at a shelter at an intermediate point and another man could take over. Thus, in some areas courier communication to Rockville or vice versa could be had without exposing any individual for more than a total time of ten or fifteen minutes.

Since the electrical communications circuits will be of limited capacity in any event, such things as daily reports, shelter censuses, and even letters between separated members of families could be sent to any point in the County by courier. Newspapers and magazines from outside the affected area could be distributed. Such a systematic courier service could do much toward keeping up morale and easing the tensions which are certain to be present during such a period of confinement as is here contemplated.

This report will not attempt to set up a courier system plan. The operation of such a system will be so dependent on conditions that are constantly changing as to make even minimal adherence to a preconceived plan a remote probability. Furthermore, courier routes and schedules can be improvised on the spot with ease and rapidity, given reports on radioactivity and road conditions in the county. Travel should obviously be by automobile or truck. It seems to be a safe conclusion that there would be no shortage of such vehicles, with good supplies of fuel in their tanks, which could be commandeered for this purpose. Radio equipment in the vehicles would be desirable for control while en route between points as a safety factor.

It goes without saying that radiological monitoring and other techniques must be applied to prevent any courier from absorbing a dangerous dose of radiation. Radiological monitoring and control personnel will know what criteria to apply in selecting individuals for courier duty.

We strongly urge that wardens at various echelons be briefed on the utility of couriers for the transmission of matter which does not have an urgency demanding the use of electrical communications systems or which is of a nature not suitable for transmission by radio or wirelines.

5.26 Estimated Cost of the Montgomery County Shelter Communication System

Radio Initial Costs

It is particularly difficult to give a dependable estimate of the costs of the radio side of the Shelter Communications System. This is due mainly to the fact that we have not yet found radio equipment which we consider wholly suitable for the system from the standpoint of cost, durability, frequency range, and power. We are, in fact, recommending that a development program be instituted for the purpose of making

available equipment which will meet appropriate criteria. This recommendation is set out in Chapter VIII of this report. The recommendation gives in very general terms the characteristics of the equipment desired and states briefly what our inquiries revealed.

We think it probable that the absence of a market is responsible for the lack of proper equipment, and that a demand for equipment sufficient to man a nation-wide shelter program would stimulate production of the desired models at prices within reach of the average community. Such a trend has resulted in every major area of radio communications development and we think that a notable example has been the proliferation of Class D (27 Mc) Citizens Radio Service equipments. Except for frequency regions and modulation type, most of the equipment which we recommend in connection with the fallout shelter program is similar to the CRS transceivers mentioned above. We think further that lower marketing costs of shelter communications equipment (quantity sales instead of individual sales) should permit the construction and selling of shelter equipment at eventual costs comparable to those of CRS gear even though built to higher standards.

The cost estimates which follow take into account the factors mentioned in the preceding paragraph. On that basis we believe it is realistic to estimate the cost of one watt 150 Mc transmitters at somewhat more than presently-available CRS one-watt transceivers of good quality. Transceivers for use on 450 Mc might carry estimated costs of 10 to 20 per cent more per unit; 950 Mc transceivers (single-channel) should cost no more than the 450 Mc transceivers.

On the above basis we estimate the unit costs as follows: 150 Mc one watt, $250; 450 Mc 3 watt, $300; 950 Mc 3 watt, $300; 950 Mc 10 watt (needed at County HQ only) $500. It is emphasized that these estimates are based on a development program; at the present time we do not consider suitable equipments available at all.

As for the 27 Mc equipments, good one and three watt transceivers can be had at $200 or less.

Emergency Power Supplies

As stated in Chapter V, it is recommended that a 12 volt bank of lead-acid storage batteries be provided to furnish emergency power for the radio equipment and for lighting in extreme emergencies. Six-volt batteries with suitable characteristics are available at $36 each or $72 per shelter.

Detailed radio initial costs are estimated below:

3 each	950 Mc Transceivers (10 watt) at $500	$ 1,500
	Antenna & Installation for above at $150	450
12 each	950 Mc Transceivers (3 watt) at $300	3,600
	Antennas & Installation for above at $100	1,200
156 each	450 Mc Transceivers (3 watt) at $300	46,800
	Antennas & Installation for above at $100	15,600
681 each	150 Mc Transceivers (1 watt) at $250	156,690
	Antennas & Installation for above at $50	34,050

103 each	27 Mc Citizens Radio Band Transceivers at $125	12,875
	Antennas & Installation for above at $20	2,060
672 each	AM-FM Broadcast Receivers at $100	67,200
1338 each	Lead-Acid Storage Batteries, 6 V, 100 AH, complete with built-in chargers & charge indicators at $36	48,168
	INITIAL COST OF RADIO INSTALLATION	$390,193

Assuming that testing and minor servicing is done by volunteers, the greater part of the recurring cost for the radio installation would for one full-time radio technician. (He would need transportation, but it is assumed that the Division of Civil Defense would have available vehicles for general use which would be available to the radio technician.)

Yearly recurring radio costs:

Salary, Radio Technician Full-time at $6,000	$6,000
Incidental Supplies, Spare parts, etc.	3,000
TOTAL RECURRING COSTS OF RADIO INSTALLATION PER YEAR	$9,000

The useful life of the above radio installation is estimated at 10 years. At the end of that period, it is believed that technological progress would have made the installation obsolete and changes in the world political climate almost surely would call for different requirements. On these assumptions, therefore, an amortization rate of about $40,000 per year should be allowed. This includes salaries and supplies.

Wire-Line Communications Costs

As with the radio communications system, estimates of the cost of the wire-line communication system depend upon certain assumptions. The estimates shown below are based on rental of lines and equipment from the local telephone company and maintenance by it. It is assumed that the telephone company will supply equipment of the types required, especially magneto-ringing instruments of the general type of the military EE-8. This instrument is known for its ruggedness and dependability under rough usage.

Like the radio costs, the wire-line costs can be divided into initial and recurring, with the long-run expenses, unlike radio, mostly in the latter category. Costs can be further broken down into (1) line rental, (2) switchboard rental, and (3) telephone instrument rental.

There are two different line rental rates in Montgomery County. In about one-fourth of the County designated as "metropolitan" (the portion of the County adjacent to the District of Columbia), the rate is $4 for the first mile or fraction thereof and $1 for each additional 1/4 mile per month; in the remainder of the County the corresponding figures are $3 and $0.75.

There are two types of switchboards available which are suitable for the system discussed here. One has a total capacity of 17 lines and instruments (combined) and the other has a total capacity of 8 lines and instruments. The first would probably take care of the installations requiring up to and including 12 lines; the second a maximum of about five. For installations with no more than three lines, the ordinary key switch, at $0.25 per month each would be ample for switching purposes.

As implied above, telephones of the military field type are not available from the telephone company in Montgomery County at present. There is little doubt, however, that they would be supplied if sufficient demand were present. The telephone instrument rental rate is $1.25 per month. This figure includes all servicing.

The installation rate is $5 per termination. Thus, the installation of a switchboard, with five lines coming in and four extensions telephone instruments would be $45.

To discuss concretely the basis for the actual estimated wireline mileage cost, it is noted that, as a practical matter, Districts 4, 5, 7, 10, and 13 comprise the "metropolitan" portion of the County and take the $4 mileage rate. The remainder of the County would take the $3 rate. In the metropolitan area, nearly all of the shelters are within a mile of their Precinct Headquarters; therefore the mileage can be taken (except for District 10), from the cost standpoint, as the number of shelters. Higher echelon mileage should be taken as the actual assumed mileage since distances from Precinct-to-Area HQ and higher are generally more than a mile. In the non-metropolitan area of the County, Shelter-to-Precinct distances are nearly always greater than a mile and actual mileages are used throughout.

As for switchboards, in Precincts or equivalent areas where the number of shelters is five or less, the small board is recommended; in others, the larger. Where fewer than four lines come into a Headquarters location, it is recommended that each line be terminated in a telephone instrument and key switches be installed for interconnection.

Where switchboards are installed, it is recommended that one telephone instrument be provided for each two incoming lines.

Costs in the tabulation below are calculated on the bases discussed above.

District 1 (Laytonsville)	
22 Miles Wire at $3	$ 66.00
3 Telephone Instruments with Key Switches at $1.50	4.50
2 Telephone Instruments at $1.25	2.50
District 2 (Clarksburg)	
26.5 Miles Wire at $3	79.50
1 Switchboard at $7	7.00
6 Telephone Instruments at $1.25	7.50
District 3 (Poolesville)	
30 Miles Wire at $3	90.00
3 Telephone Instruments with Key Switches at $1.50	4.50
2 Telephone Instruments at $1.25	2.50
District 4 (Rockville)	
81 Miles Wire at $4	324.00
8 Switchboards at $10	80.00
99 Telephone Instruments at $12.5	123.75

District 5 (Colesville)	
74 Miles Wire at $4	$ 296.00
5 Switchboards at $10	50.00
1 Switchboard at $7	7.00
63 Telephone Instruments at $1.25	78.75
3 Telephone Instruments with Key Switches at $1.50	4.50
District 6 (Darnestown)	
24 Miles Wire at $4	96.00
1 Switchboard at $7	7.00
6 Telephone Instruments at $1.25	7.50
District 7 (Bethesda)	
290 Miles Wire at $4	1,160.00
14 Switchboards at $10	140.00
5 Switchboards at $7	35.00
280 Telephone Instruments at $1.25	350.00
6 Telephone Instruments with Key Switches at $1.25	7.50
District 8 (Olney)	
31 Miles Wire at $3	93.00
1 Switchboard at $10	10.00
14 Telephone Instruments at $1.25	17.50
District 9 (Gaithersburg)	
22.5 Miles Wire at $3	67.50
2 Switchboards at $10	20.00
20 Telephone Instruments at $1.25	25.00
District 10 (Potomac)	
31.5 Miles Wire at $4	126.00
1 Switchboard at $10	10.00
14 Telephone Instruments at $1.25	17.50
District 11 (Barnesville)	
26 Miles Wire at $3	78.00
3 Telephones with Key Switches at $1.50	4.50
2 Telephones at $1.25	2.50
District 12 (Damascus)	
20 Miles Wire at $3	60.00
1 Switchboard at $10	10.00
11 Telephone Instruments at $1.25	13.75

District 13 (Wheaton)	
398 Miles Wire at $4	$ 1,592.00
39 Switchboards at $10	390.00
9 Switchboards at $7	63.00
6 Telephone Instruments with Key Switches at $1.50	7.50
464 Telephone Instruments at $1.25	580.00
TOTALS	
985 Miles Wire	$ 4,128.00
24 Telephone Instruments with Key Switches	36.00
983 Telephone Instruments	603.50
17 Switchboards at $7	119.00
71 Switchboards at $10	710.00
TOTAL MONTHLY TELEPHONE RENTAL COST	$ 5,596.50
PER YEAR	$67,161.00

INSTALLATION COSTS (on the basis of $5 per termination) are computed as follows:

1007 Telephone Instruments	$ 5,035.00
591 Lines Terminated in Switchboards	2,955.00
TOTAL ESTIMATED INSTALLATION COST	$ 7,990.00

EXPLANATORY NOTE

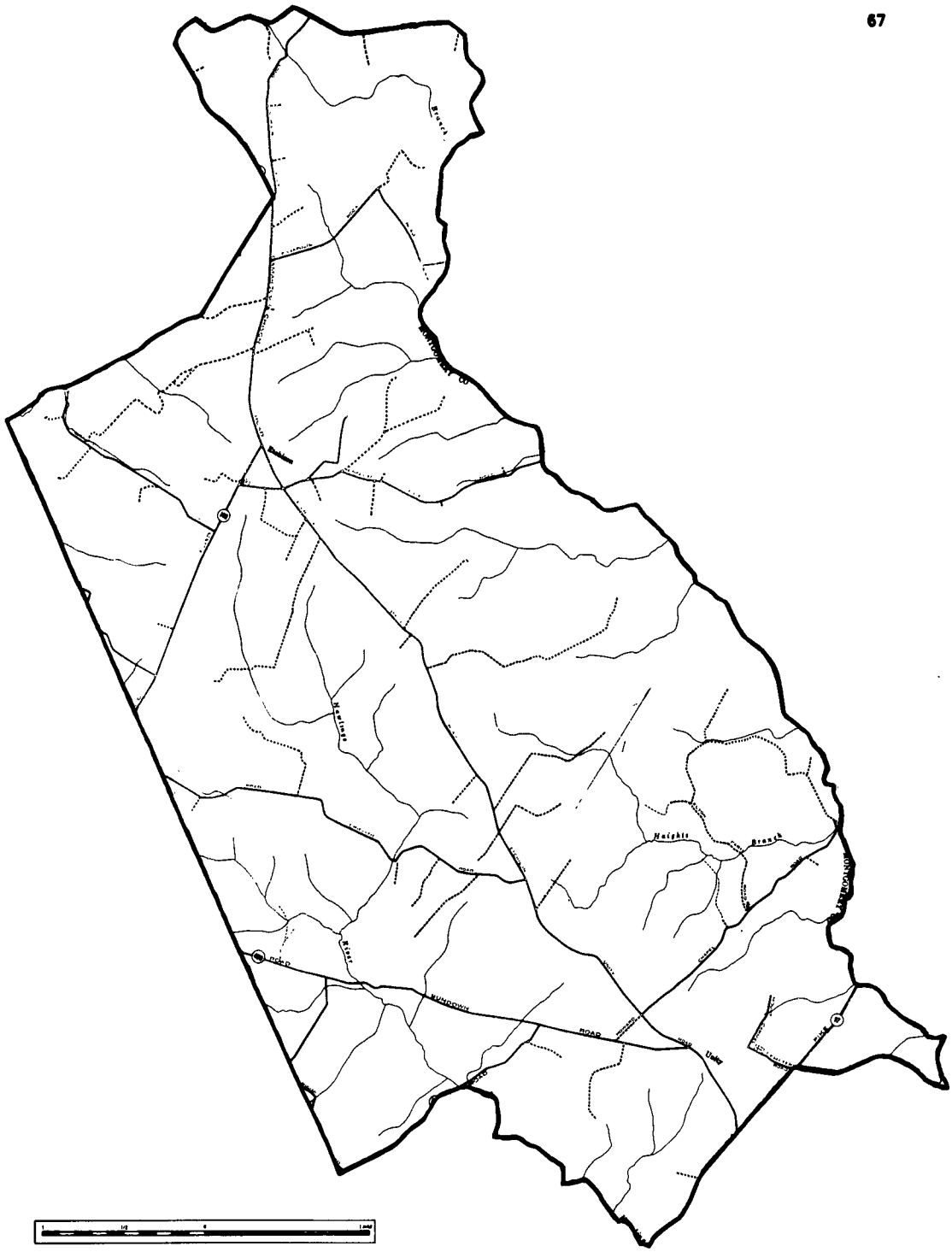
The following Pages 65 through 144 consist of tabulations of communications plant requirements for the area represented by each accompanying map. Due to uneven population distribution there are differences in organization between Civil Defense Districts.

Districts 1, 2, 3, 6, 8, 9, 10, 11, and 12 have no internal breakdown; Districts 4 and 5 have Precincts but no Area breakdowns; Districts 7 and 13 have both Precinct and Area designations.

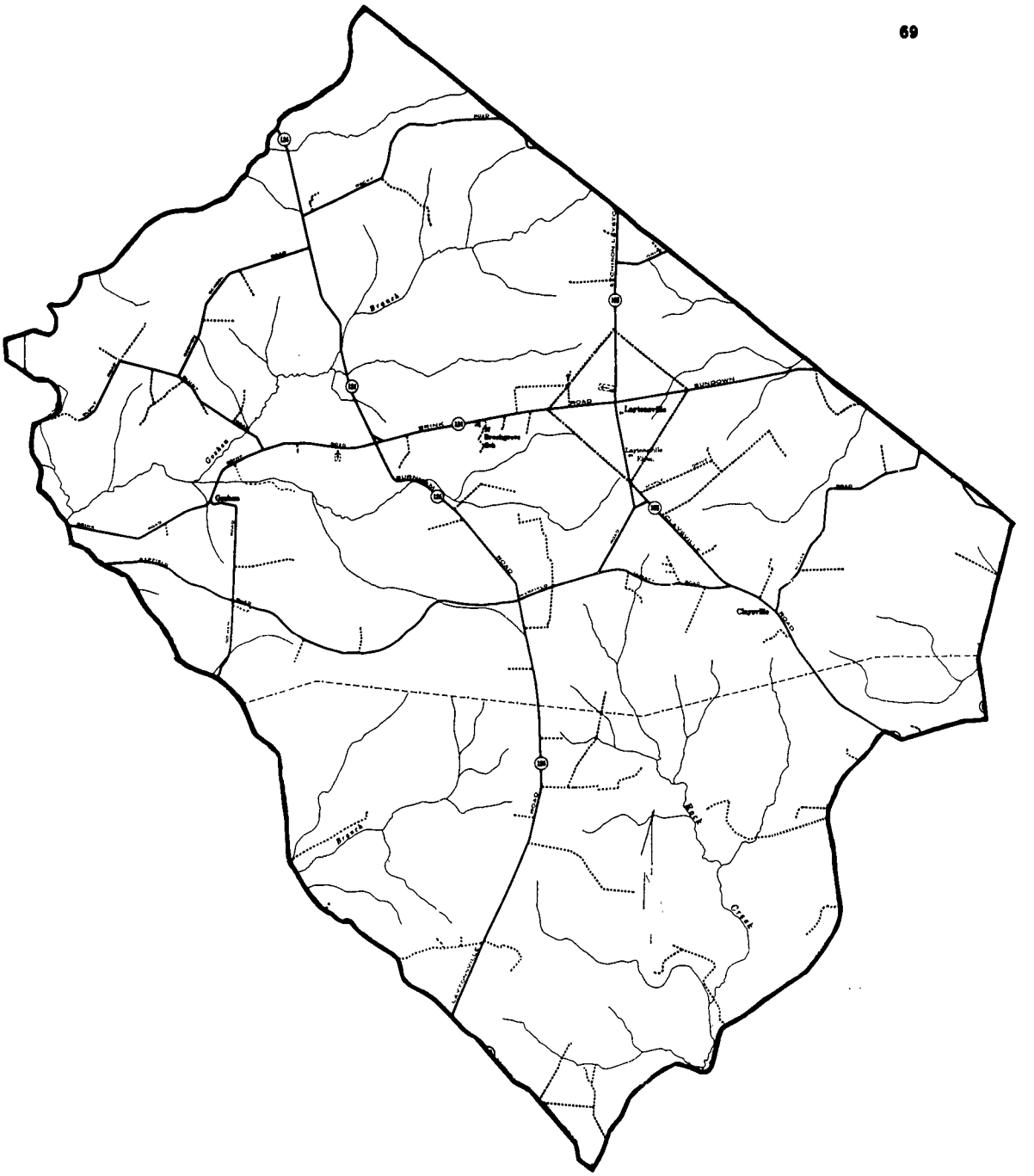
The maps appearing on these pages are adapted from copies of portions of the four-part "Street Map of Montgomery County". This map is published and copyrighted by the Maryland-National Capital Park and Planning Commission, Silver Spring, Maryland, and is used herein by permission. Requests for rights to further reproduction should be made to the Commission at the above address.

DISTRICT 1
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 1 to CHQ	9	1	1	1	1	Laytonsville El. Sch.	1715	3
DHQ to Dist. 12	6							
Shelter 2 to DHQ	3		1	1		Etchison		
Shelter 3 to DHQ	4		1	1		Unity		
Totals	22	1	3	3	1		1715	3



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 1 (Eastern Part)

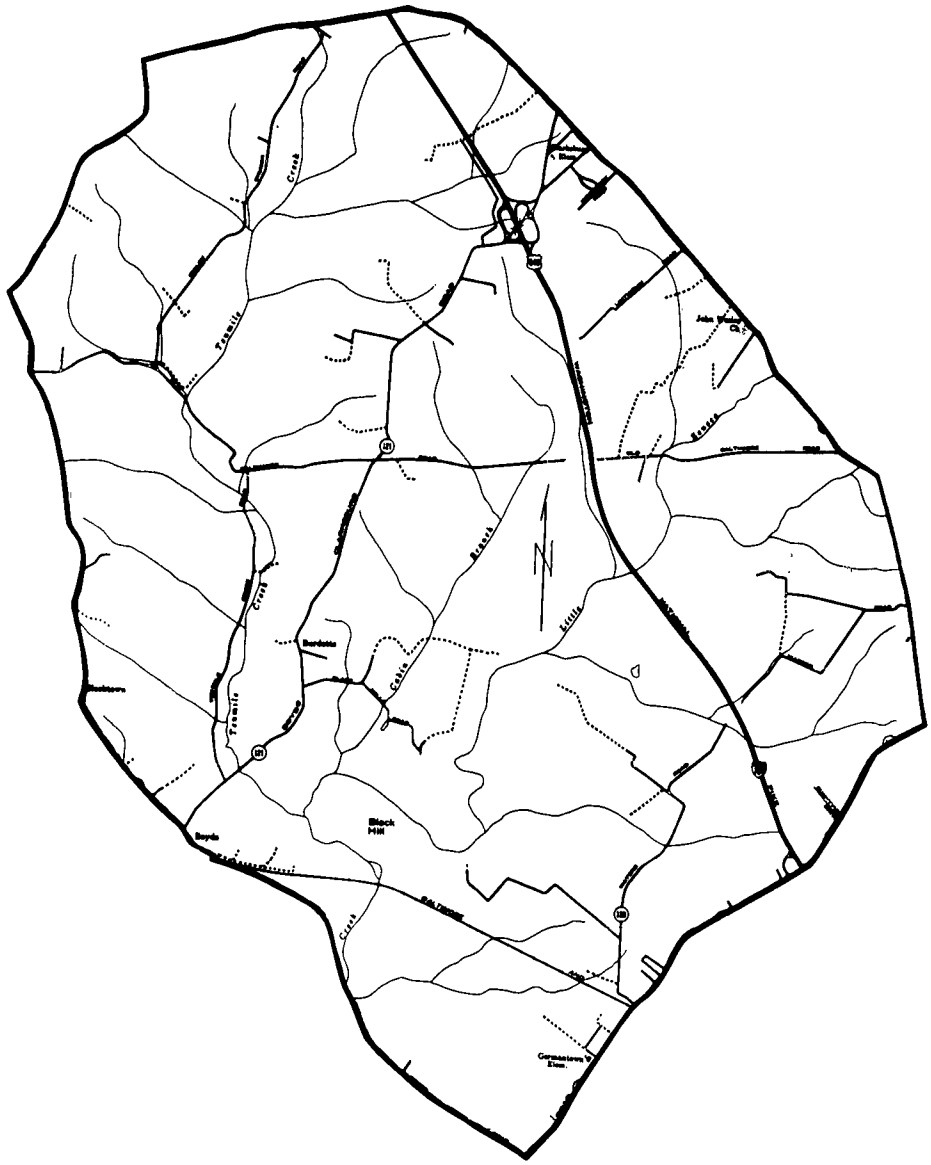


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 1 (Western Part)

DISTRICT 2
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 2 to CHQ	13	1	1	1	1	Clarksburg El. Sch.	1930	4
DHQ to Dist. 11	5.5							
Shelter 2 to DHQ	3		1	1		Hyattstown		
Shelter 3 to DHQ	2		1	1		Burdette		
Shelter 4 to DHQ	3		1	1		Neelsville		
Totals	26.5	1	4	4	1		1930	4

MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 2 (Eastern Part)

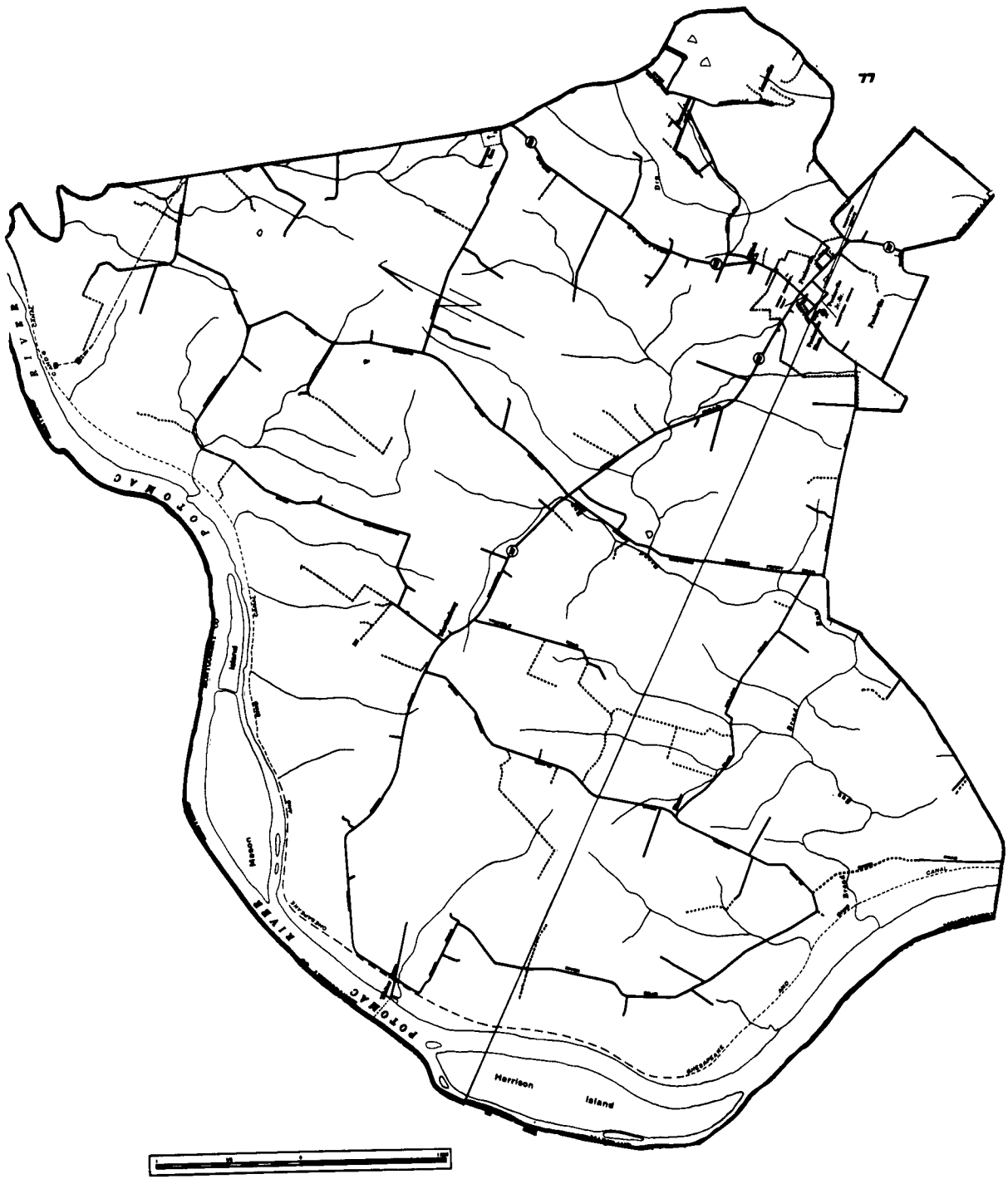


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 2 (Western Part)

DISTRICT 3
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 3 to CHQ	15	1	1	1	1	Poolesville El. Sch.	1450	3
DHQ to Dist. 6	8							
Shelter 2 to DHQ	3		1	1		Martinsburg		
Shelter 3 to DHQ	4		1	1		Dawsonville		
Totals	30	1	3	3	1		1450	3

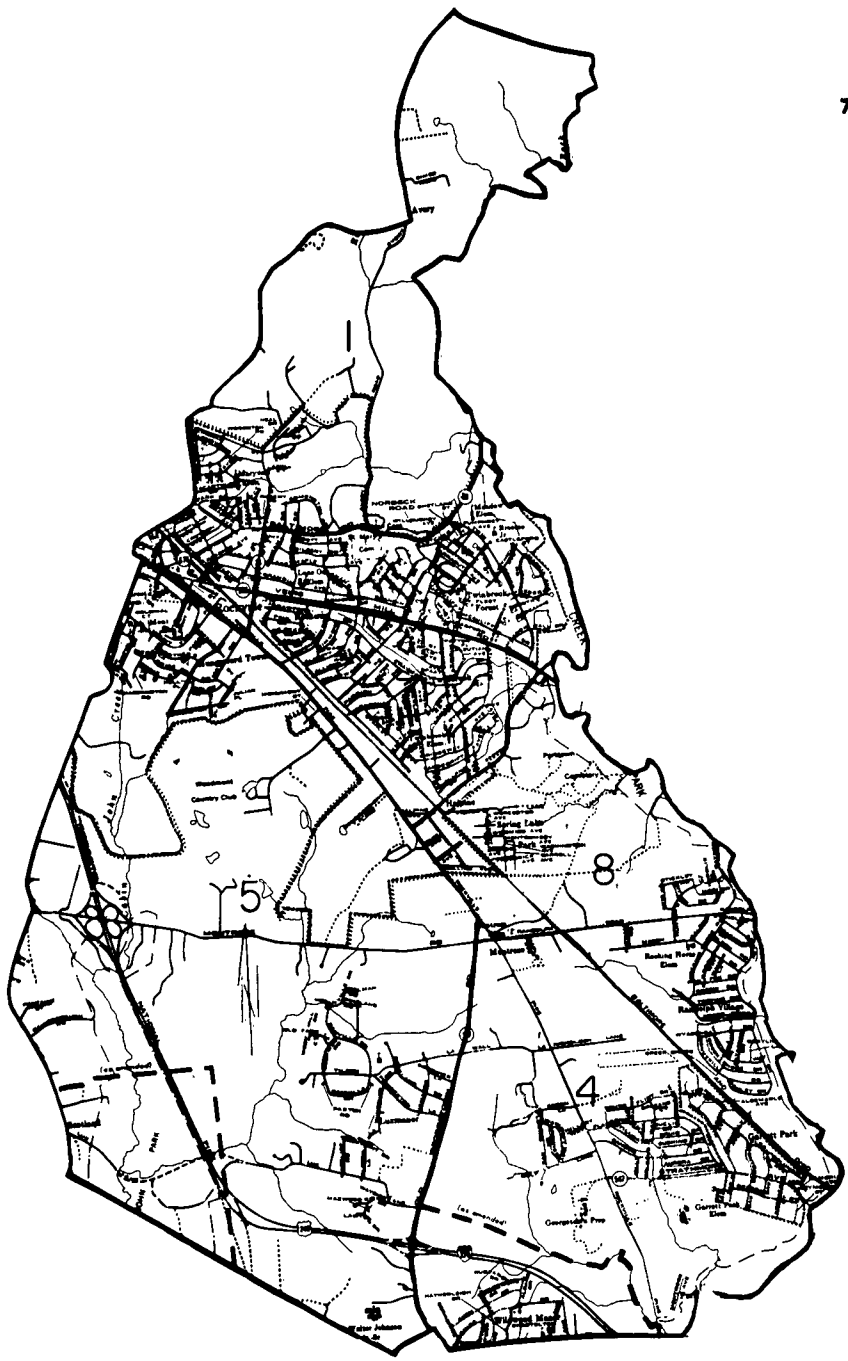
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 3 (Eastern Part)



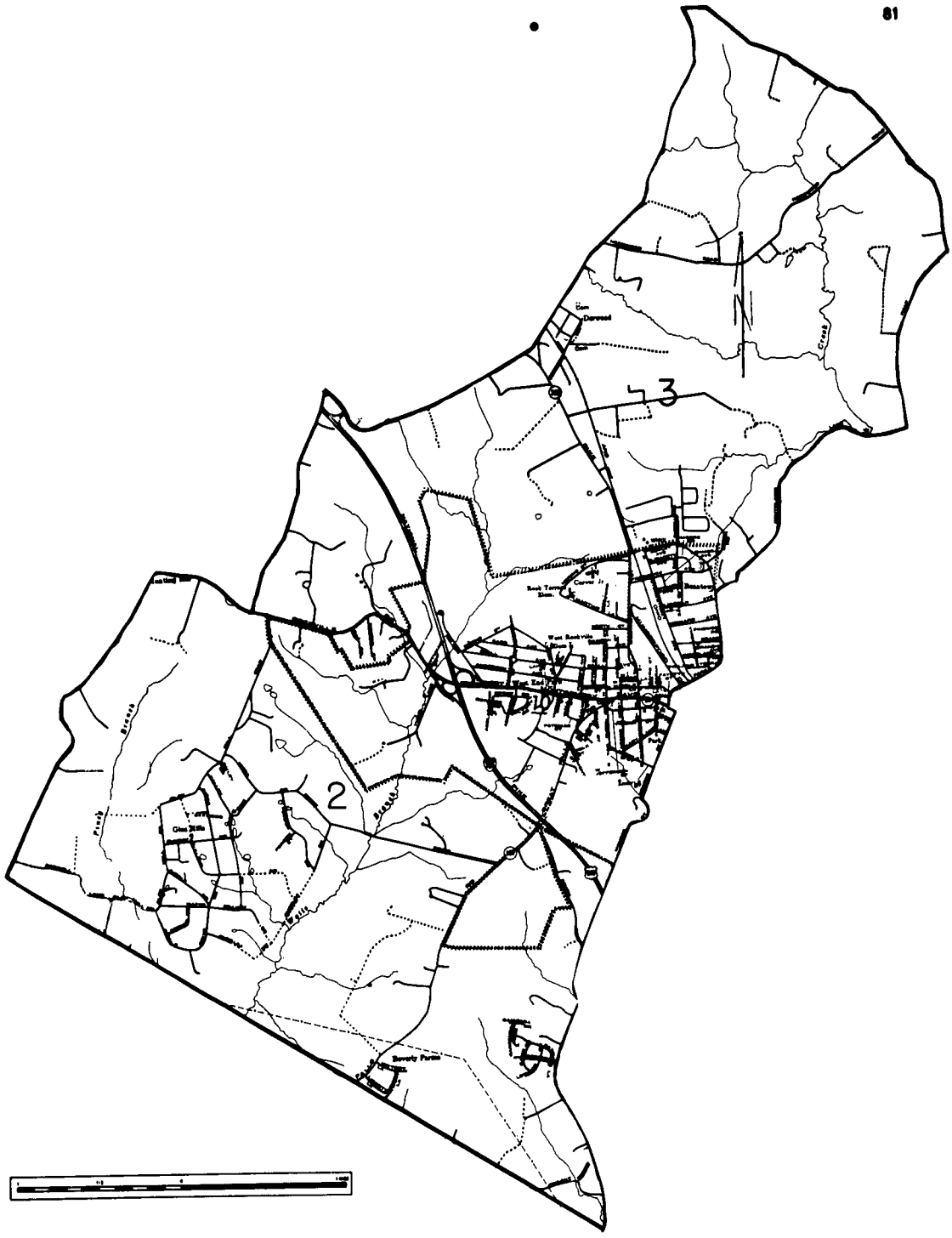
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 3 (Western Part)

DISTRICT 4
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District to CHQ	0		0			EOC, Rockville		
Precinct 1 to DHQ	2.5		1	1	1	Avery Rd. & Southlawn		
Shelters to PHQ	2			5		Lane	2640	6
Precinct 2 to DHQ	3		1	1	1	Sunset Dr. & Ridge Rd.		
Shelters to PHQ	2			4			2770	5
Precinct 3 to DHQ	1		1	1	1	Rock Terrace El. Sch.		
Shelters to PHQ	5			5			3235	6
Precinct 4 to DHQ	4.5		1	1	1	Garrett Park El. Sch.		
Shelters to PHQ	6			9			5240	10
Precinct 5 to DHQ	0.5		1	1	1	Richard Montgomery HS		
Shelters to PHQ	6			6			3290	7
Precinct 6 to DHQ	1		1	1	1	Lone Oake El. Sch.		
Shelters to PHQ	4.5			9			4975	10
Precinct 7 to DHQ	1		1	1	1	Twin Brook El. Sch.		
Shelters to PHQ	4			10			5630	11
Precinct 8 to DHQ	4		1	1	1	Rocking Horse El. Sch.		
Shelters to PHQ	4.5			9			4975	10
Totals	51.5		8	65	8		32,755	65



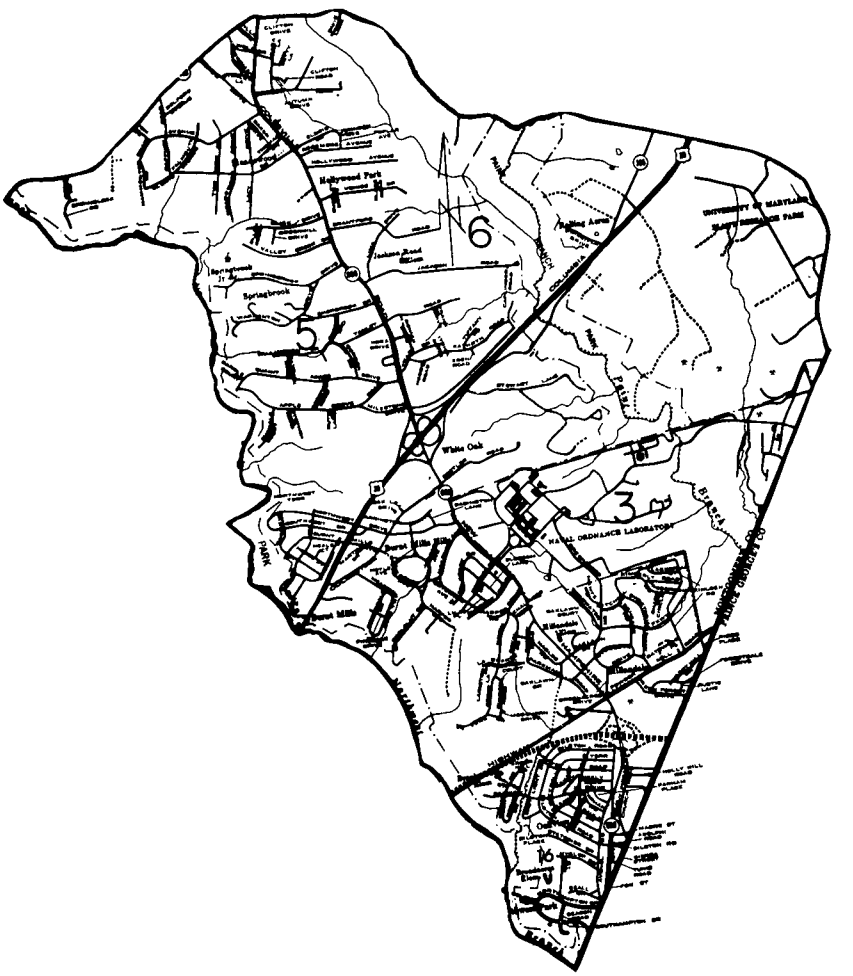
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 4
Precincts 1, 4, 5, 6, 7, and 8



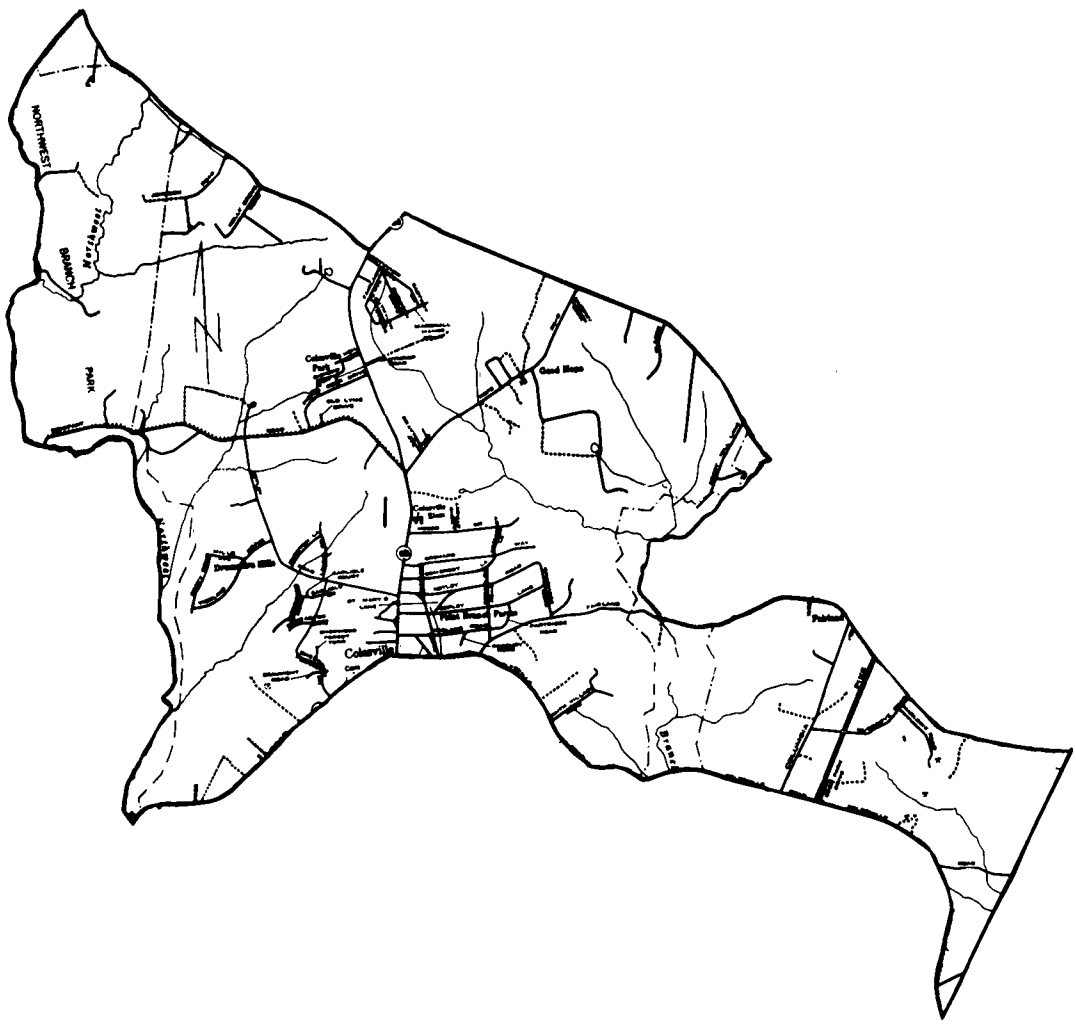
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 4
Precincts 2 and 3

DISTRICT 5
WIRE LINE AND RADIO REQUIREMENTS

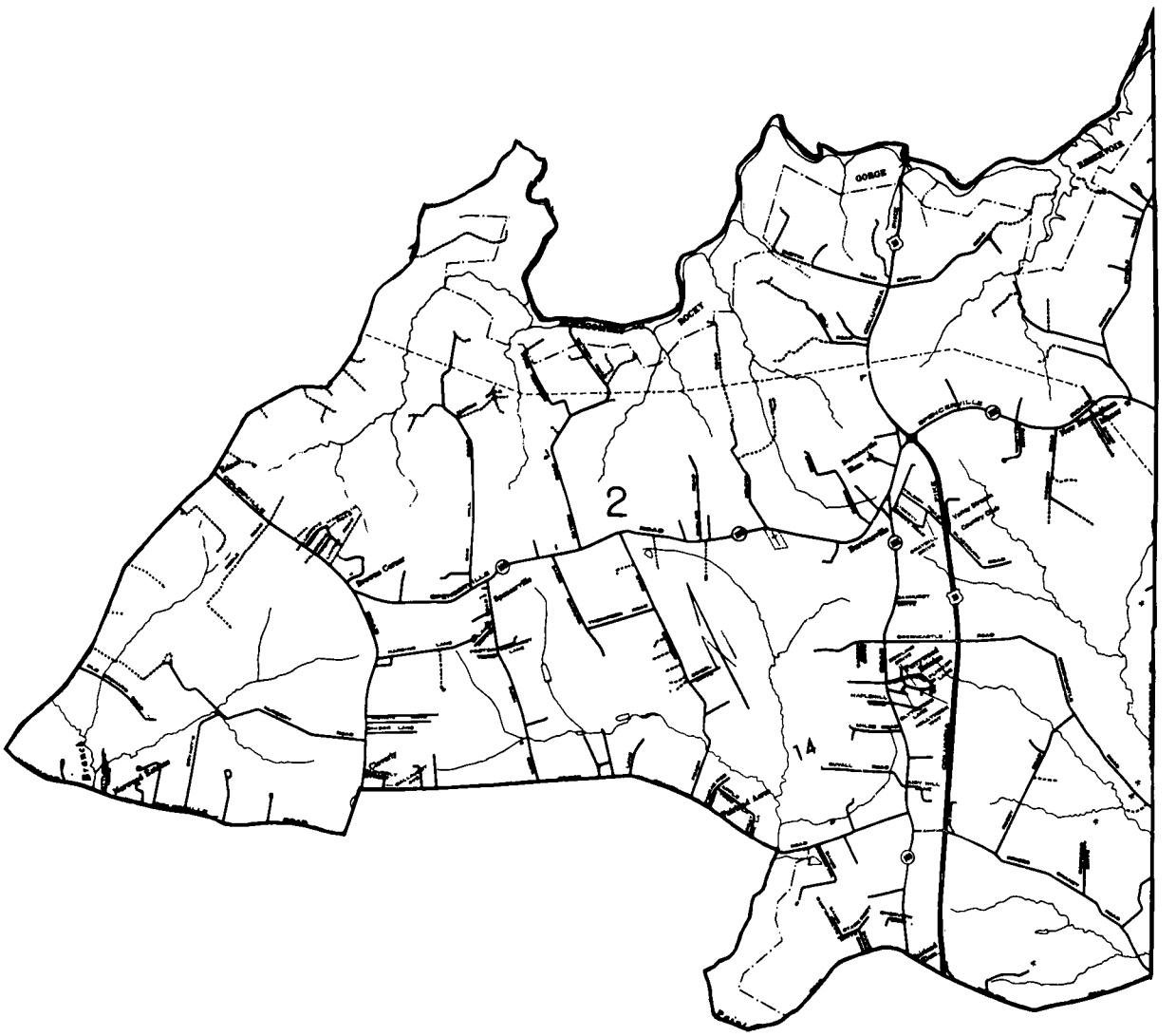
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 5 to CHQ	8	1	1	1	1	Colesville El. Sch.		
DHQ to Dist. 8	6.5							
Precinct 1 to DHQ	0		1	1	1	Colesville El. Sch.		
Shelters to PHQ	5			5			2,945	6
Precinct 2 to DHQ	10		1	1	1	Burtonsville El. Sch.		
Shelters to PHQ	9		4	3			3,640	7
Precinct 3 to DHQ	4		1	1	1	Hillandale El. Sch.		
Shelters to PHQ	5		4	4			4,290	9
Precinct 4 to DHQ	5		1	1	1	Broadacres El. Sch.		
Shelters to PHQ	3			11			5,890	12
Precinct 5 to DHQ	2		1	1	1	Springbrook El. Sch.		
Shelters to PHQ	3.5			4			2,700	5
Precinct 6 to DHQ	2		1	1	1	Jackson Rd. El. Sch.		
Shelters to PHQ	2			2			1,500	3
Total	65	1	15	36	7		20,965	42



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 5
Precincts 3, 4, 5, and 6



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 5
Precinct 1

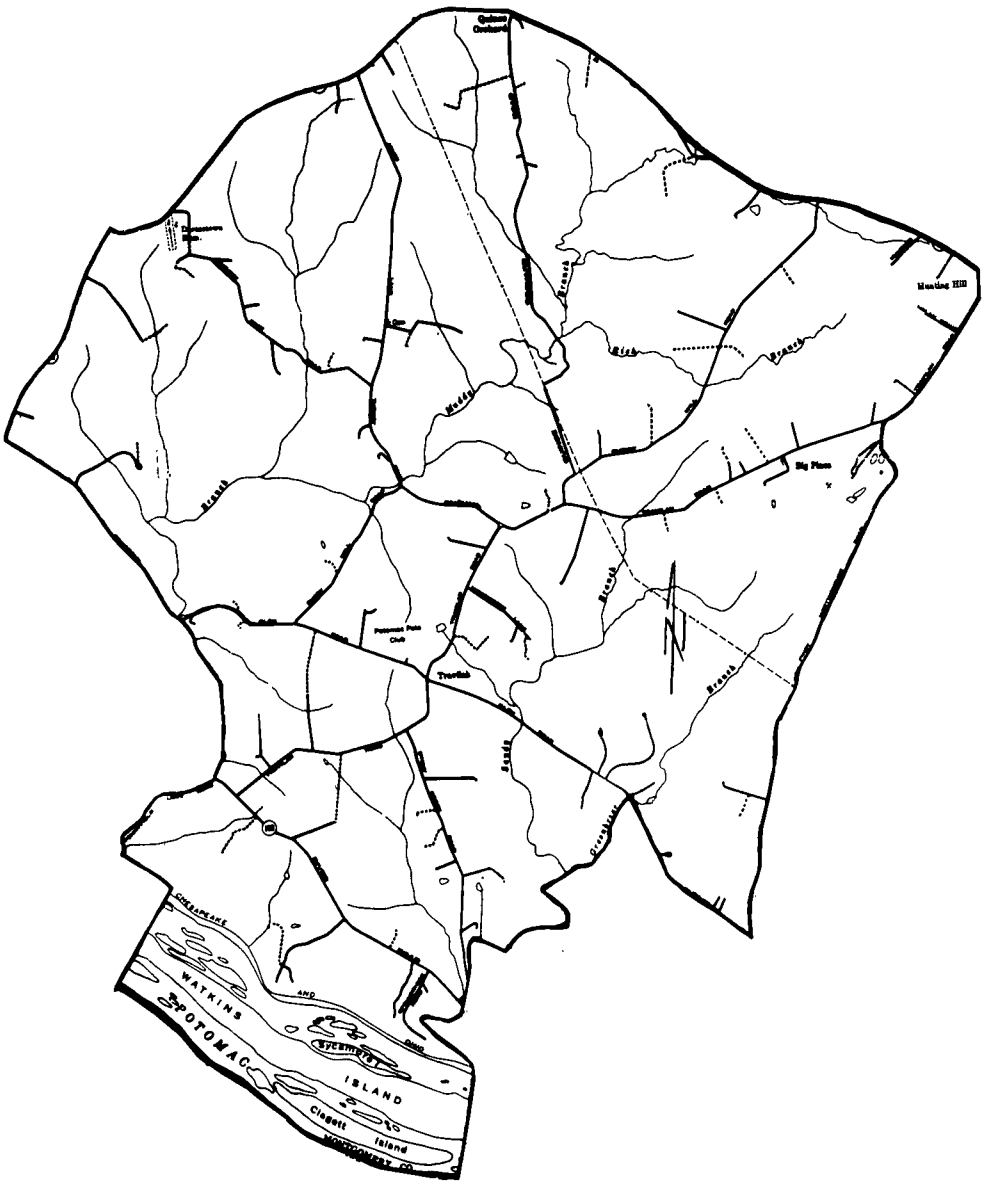


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 5
Precinct 2

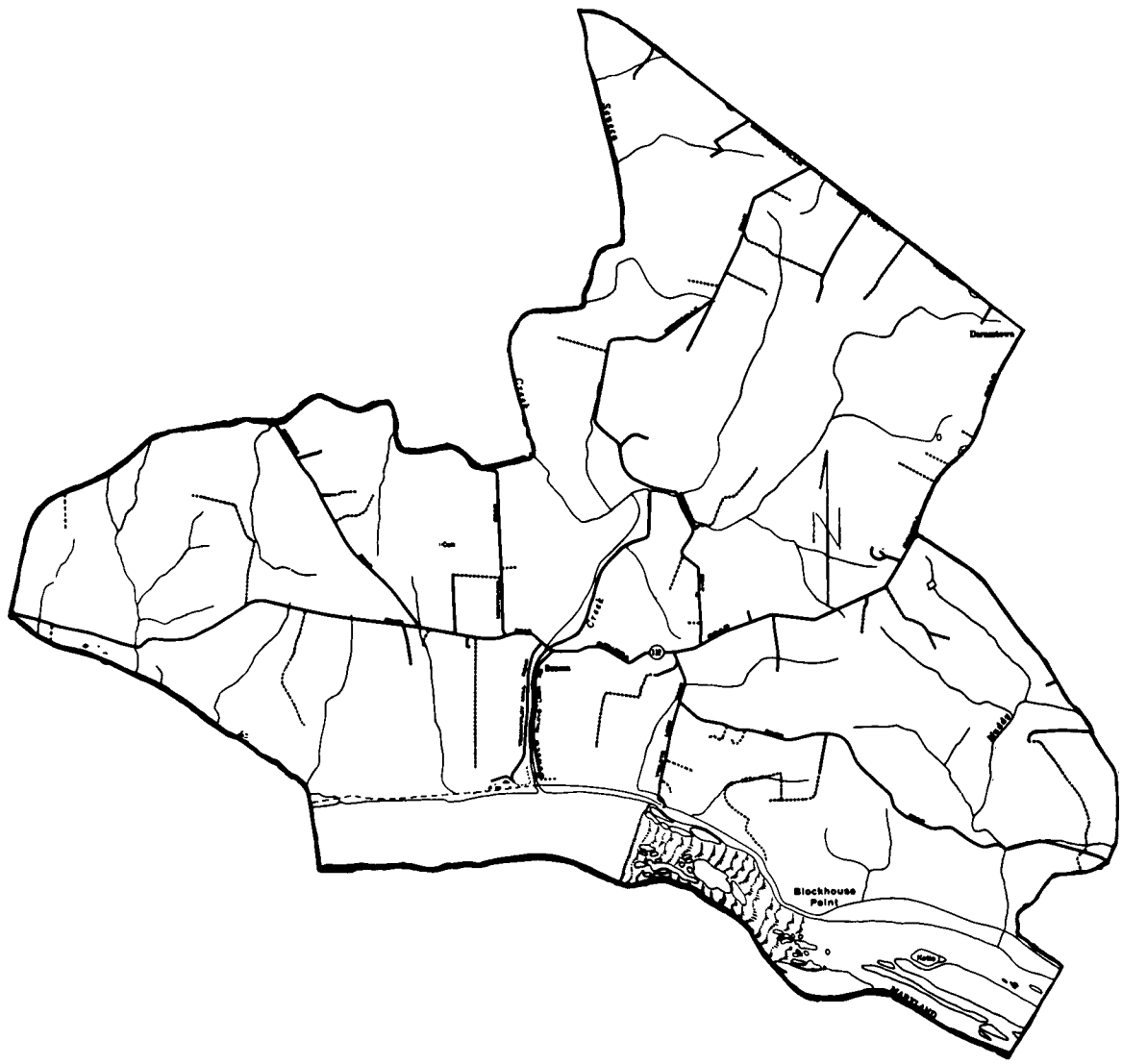
DISTRICT 6
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 6 to CHQ	8	1	1	1	1	Darnestown El. Sch.	2235	4
DHQ to Dist. 10	7.5							
Shelter 2 to DHQ	2.5		1	1		Seneca		
Shelter 3 to DHQ	3		1	1		Brownstown		
Shelter 4 to DHQ	3		1	1		Travilah El. Sch.		
Totals	24	1	4	4	1		2235	4

MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 6
(North)



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 6
(Southeast)



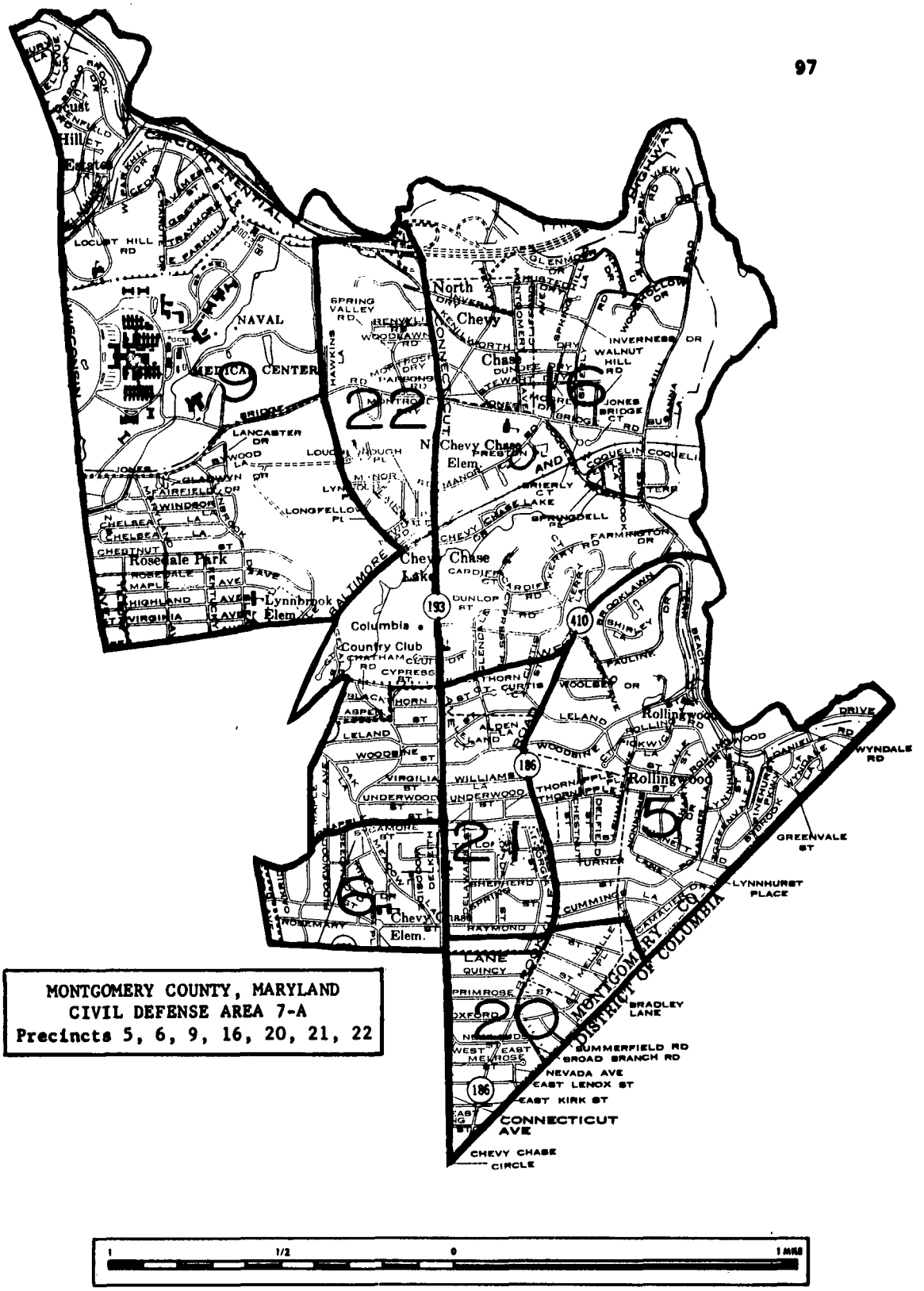
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 6
(Southwest)

DISTRICT 7
SUMMARY OF COMMUNICATIONS PLANT REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
District to CHQ	7.5	1				Bethesda El. Sch.		
Area A	24.5		8	38	7		18,235	37
Area B	29		7	56	6		27,715	55
Area C	29		7	51	6		25,990	50
Area D	30.5		5	45	4		21,000	44
District Totals	12.5	1	27	190	23		92,940	186

DISTRICT 7, AREA A

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	1		1	1		North Chevy Chase El. Sch.		
Precinct 5 to AHQ	1		1	1	1	Rollingwood El. Sch.		
Shelters to PHQ	4			7			4,080	8
Precinct 6 to AHQ	2		1	1	1	Chevy Chase El. Sch.		
Shelters to PHQ	0.5			2			1,445	3
Precinct 9 to AHQ	1		1	1	1	Lynnbrook El. Sch.		
Shelters to PHQ	2.5			4			2,600	5
Precinct 16 to AHQ	0		1	1	1	N. Chevy Chase El. Sch.		
Shelters to PHQ	3.5			7			3,800	8
Precinct 20 to AHQ	2		1	1	1	Newlands & Oxford		
Shelters to PHQ	0.5			2			1,450	3
Precinct 21 to AHQ	1.5		1	1	1	Florida & Taylor		
Shelters to PHQ	2			4			2,350	5
Precinct 22 to AHQ	0.5		1	1	1	Minor Rd. & McAuliffe Pl.		
Shelters to PHQ	2.5			4			2,510	5
Totals	24.5		8	38	7		18,235	37

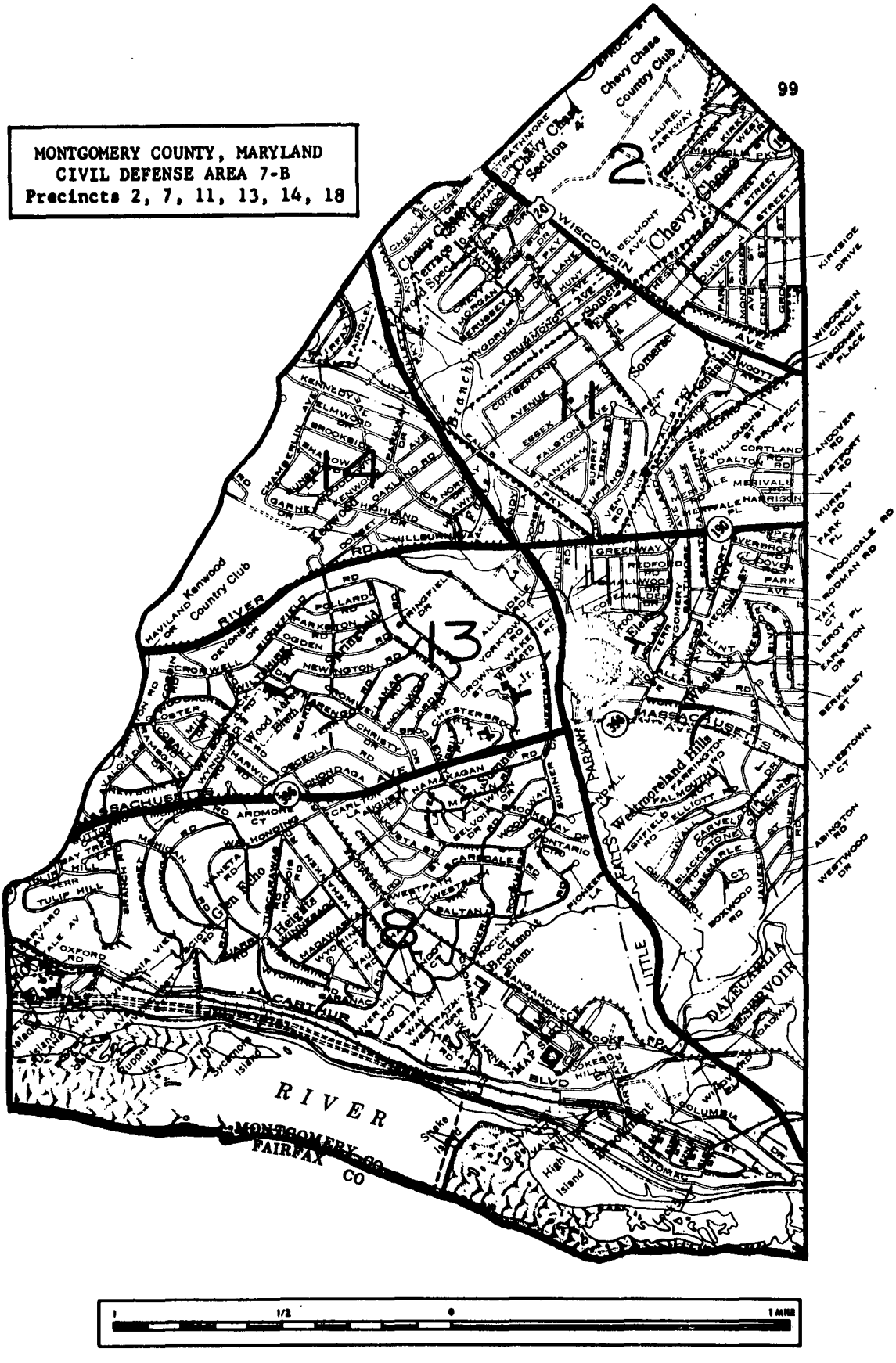


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 7-A
Precincts 5, 6, 9, 16, 20, 21, 22

DISTRICT 7, AREA B

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	2		1	1		Western Jr. HS		
Precinct 2 to AHQ	2		1	1	1	Grafton & Cedar Pkwy.		
Shelters to PHQ	1			3			2,090	4
Precinct 7 to AHQ	0.5		1	1	1	Westbrook El. Sch.		
Shelters to PHQ	4			9			5,200	10
Precinct 11 to AHQ	1		1	1	1	Somerset El. Sch.		
Shelters to PHQ	2.5			9			5,140	10
Precinct 13 to AHQ	0.5		1	1	1	Wood Acres El. Sch.		
Shelters to PHQ	3.5			8			4,660	9
Precinct 14 to AHQ	2		1	1	1	Kenwood & Pkwy. Dr.		
Shelters to PHQ	3.5			8			4,360	9
Precinct 18 to AHQ	1		1	1	1	Brookmont El. Sch.		
Shelters to PHQ	5.5			12			6,265	13
Totals	29		7	56	6		27,715	55

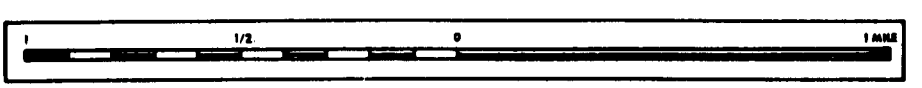
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 7-B
Precincts 2, 7, 11, 13, 14, 18



DISTRICT 7, AREA C

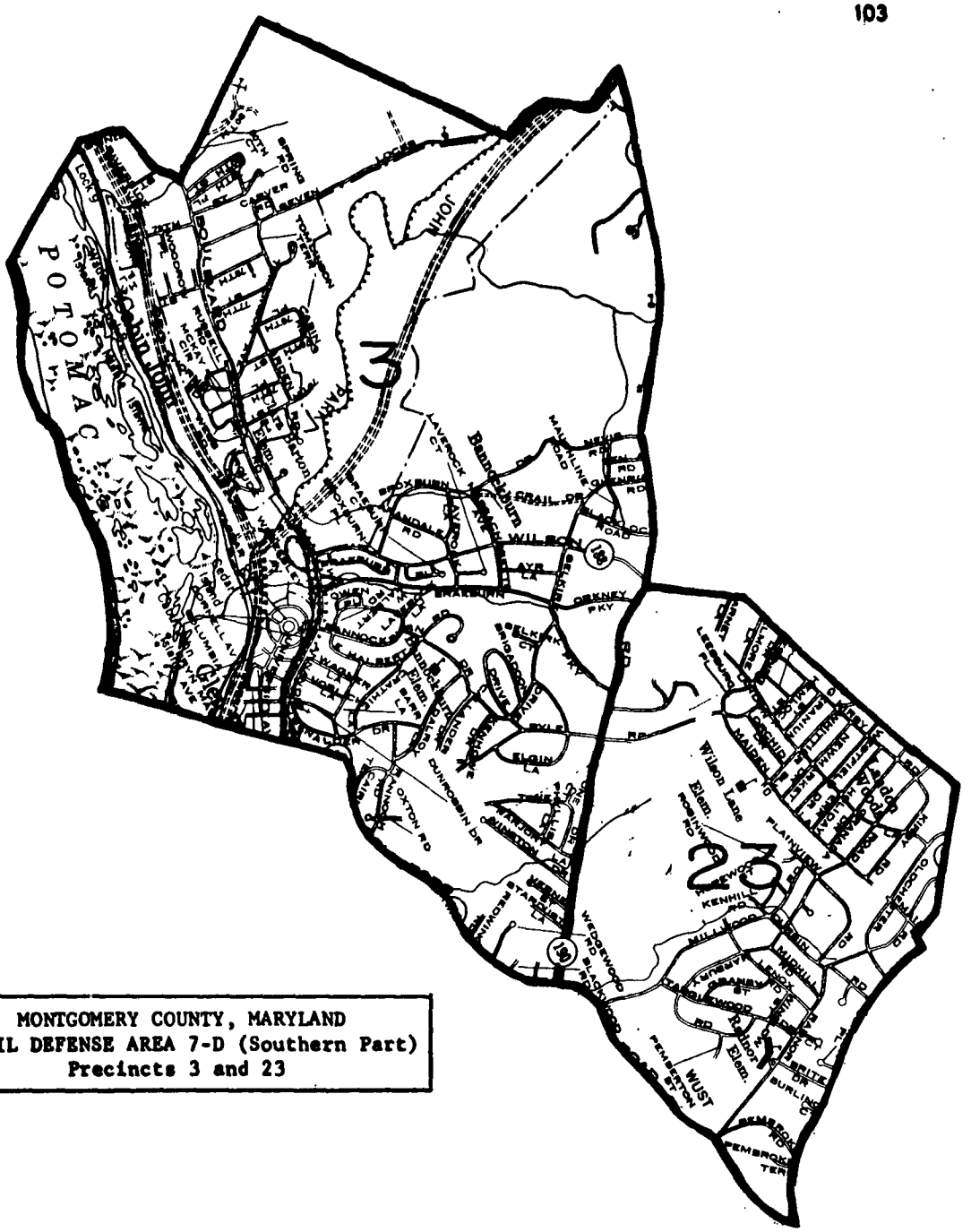
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	1.5		1	1		Bradley El. Sch.		
Precinct 1 to AHQ	2		1	1	1	Bethesda Ch. Ch. Sr. HS		
Shelters to PHQ	3			7			4,080	8
Precinct 4 to AHQ	1.5		1	1	1	Bethesda El. Sch.		
Shelters to PHQ	3			6			4,700	7
Precinct 8 to AHQ	1		1	1	1	Auburn & Norfolk		
Shelters to PHQ	2			5			2,740	6
Precinct 10 to AHQ	1		1	1	1	Alta Vista El. Sch.		
Shelters to PHQ	4			8			4,610	9
Precinct 12 to AHQ	0		1	1	1	Bradley El. Sch.		
Shelters to PHQ	6			10			5,265	11
Precinct 19 to AHQ	0.5		1	1	1	Conway Rd. & Burley Dr.		
Shelters to PHQ	3.5			8			4,595	9
Totals	29		7	51	6		25,990	50

MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 7-C
Precincts 1, 4, 8, 10, 12, 19

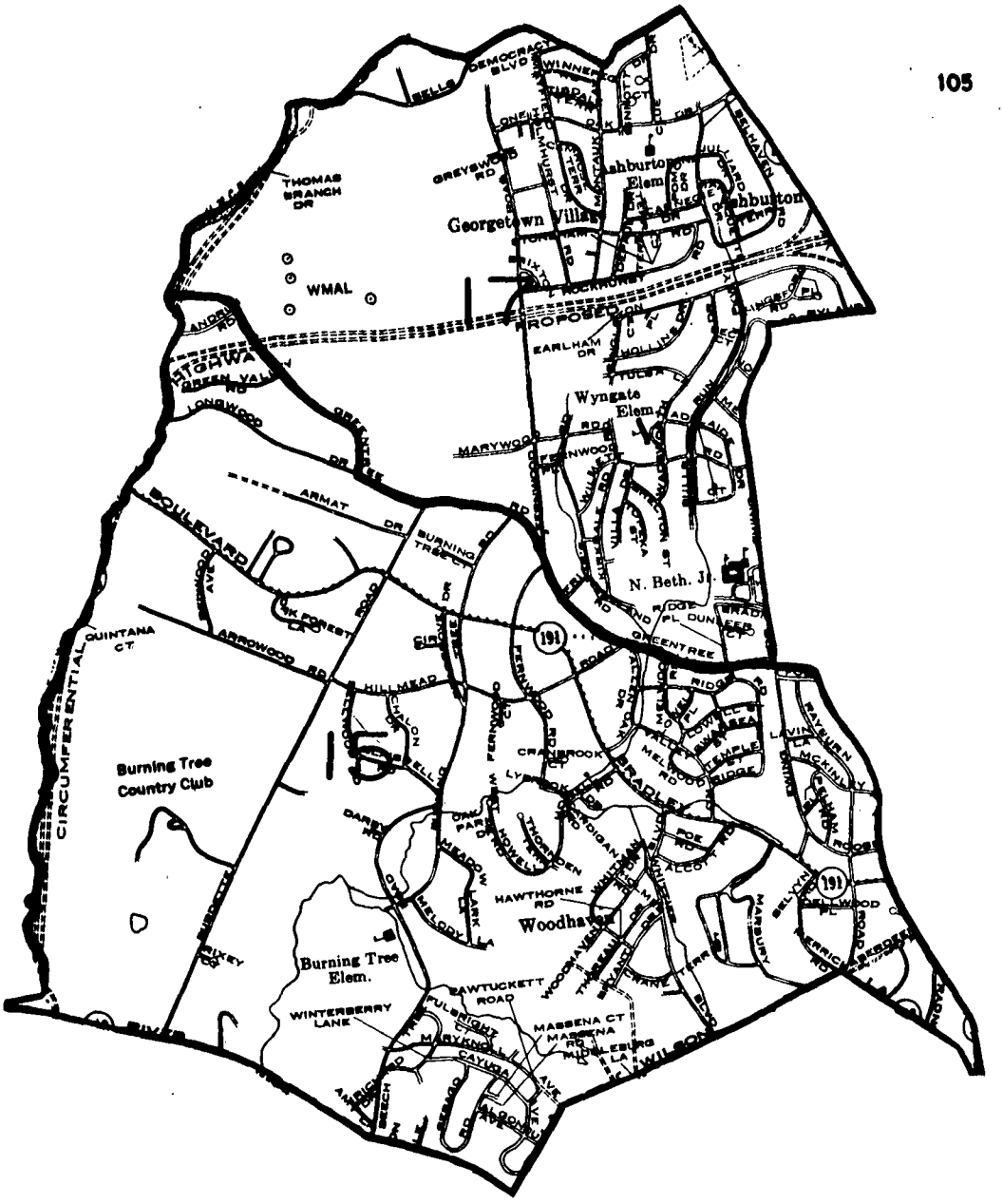


DISTRICT 7, AREA D

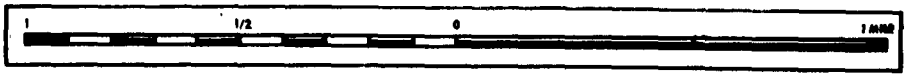
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	3.5		1	1		Burning Tree El. Sch.		
Precinct 3 to AHQ	1.5		1	1	1	Clara Barton El. Sch.		
Shelters to PHQ	7			11			5,980	12
Precinct 15 to AHQ	0		1	1	1	Burning Tree El. Sch.		
Shelters to PHQ	7			11			5,870	12
Precinct 17 to AHQ	1.5		1	1	1	Wyngate El. Sch.		
Shelters to PHQ	6			11			5,205	12
Precinct 23 to AHQ	1		1	1	1	Wilson Lane El. Sch.		
Shelters to PHQ	3			7			3,945	8
Totals	30.5		5	45	4		21,000	44



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 7-D (Southern Part)
Precincts 3 and 23

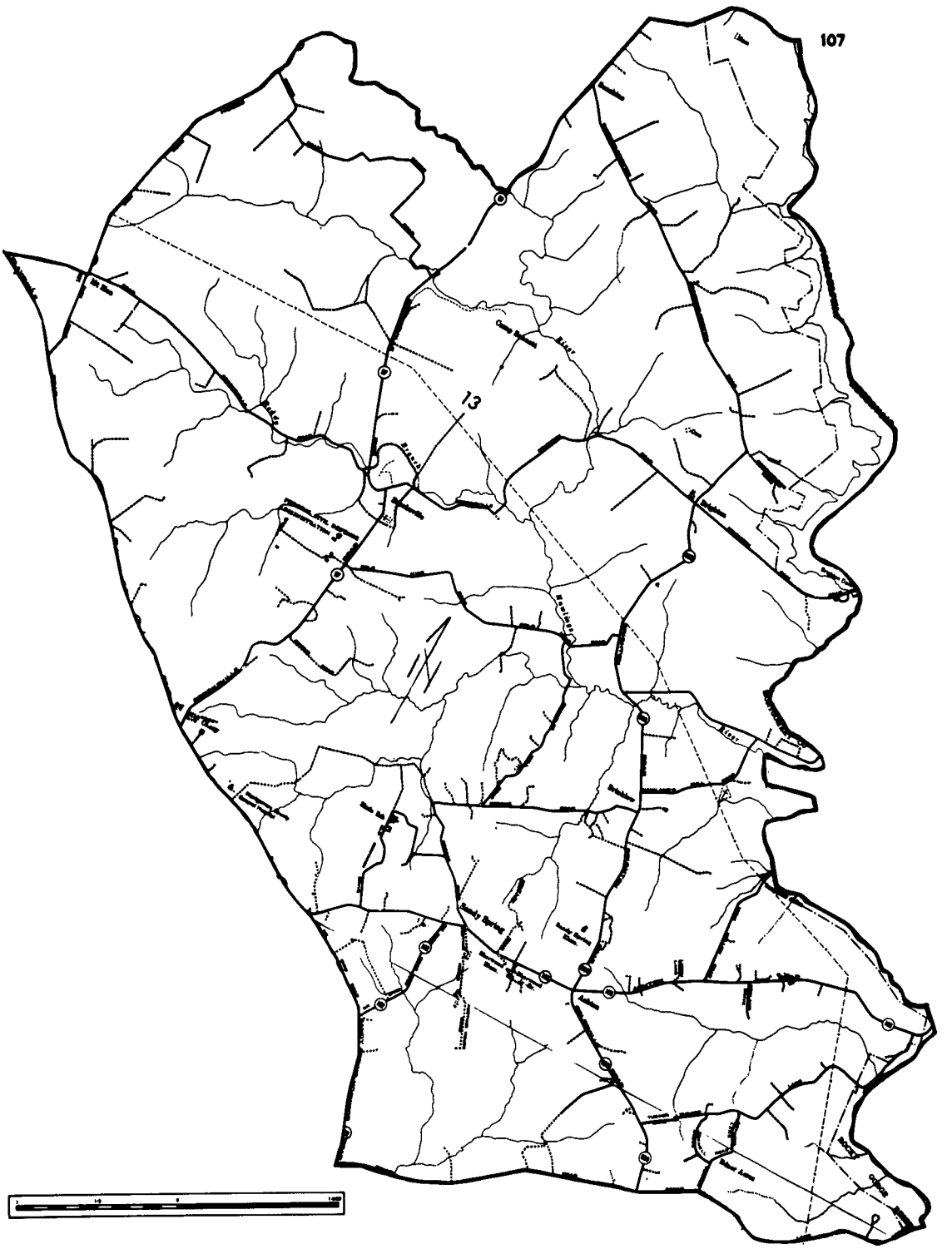


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 7-D (Northern Part)
Precincts 15 and 17

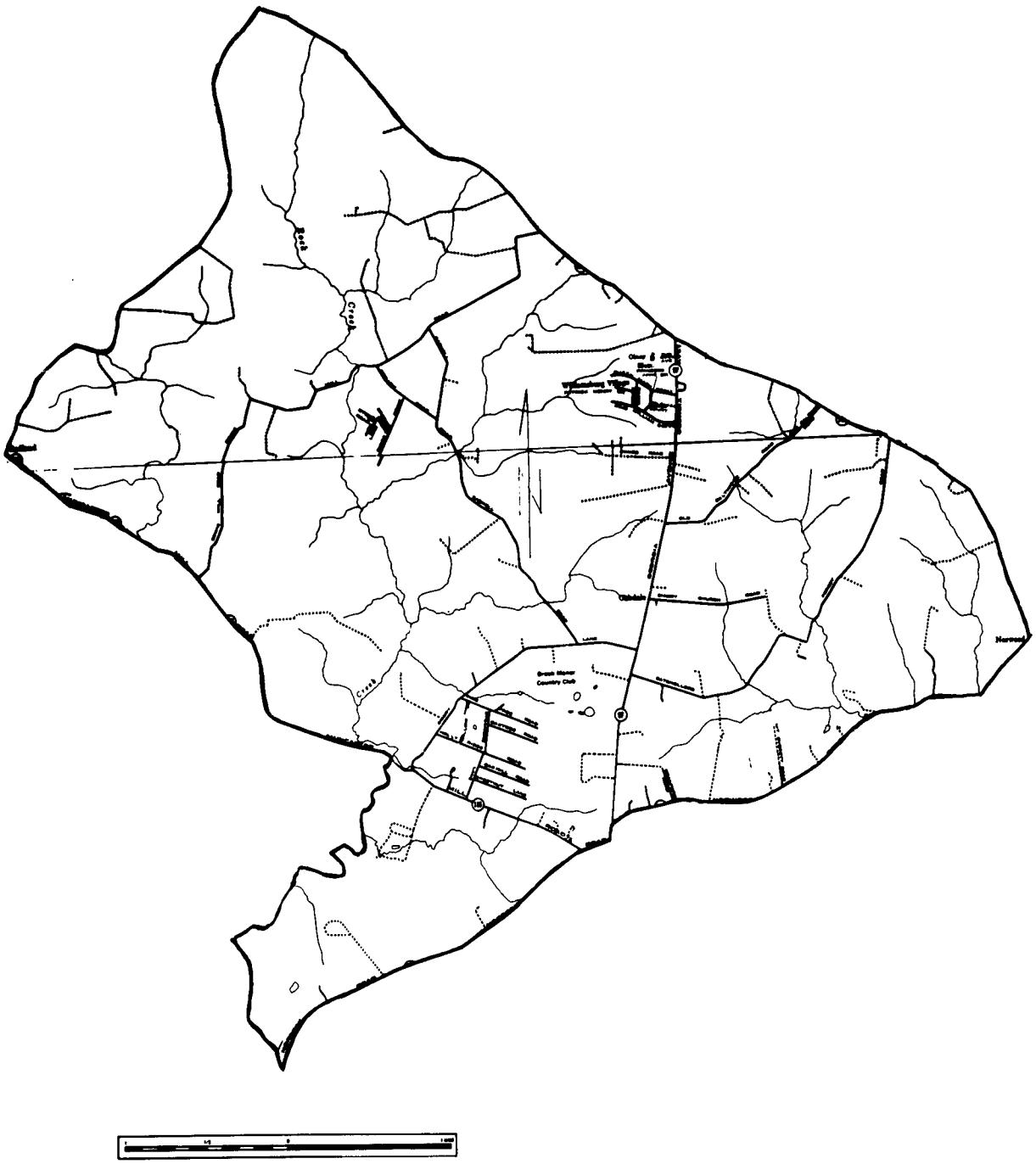


DISTRICT 8
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 8 to CHQ	6.5	1	1	1	1	Olney El. Sch.	4,660	8
DHQ to Dist. 1	6							
Shelter 2 to DHQ	2		1	1		Sandy Spring El. Sch.		
Shelter 3 to DHQ	2		1	1		Brookeville		
Shelter 4 to DHQ	3		1	1		Ashton		
Shelter 5 to DHQ	3.5		1	1		Brighton		
Shelter 6 to DHQ	3		1	1		Mt. Zion		
Shelter 7 to DHQ	3.5		1	1		Oakdale		
Shelter 8 to DHQ	1.5		1	1		Bowie Mill & Cashell Rds.		
Totals	31	1	8	8	1		4,660	8



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 8 (Eastern Part)

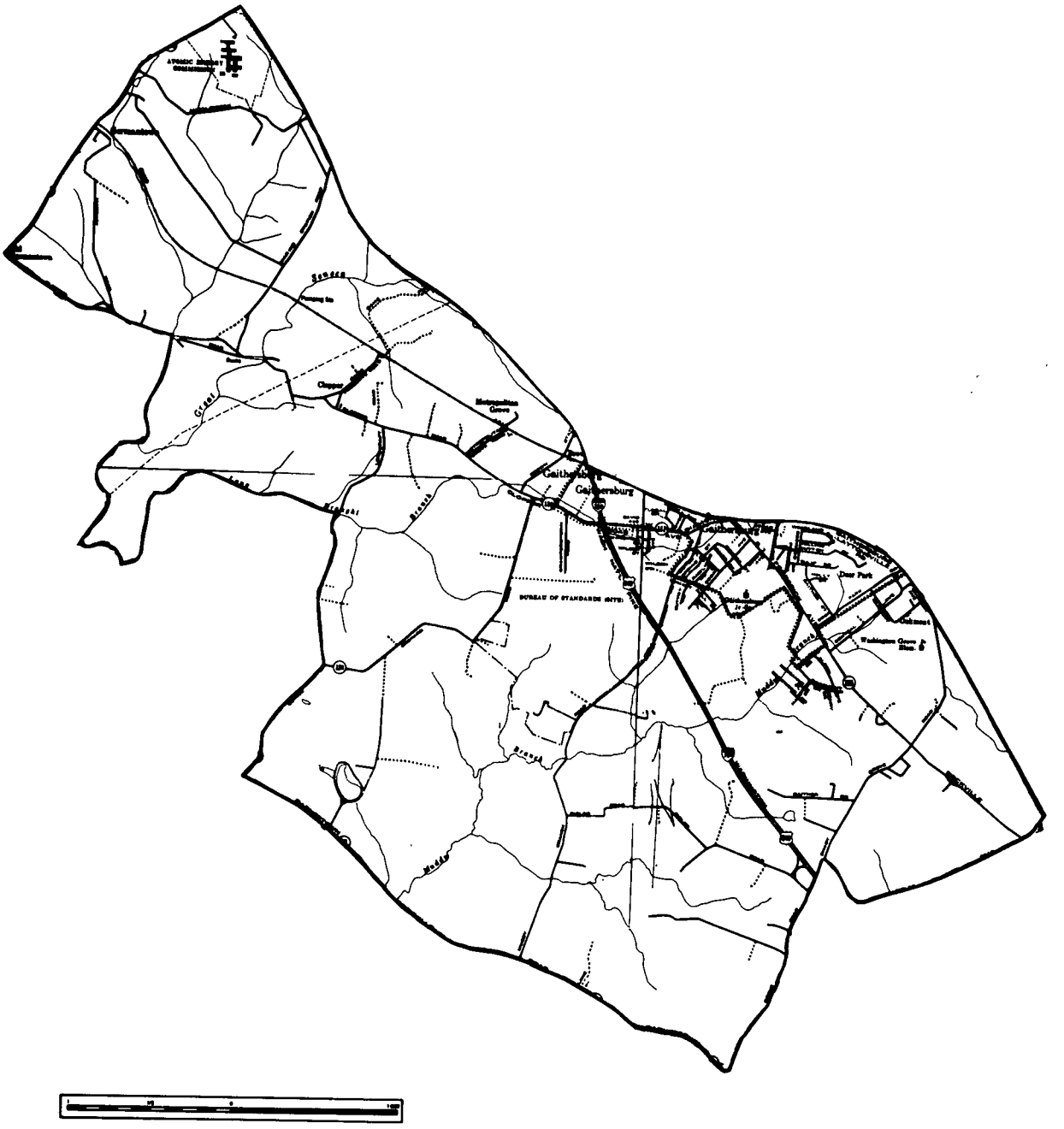


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 8 (Western Part)

DISTRICT 9
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 9 to CHQ	5	1	1	1	1	Gaithersburg HS		
DHQ to Dist. 1	5.5							
Precinct 1 to DHQ	1		1	1	1	Gaithersburg El. Sch.		
Shelters to PHQ	4		1	5			3,500	7
Precinct 2 to DHQ	0		1	1	1	Gaithersburg HS		
Shelters to PHQ	7		3	2			2,840	6
Totals	22.5	1	7	10	3		6,340	13

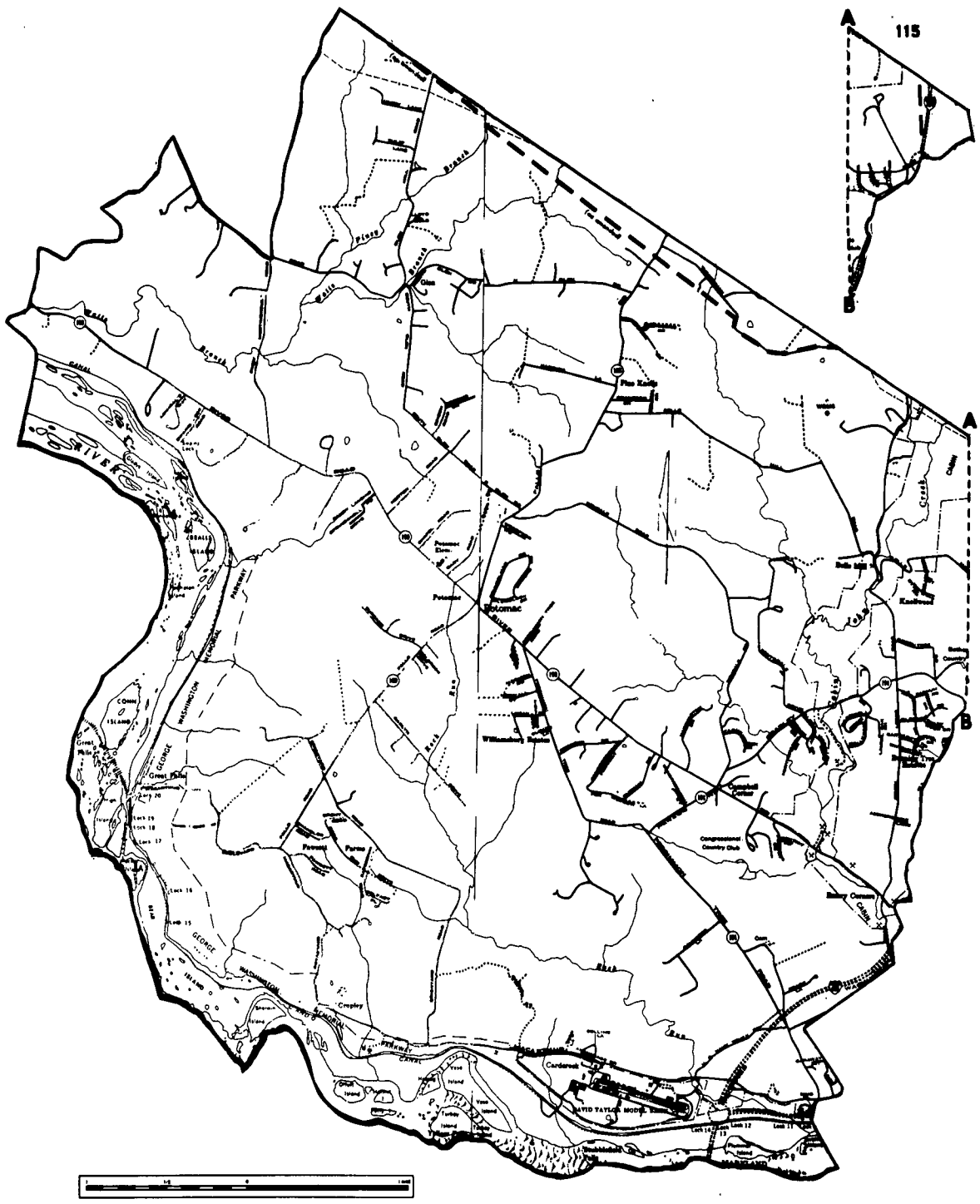
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 9
Precinct 1



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 9
Precinct 2

DISTRICT 10
WIRE LINE AND RADIO REQUIREMENTS

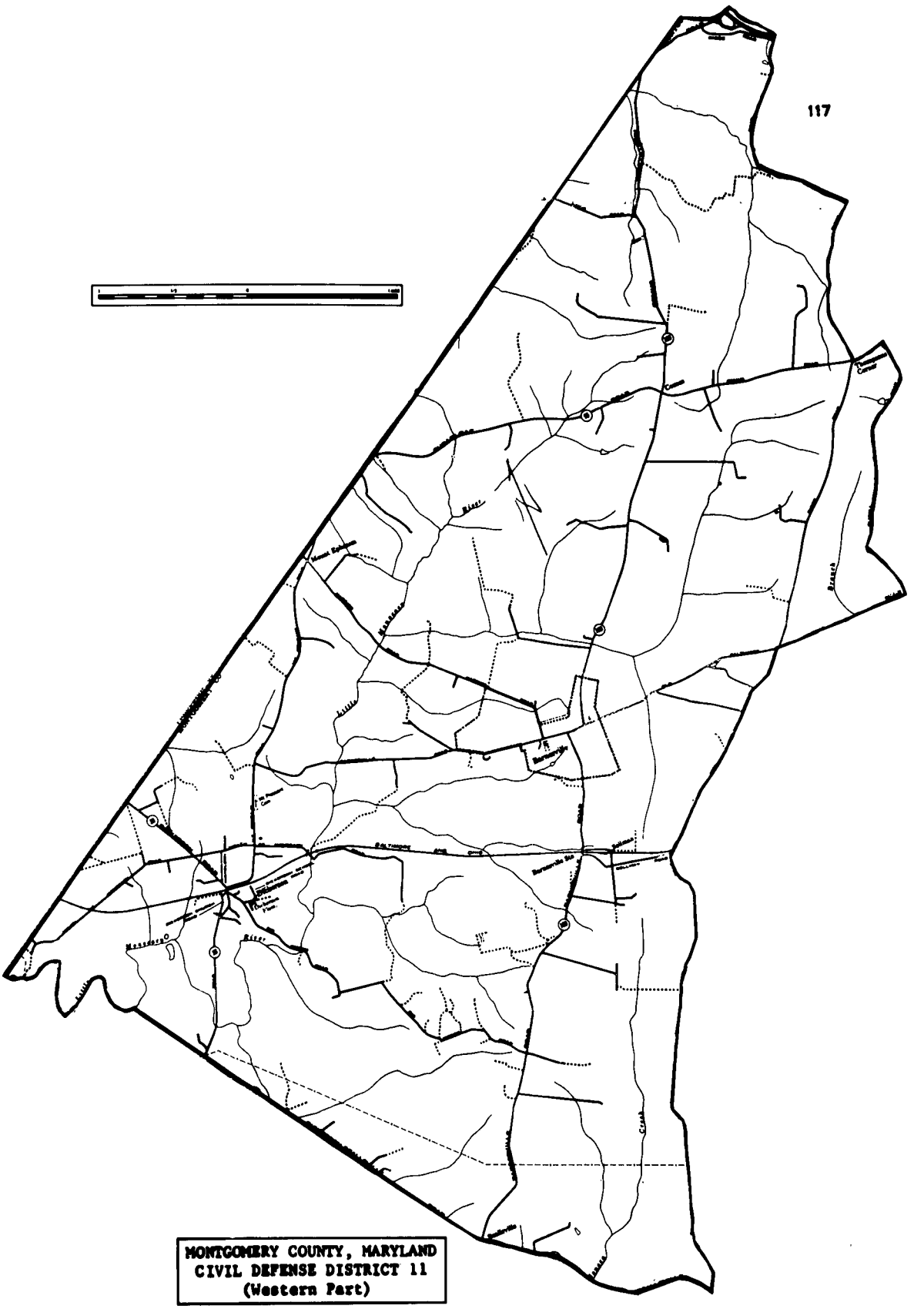
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 10 to CHQ	5.5	1	1	1	1	Potomac El. Sch.	4,640	9
DHQ to Dist. 7	6.5							
Shelter 2 to DHQ	2		1	1		Truxton		
Shelter 3 to DHQ	2		1	1		Glen		
Shelter 4 to DHQ	2.5		1	1		Potomac HS		
Shelter 5 to DHQ	2		1	1		Campbell Corner		
Shelter 6 to DHQ	3		1	1		Leland Corner		
Shelter 7 to DHQ	3		1	1		Hermon Church		
Shelter 8 to DHQ	2.5		1	1		Bell's Mill		
Shelter 9 to DHQ	2.5		1	1		Congressional Country Club		
Totals	31.5	1	9	9	1		4,640	9



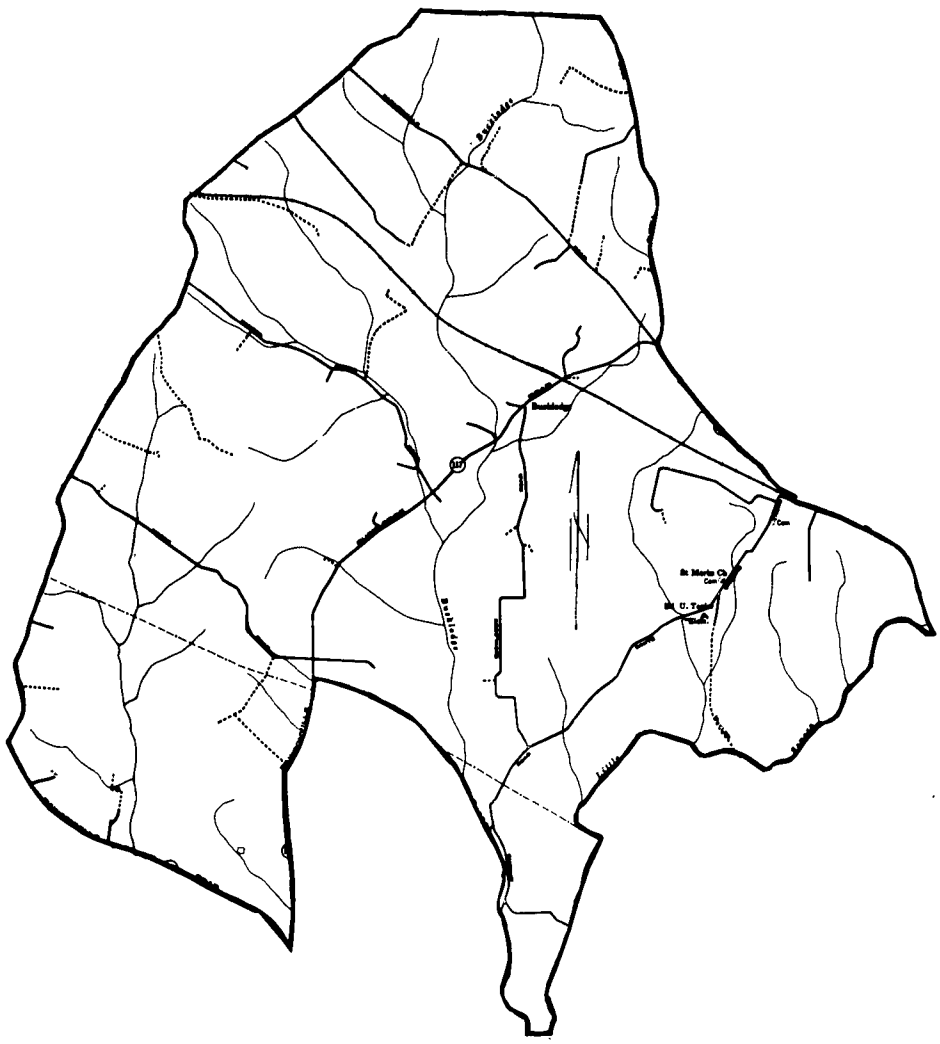
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 10

DISTRICT 11
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 11 to CHQ	15	1	1	1	1	Monocacy El. Sch.	1,515	3
DHQ to Dist. 3	6							
Shelter 2 to DHQ	2.5		1	1		Dickerson		
Shelter 3 to DHQ	2.5		1	1		Comus		
Totals	26	1	3	3	1		1,515	3



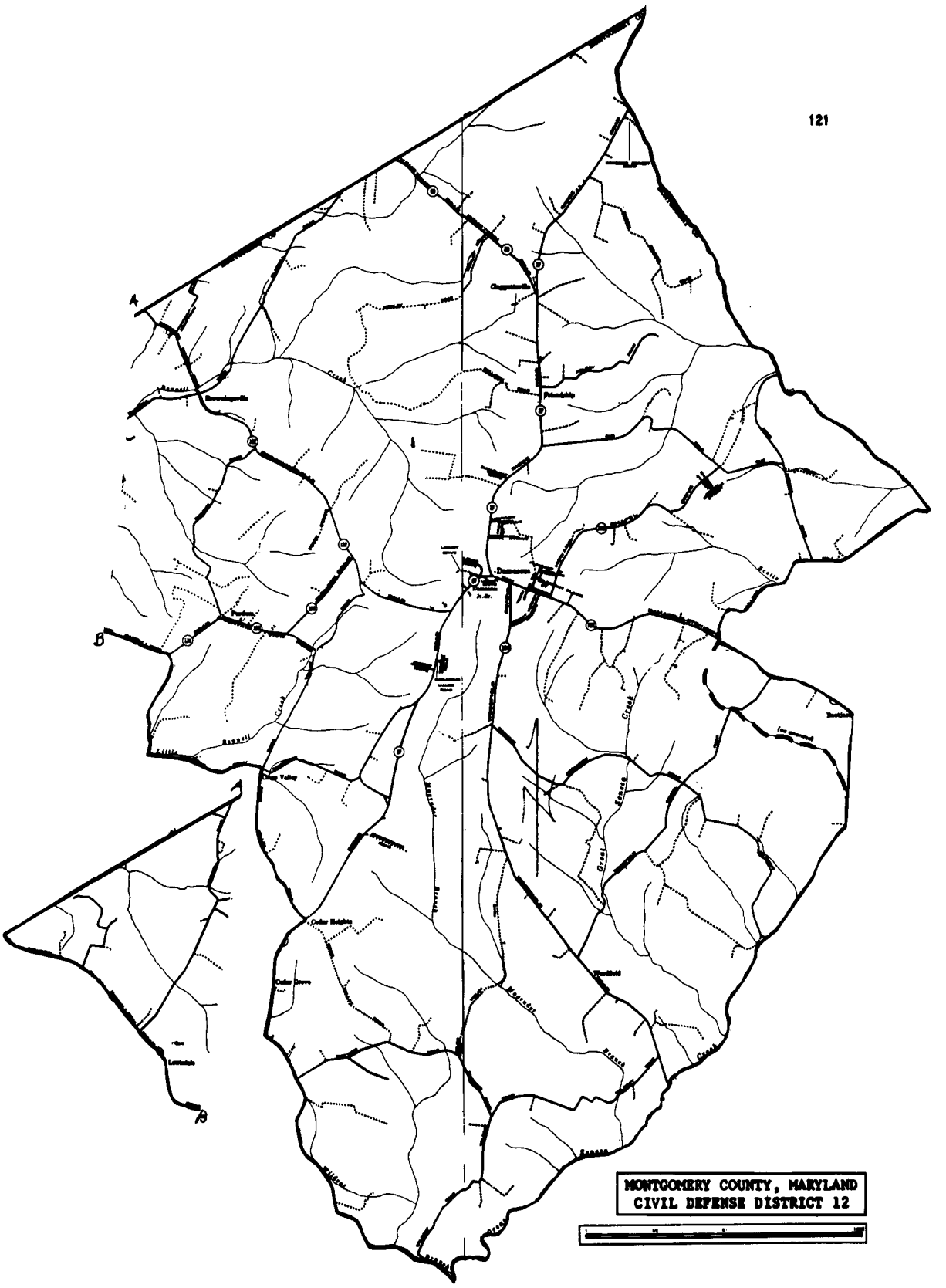
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 11
(Western Part)



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 11
(Eastern Part)

DISTRICT 12
WIRE LINE AND RADIO REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Locations	Pop.	Shelters
District 12 to CHQ	0*	1	1	1	1	Damascus El. Sch.	3,700	7
DHQ to Dist. 2	5.5							
Shelter 2 to DHQ	3		1	1		Woodfield		
Shelter 3 to DHQ	2		1	1				
Shelter 4 to DHQ	3		1	1		Clagettsville		
Shelter 5 to DHQ	2.5		1	1		Browningsville		
Shelter 6 to DHQ	1.5		1	1		Friendship		
Shelter 7 to DHQ	2.5		1	1		Woodfield Sch. Rd. & Md. 108		
Totals	20	1	7	7	1		3,700	7

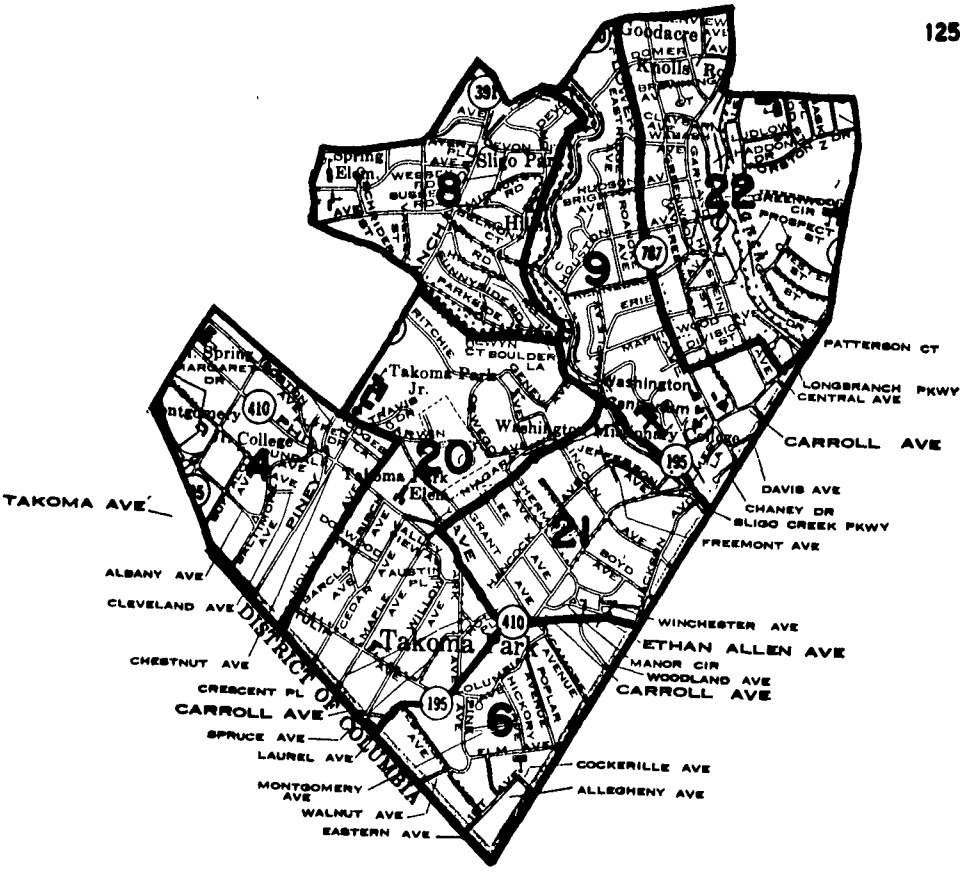

MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE DISTRICT 12

DISTRICT 13
SUMMARY OF COMMUNICATIONS PLANT REQUIREMENTS

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
District to CHQ	6	1	1	1		Stephen Knolls Sch.		
DHQ to Dist. 5	4							
Area A	31.5		8	32	7	Takoma Park Jr. HS	15,835	31
Area B	22.5		6	40	5	Eastern Jr. HS	20,170	39
Area C	24.5		7	50	6	Woodside El. Sch.	23,810	49
Area D	32.5		8	56	7	Kensington Jr. HS	27,070	55
Area E	26		7	49	6	Sligo Jr. HS	23,660	48
Area F	28.7		7	47	6	Newport Jr. HS	23,420	46
Area G	29.5		8	54	7	Georgian Forest El. Sch.	26,790	53
District Totals	204.2	1	52	329	44		160,755	321

DISTRICT 13, AREA A

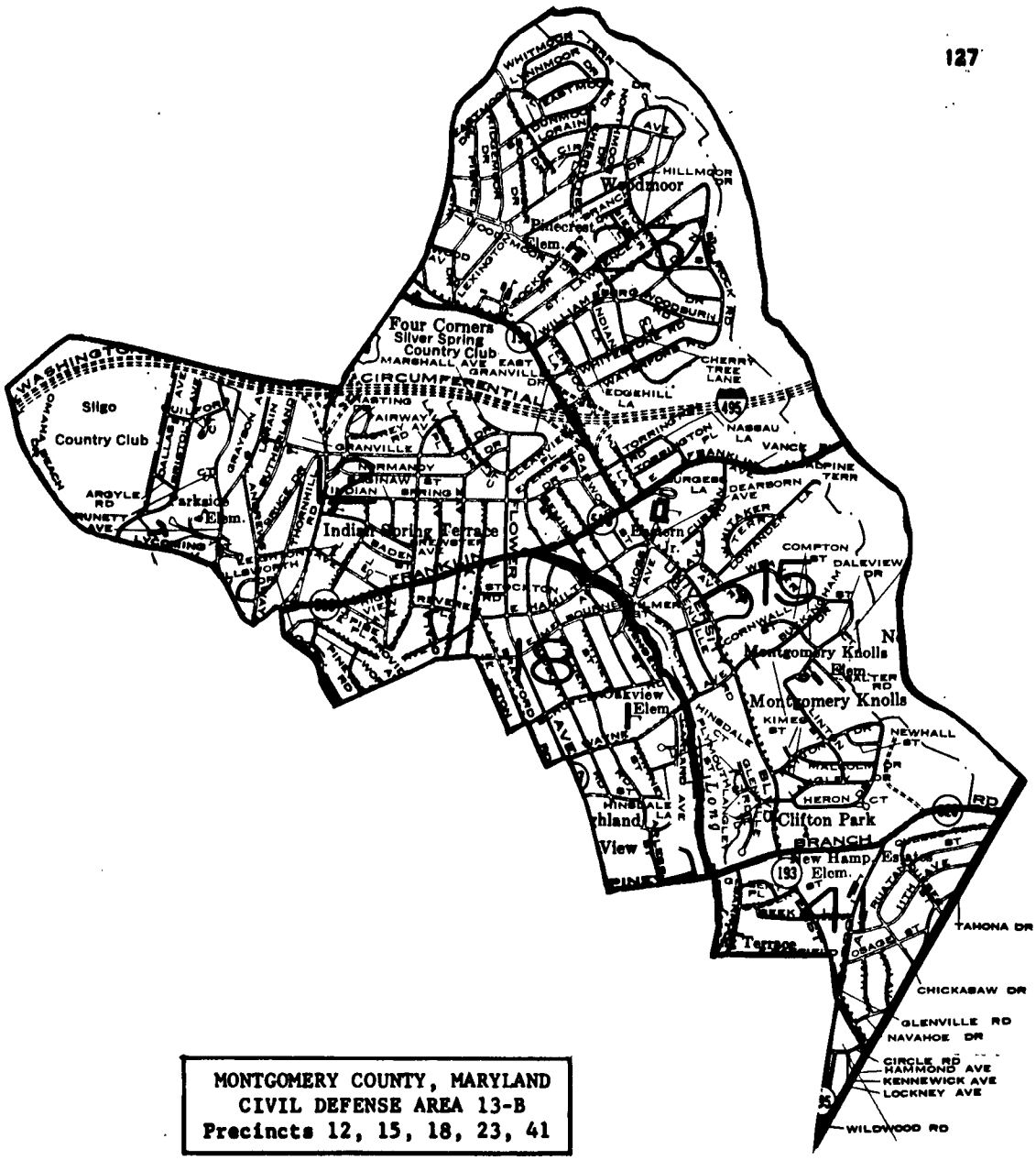
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	3.5		1	1		Takoma Park Jr. HS		
Precinct 4 to AHQ	1		1	1	1	Montgomery Jr. College		
Shelters to PHQ	1			2			1,555	3
Precinct 6 to AHQ	2.5		1	1	1	Takoma Park E. Sch.		
Shelters to PHQ	2.5			2			1,415	3
Precinct 8 to AHQ	1.5		1	1	1	Piney Br. & Sligo Pk.		
Shelters to PHQ	2			3			2,080	4
Precinct 9 to AHQ	1.5		1	1	1	Houston & Roanoke		
Shelters to PHQ	1.5			4			2,600	5
Precinct 20 to AHQ	0		1	1	1	Takoma Park Jr. HS		
Shelters to PHQ	3			4			2,545	5
Precinct 21 to AHQ	1.5		1	1	1	Sherman & Hancock		
Shelters to PHQ	3			3			1,990	4
Precinct 22 to AHQ	3		1	1	1	Montgomery Knolls El.		
Shelters to PHQ	4			6		Sch.	3,650	7
Totals	30.5		8	32	7		15,835	31



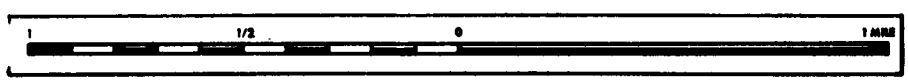
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-A
Precincts 4, 6, 8, 9, 20, 21, 22

DISTRICT 13, AREA B

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	3.5		1	1		Eastern Jr. HS		
Precinct 12 to AHQ	1		1	1	1	Parkside El. Sch.		
Shelters to PHQ	3			8			4,650	9
Precinct 15 to AHQ	0.5		1	1	1	Montgomery Knolls El.		
Shelters to PHQ	3			6			3,650	7
Precinct 18 to AHQ	0.5		1	1	1	Oakview El. Sch.		
Shelters to PHQ	2			6			3,655	7
Precinct 23 to AHQ	1		1	1	1	Pinecrest El. Sch.		
Shelters to PHQ	4			9			4,920	10
Precinct 41 to AHQ	2		1	1	1	New Hamp. Est. El. Sch.		
Shelters to PHQ	2			5			3,295	6
Totals	22.5		6	40	5		20,170	39

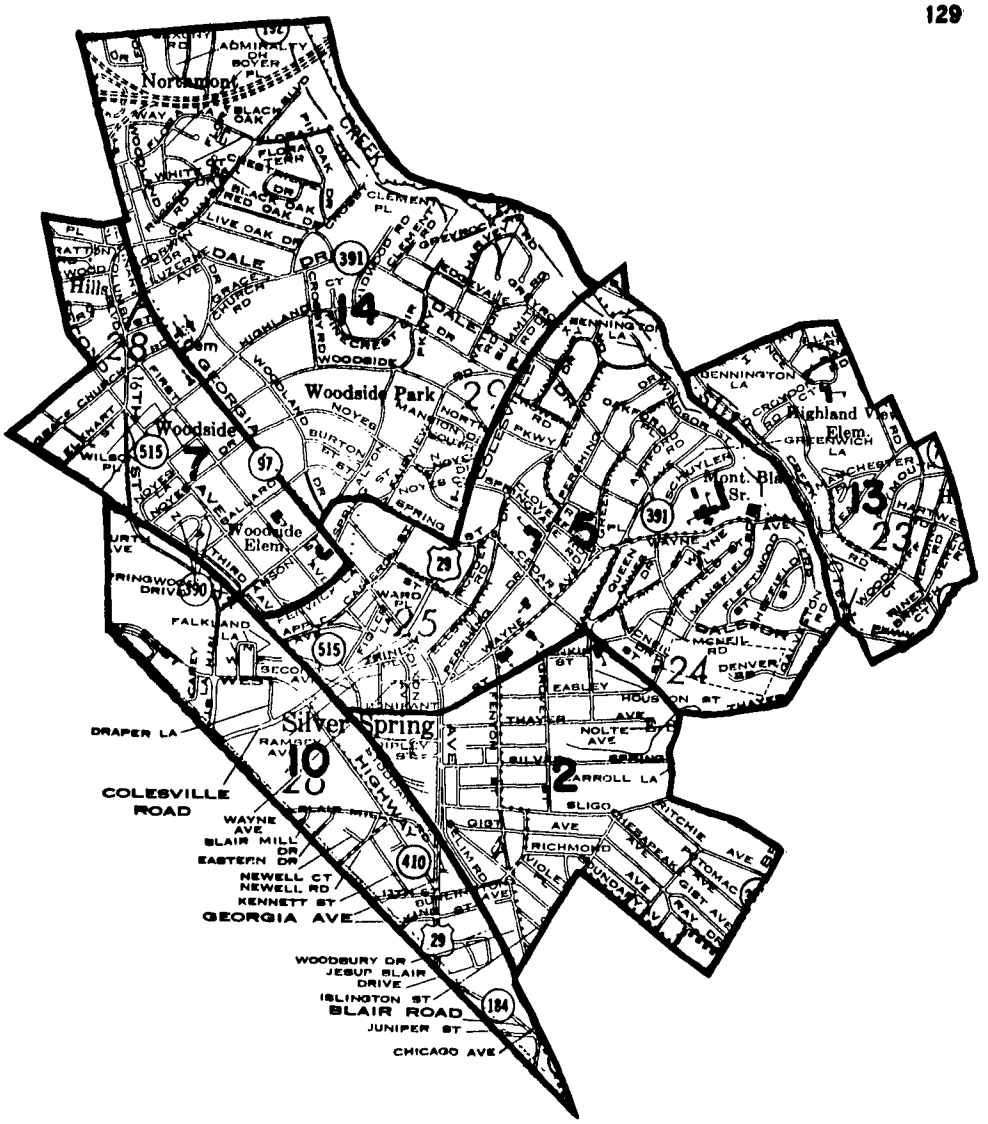


MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-B
Precincts 12, 15, 18, 23, 41



DISTRICT 13, AREA C

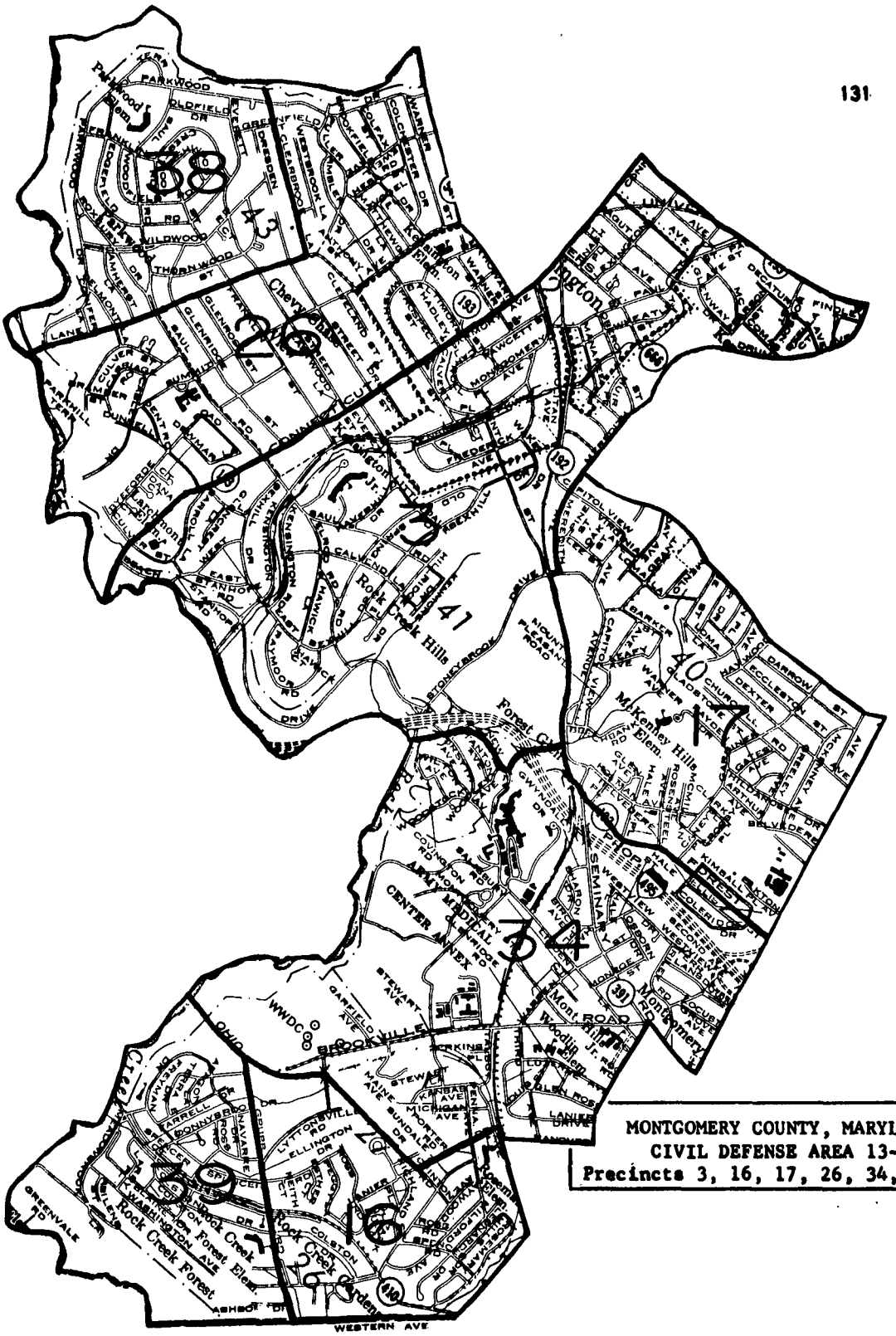
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	1		1	1		Woodside El. Sch.		
Precinct 2 to AHQ	2		1	1	1	Silver Spring & Fenton		
Shelters to PHQ	3			7			3,810	8
Precinct 5 to AHQ	1		1	1	1	Montgomery Blair Sr. HS		
Shelters to PHQ	4			9			5,230	10
Precinct 7 to AHQ	0		1	1	1	Woodside El. Sch.		
Shelters to PHQ	2			3			1,760	4
Precinct 10 to AHQ	0.5		1	1	1	Colesville Rd. &		
Shelters to PHQ	4			9		E. W. Hy.	4,780	10
Precinct 13 to AHQ	1.5		1	1	1	Highland View El. Sch.		
Shelters to PHQ	2			7			3,850	8
Precinct 14 to AHQ	0.5		1	1	1	Woodside & Alton Pkwy.		
Shelters to PHQ	3			8			4,380	9
Totals	24.5		7	50	6		23,810	49



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-C
Precincts 2, 5, 7, 10, 13, 14

DISTRICT 13, AREA D

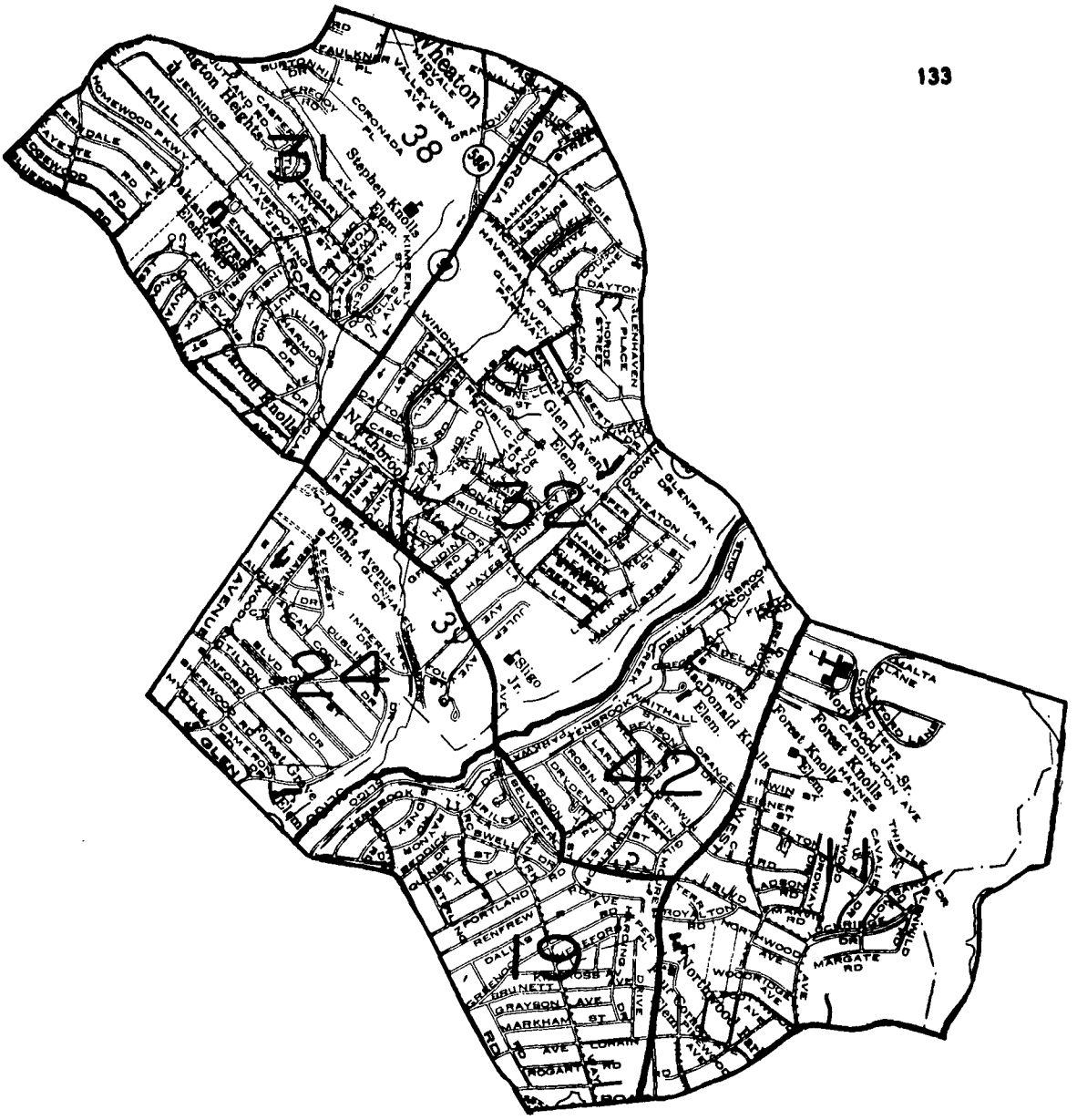
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	1.5		1	1		Kensington Jr. HS		
Precinct 3 to AHQ	0		1	1	1	Kensington Jr. HS		
Shelters to PHQ	7			9			5,100	10
Precinct 16 to AHQ	2		1	1	1	Rosemary El. Sch.		
Shelters to PHQ	3			8			4,260	9
Precinct 17 to AHQ	1		1	1	1	McKenney Hills El. Sch.		
Shelters to PHQ	3.5			8			4,470	9
Precinct 26 to AHQ	0.5		1	1	1	Summit & Dresden		
Shelters to PHQ	2.5			8			4,460	9
Precinct 34 to AHQ	1.5		1	1	1	Woodlin El. Sch.		
Shelters to PHQ	2.0			5			3,120	6
Precinct 38 to AHQ	1		1	1	1	Parkwood El. Sch.		
Shelters to PHQ	2			6			3,335	7
Precinct 39 to AHQ	2		1	1	1	Rock Creek Forest El.		
Shelters to PHQ	3			4		Sch.	2,325	5
Totals	32.5		8	56	7		27,070	55



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-D
Precincts 3, 16, 17, 26, 34, 38, 39

DISTRICT 13, AREA E

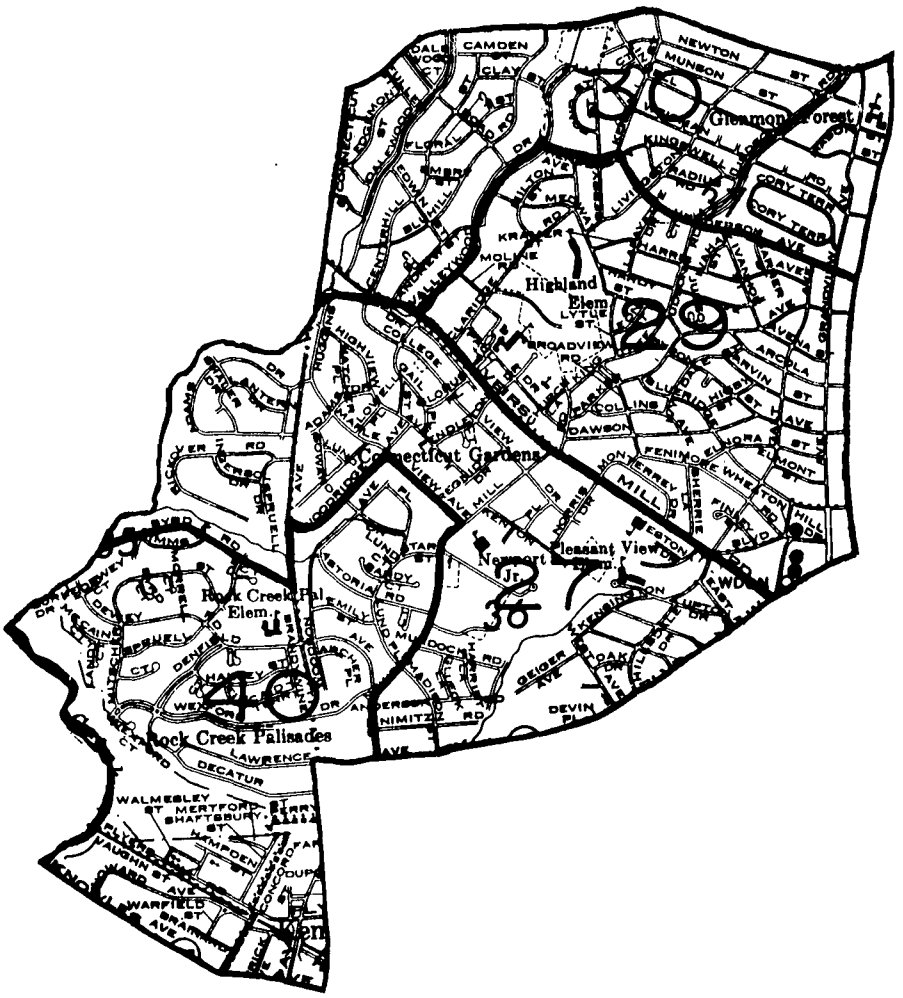
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	1		1	1		Sligo Jr. HS		
Precinct 11 to AHQ	1		1	1	1	Forest Knolls El. Sch.		
Shelters to PHQ	4			7			3,995	8
Precinct 19 to AHQ	0.5		1	1	1	Dallas & Lanark Way		
Shelters to PHQ	3.5			8			4,390	9
Precinct 24 to AHQ	0.5		1	1	1	Forest Grove & Cody		
Shelters to PHQ	2			5			2,910	6
Precinct 31 to AHQ	1		1	1	1	Oakland Terrace El. Sch.		
Shelters to PHQ	4.5			10			5,350	11
Precinct 32 to AHQ	0.5		1	1	1	Glen Haven El. Sch.		
Shelters to PHQ	4.5			9			4,870	10
Precinct 42 to AHQ	0.5		1	1	1	MacDonald Knolls El.		
Shelters to PHQ	2.5			3		Sch.	2,145	4
Totals	26		7	49	6		23,660	48



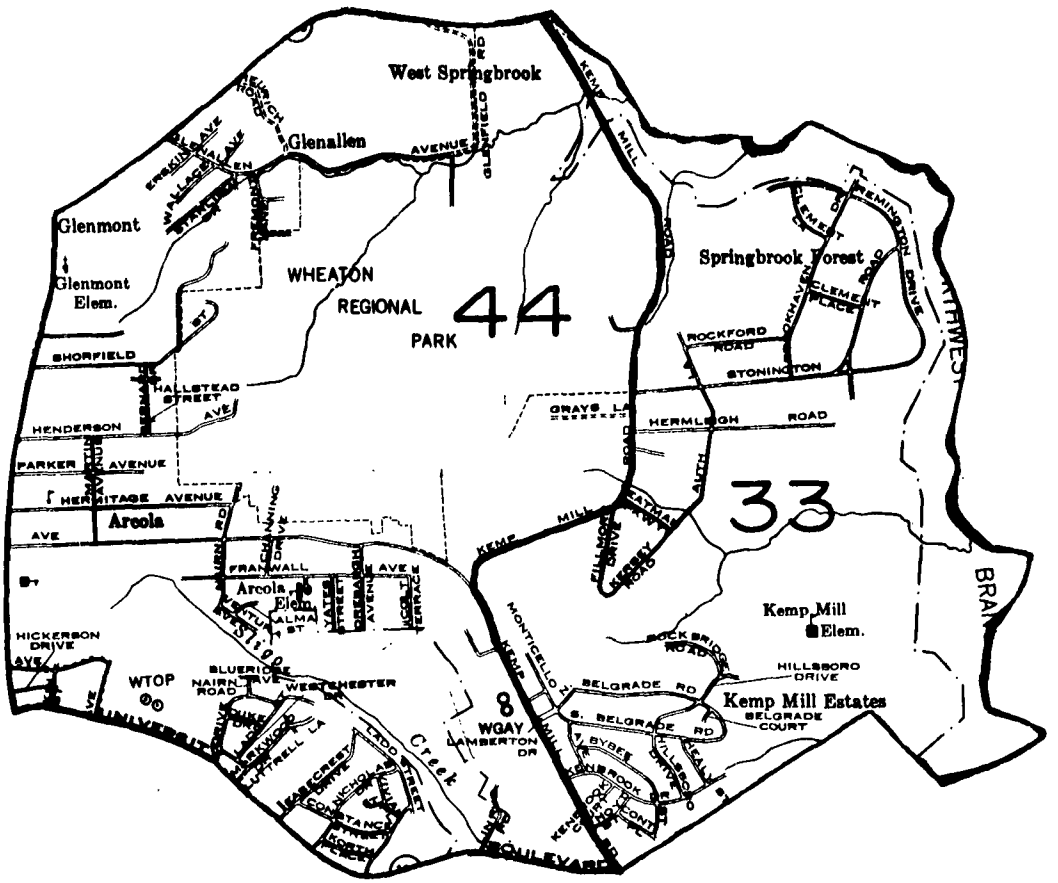
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-E
Precincts 11, 19, 24, 31, 32, 42

DISTRICT 13, AREA F

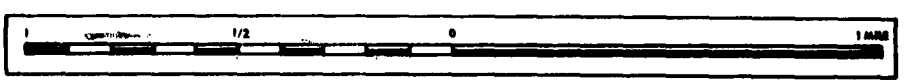
	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	0.5		1	1		Newport Jr. High		
Precinct 27 to AHQ	0		1	1	1	Newport Jr. High		
Shelters to PHQ	2.5			6			3,690	7
Precinct 29 to AHQ	1		1	1	1	Highland El. Sch.		
Shelters to PHQ	4.5			10			5,780	11
Precinct 30 to AHQ	1		1	1	1	Kendall & Wiseman		
Shelters to PHQ	6			10			5,340	11
Precinct 33 to AHQ	2.2		1	1	1	Kemp Mill El. Sch.		
Shelters to PHQ	2.5			4			2,570	5
Precinct 40 to AHQ	0.5		1	1	1	Rock Creek El. Sch.		
Shelters to PHQ	3			6			3,630	7
Precinct 44 to AHQ	2		1	1	1	Arcola El. Sch.		
Shelters to PHQ	3			4			2,410	5
Totals	28.7		7	47	6		23,420	46



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-F (Western Part)
Precincts 27, 29, 30, 40



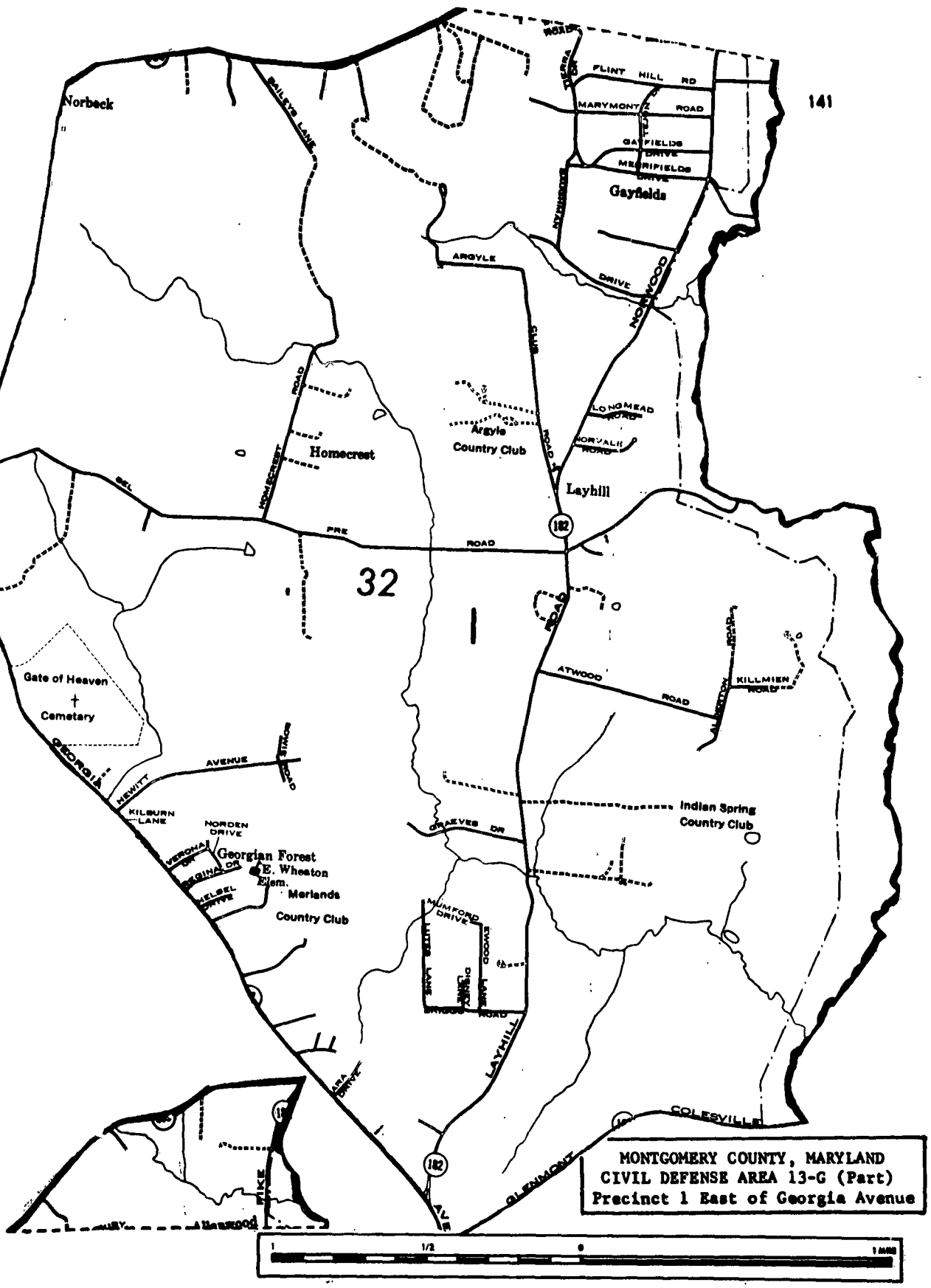
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-F (Eastern Part)
Precincts 33 and 44

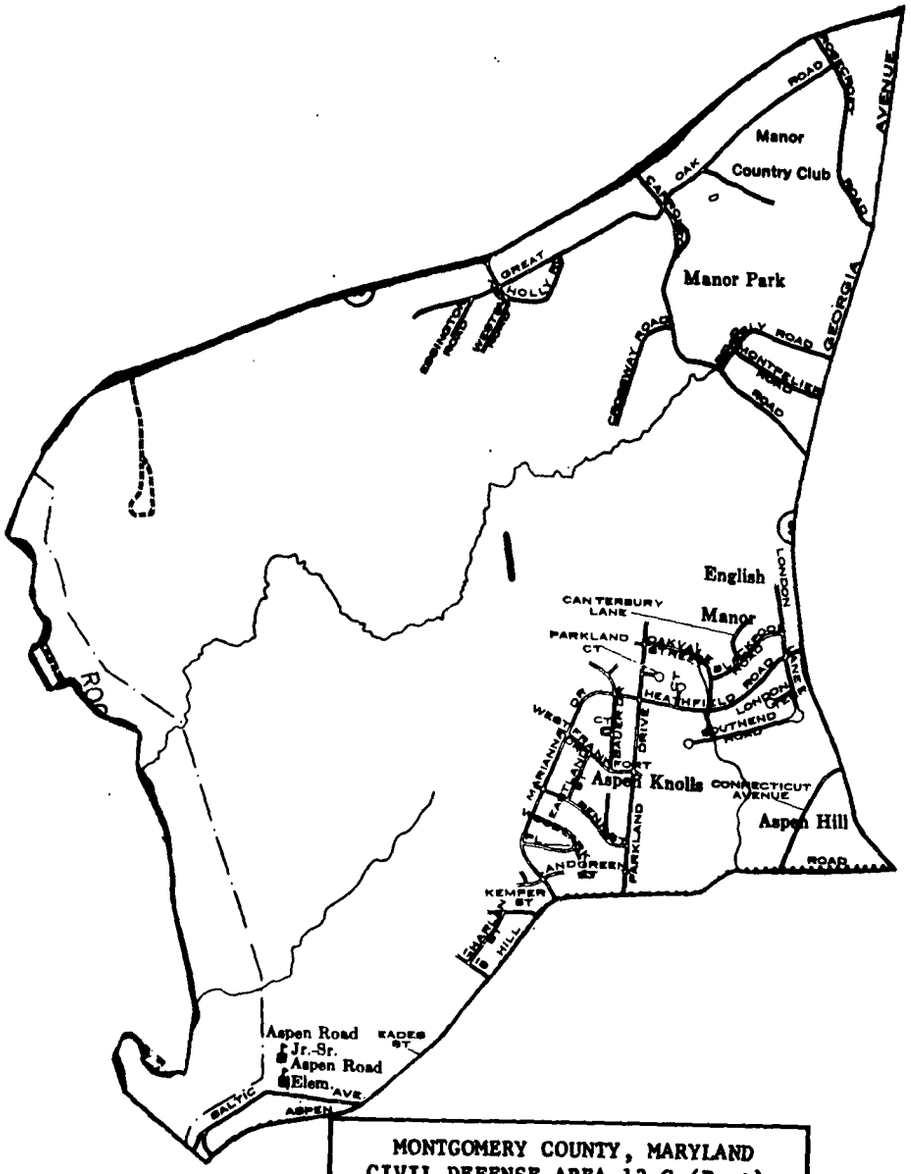


DISTRICT 13, AREA G

	Miles Wire	950 Mc	450 Mc 3 Watt	150 Mc 1 Watt	27 Mc	Headquarters Location	Pop.	Shelters
Area to DHQ	3		1	1		Georgian Forest El. Sch.		
Precinct 1 to AHQ	0		1	1	1	Georgian Forest El. Sch.		
Shelters to PHQ	4			7			4,080	8
Precinct 25 to AHQ	2.5		1	1	1	Viers Mill El. Sch.		
Shelters to PHQ	2			5			2,970	6
Precinct 28 to AHQ	1		1	1	1	Wheaton Sr. HS		
Shelters to PHQ				6			3,690	7
Precinct 35 to AHQ	1		1	1	1	Belt Jr. HS		
Shelters to PHQ	4			8			4,550	9
Precinct 36 to AHQ	1.5		1	1	1	Connecticut Park El.		
Shelters to PHQ	4			7			4,230	8
Precinct 37 to AHQ	1.5		1	1	1	Independence &		
Shelters to PHQ	3			8		Parkland	4,350	9
Precinct 43 to AHQ	2		1	1	1	Wheaton Woods El.		
Shelters to PHQ				5			2,920	6
Totals	29.5		8	54	7		26,790	53

MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-G
Precincts 25, 28, 35, 36, 37, 43


Norbeck
141
FLINT HILL RD
MARYMONT Z ROAD
GAYFIELDS DRIVE
MERRIFIELDS DRIVE
Gayfields
ARGYLE
DRIVE
NORWOOD
CLUB
ROAD
Homecrest
Argyle
Country Club
LONGMEAD ROAD
Layhill
182
PRE
ROAD
32
Gate of Heaven
Cemetery
ATWOOD
ROAD
KILLMIEN ROAD
GEORGIA
AVENUE
HEWITT
KILBURN LANE
NORDEN DRIVE
VERONA DR
Georgian Forest
E. Wheaton
Elem.
Merlands
Country Club
Indian Spring
Country Club
GRAEVES DR
MUMFORD DRIVE
LAYHILL
COLESVILLE
ARA DRIVE
PIKE
Kensington
MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-G (Part)
Precinct 1 East of Georgia Avenue



MONTGOMERY COUNTY, MARYLAND
CIVIL DEFENSE AREA 13-G (Part)
Precinct 1 West of Georgia Avenue

CHAPTER VI

COMMUNICATIONS PERSONNEL AND TRAINING

6.1 Shelter Echelon

From the operating standpoint our objective is to set up a Shelter Communications System which can be operated by anyone who can use an ordinary telephone. The obvious and conclusive reason for this objective is that, since the timing of a nuclear attack (season, time of day, day of the week) cannot be predicted, it is utterly unsound to set up a system which requires highly trained personnel for its operation. We need cite only two reasons for this conclusion: The difficulty of getting people to spend the time and effort necessary to acquire the pre-emergency training, and even if they did, the uncertainty that these trained people would be able to report to the point where they were needed in case of attack. To elaborate on the latter point, it is clear that, if the attack occurred, say, between the hours of midnight and 6 A. M. during the usual work week of Monday through Friday in the winter when the children are in school, shelter wardens could be reasonably sure that key personnel would report in their specific shelters when the alarm sounded. Since attack timing is unpredictable, however, the only safe course is to rely on key personnel as little as possible.

Although shelter management is not within the purview of this study, it may be noted that, ideally, three or more persons should be trained as shelter wardens for each shelter. They should be selected in such a way that at least one would, under all foreseeable conditions, report to his assigned post when needed.

The same principle applies to all other administrative personnel, including those for communications.

As stated above, our objective was to set up a system which could be made to function without specially trained communicators. As a practical matter, training will be required if only to maintain discipline on the communications circuits.

Generally, of course, procedures used in communications will be as simple as possible. Administrative traffic will generally be in the form of short written messages. "Written-down" traffic will be the rule.

Naturally, personnel who already have training in communications techniques should be identified among the prospective shelter populations and recruited. The Shelter Warden himself should see to this, as communications is a particularly sensitive area and the successful completion of the shelter's basic mission can very easily depend upon the satisfactory performance of the communication system.

Among the recruits which a Shelter Warden should seek would be, of course, persons with a communications background, particularly telephone operators, telegraphers, secretaries, receptionists, and others accustomed to dealing with the public over the telephone. Probably the ideal person would be a housewife who is a retired telephone operator.

Shelter Wardens should recruit as many such persons as possible, drill them in the operation of the simple equipment, radio and telephone, provided in the shelter, and try to maintain a large enough

cadre so that a sufficient number could be expected to be available in the shelter to maintain a 24-hour communications watch during the shelter period.

It is not expected that communications maintenance in individual shelters during the shelter period will present any critical problems. Nevertheless, Shelter Wardens should identify among the prospective shelter population as many persons capable of repairing communications equipment as possible. A simple tool kit and an appropriate assortment of spare parts should be kept as a part of the shelter materiel, but prospective maintenance men may be encouraged to supplement these from their own stocks.

Shelter Wardens will generally be too busy to properly supervise communications. Therefore, they should select and train communications supervisors (Assistant Shelter Wardens for Communications?). These supervisors would have the particularly important duties of seeing that the communications circuits are manned at all times, that message priorities are assigned and adhered to, that circuit efficiency is maintained, and that operators generally do their jobs efficiently and impersonally, and particularly that they do not spread rumors and gossip.

Separate watches should be maintained on broadcast frequencies and on the two-way telephone and radio circuits. This means that at least two persons will be required for each watch. Watches should be no more than four hours long, so at least twelve persons will be needed to man the communications circuits for each 24-hour day. If possible, three times that many should be trained for the job to insure a full complement during actual shelter occupancy periods. This may seem at first to be an unnecessarily large communications crew, but, aside from the actual needed manpower, it will be remembered that maintenance of morale among busy people (if they think they are doing important jobs) is simplified.

In large shelters, runners will also be required for the communications system. Their jobs would be to deliver written messages or call the addressees to the communications center for direct conversations with the callers. Little or no training would be required, so runners could be recruited from members of the shelter population not occupied with conflicting assignments.

6.2 Precinct Echelon

The Precinct Shelter Headquarters will be the terminus of circuits from each of the other shelters in the Precinct, as well as from the Area echelon. This will mean as many as eleven or twelve circuits in some cases. Obviously, the Precinct Communications Center will take on a more "professional" aspect, more attention will have to be paid to procedures, more highly trained personnel will have to be utilized, and more operators will be required. The personnel problem will be greater because recruitment will of necessity be limited to prospective occupants of a single shelter. There seems to be no reason, however, to set up both a Precinct and a Shelter Communications organization in the same shelter. Thus the Precinct communications officer (by whatever name he might be designated) would oversee both the Precinct communications and the Communications relating specifically to the shelter in which the Precinct Headquarters is housed.

6.3 Area Echelon

While it is not the purpose of this study to delineate the basic mission of Civil Defense organizational units, it seems desirable to locate the "action level" of the overall Montgomery County Shelter System. Inasmuch as each Area contains the population of a small city (about 25,000 persons), it appears likely that the area would function best as the basic administrative unit in the two most heavily populated Districts (Wheaton and Bethesda); in the rest of the County the District probably should be the action level. The assumption is somewhat arbitrary but the County level obviously must be kept as free as possible from the necessity of operational decisions in order that it can concern itself with matters of policy, coordination within the County, and liaison with State and Federal levels. The Shelter level will be concerned wholly, and the Precinct level mainly, with operational matters.

This decision is important from the communications standpoint since the number and kind of communication circuits required will depend upon the flow of traffic between echelons and, to a lesser extent, within echelons.

Area Headquarters will naturally be located in a shelter favorably situated with respect to the various Precinct Headquarters. Other considerations to be taken into account will be the suitability and availability of storage space for spare supplies and equipment. It is recommended, however, that Area communications centers be separated from the communications center of the shelter in which Area Headquarters is located. It might be possible to use for this purpose available space which has the required Protection Factor but which is unsuitable for a mass shelter because of capacity.

Area communications personnel should be selected and trained with care since they will be handling a considerable volume of traffic of an important nature and facilities will have to be used as efficiently as possible. As an example, the volume of radiological monitoring reports alone during the early phases may constitute a sizeable load. Area Wardens will find it necessary to devote much of their effort to the recruiting and training of communications personnel.

The Area Communications Officer should be a person with professional communications experience. He should designate First, Second, and Third Assistants and train them to take over if he fails to reach his assigned location when the emergency occurs. He should also designate and train Traffic Chiefs for each watch during the 24 hours of the day. The requirements for these jobs will probably preclude the setting up of six-hour watches because of the scarcity of qualified people. Either a single eight- or two four-hour watches per person daily are therefore recommended for the Area communications level.

Broadcast radio monitoring will be particularly important at the Area level since broadcast information may be important from the Area Warden's decision-making standpoint. Secretarially-trained persons who can use shorthand would be especially desirable here. Area Communications Centers will be connected up to District Headquarters as well as down to Precinct Headquarters.

6.4 District Echelon

Each of the 13 Districts will have a District Warden. Their headquarters will be in shelters chosen at points as centrally located with respect to their Districts as possible. They, likewise, should be in shelter

areas of limited capacity, if possible. If located in a mass shelter, the District Warden's administrative area should be as isolated from the general shelter activities as possible. Experienced communications personnel would be especially desirable here and pre-emergency training and drilling very important, since the volume of reports and general information to the County level would be large. In District 13 (Wheaton) the volume of fallout reports alone might be expected to reach 325 per hour for the first twelve hours after the attack. (This again assumes that each shelter will contain a monitoring station for fallout).

6.5 The Flow of Communications Traffic

In any organization the traffic load between echelons is greatly influenced by the decision-making levels. In the proposed organization it is obvious that the lower the points in the organization where problems can be disposed of, the less will be the traffic load at the higher levels.

Since it is a principle of good organization to dispose of problems at the lowest practicable level, it is assumed that Shelter and Precinct problems will generally be disposed of below or at the Area level, and that the Area and District will seldom ask for decisions by the County Director of Civil Defense. In other words, it is assumed that each level of the organization will be delegated sufficient authority to make its own decisions to the fullest practicable extent. One exception, of course, will be the case where there are insufficient data upon which to base a decision as, perhaps, where a decision must be made whether or not outside travel over a specified route is feasible. Since radiological data flows to County Headquarters for plotting and evaluation, it might be necessary that such a decision be made at the County level.

CHAPTER VII

INTRA-SHELTER COMMUNICATIONS

Consideration of the desirability of furnishing communications facilities for use solely within the living area of the individual shelter must not be overlooked. The need for such communications facilities would be slight, however, in the 500-person structures which are made a basic assumption in this report.

Such a structure would, under the generally-accepted criterion of ten square feet of floor space per person, have an area of 5,000 square feet. If rectangular in layout, it might be 100 feet long by 50 feet wide. (This does not include service and administrative areas.)

Over distances such as those in the preceding paragraph, it seems that signal lights for waking-hour use and buzzers for sleeping periods would be the maximum needed, for instance, to call key personnel to the communication area. Runners or messengers would also suffice.

For general announcements, nothing like a public address system would be needed. Straight lung-power could surely adequately cover the distances involved. Radio broadcasts or recorded entertainment material could be made to cover the area at an adequately high level if reproduced by an ordinary home-type radio receiver or phonograph.

The problem would become greater if the shelter consisted of a number of non-contiguous areas in a building, such as corridors in the core of a multi-floor office building. In such a case means must be provided for locating key personnel with minimum delay. If considerable distances are involved, sound-powered telephones should be ideal. The use of such instruments naturally involves some form of signal to call the individual to the telephone. Buzzers, bells, or lights immediately suggest themselves. The desirability of adding extension instruments to the shelter communication system should be cautiously explored in connection with the problems of individual installation. All such instruments **must**, however, be controlled from the communications areas to prevent unauthorized use.

We have given considerable thought to the use of public-address types of systems in fallout shelters. It is easy to see how they could be used to disseminate information of general interest, to carry music and other entertainment material to all points in a shelter and to page individuals.

Such systems may be of considerable value in large shelters if used with discretion. Their greatest value would probably be in disseminating information of interest to most of the people in the shelter and for planned entertainment periods. If used for paging or for background music, great care must be taken to avoid further aggravating an inherently touchy morale situation.

No recommendations will be made here on the precise equipment requirements for intra-shelter communications since each installation should be made to fit the particular shelter area involved and the installations are utterly simple and routine in most cases. If public address type equipment is used, transistor-types should by all means be selected to improve reliability and to ease demands on emergency power supplies.

To Summarize:

We do not foresee the need for elaborate intra-shelter communication systems. In our assumed 500-person shelter we believe that signal lights and buzzers, with runners from the communications area, would suffice. In shelters with a more complicated configuration or with a much greater capacity, sound powered telephones should be installed at key points. If the Shelter Warden's headquarters is remote from the communications area, extension instruments should be installed. Public address types of systems may be useful if used judiciously. Information of importance and general interest should be announced orally and posted in summary on bulletin boards.

CHAPTER VIII

SUMMARY AND RECOMMENDATIONS FOR FURTHER STUDY

8.1 Summary

This study was conducted during the period May through December, 1962, to determine the inter- and intra-emergency shelter information requirements and to propose ways and means of meeting them which could be embodied in pre-attack shelter plans. Montgomery County, Maryland, was chosen as a representative community for the study prototype. The major consideration for this study was the assumption of a radioactive fallout effect only, compelling all in the County to remain in fallout shelters for a period of approximately two weeks.

The communication requirements necessary for the control, cohesion, and maintenance of a population group of some 350,000 for the two-week period following the thermonuclear attack were identified. These requirements, totalling ten categories of information, were then subjected to an analysis to determine the time required to transmit, receive, and relay essential messages over a single leased wire telephonic network, employing the principle of a command and control communication net. Also proposed was a two-way radio backup to the primary telephonic system.

The time analysis demonstrated that the proposed communication system will be more than adequate to fulfill all the communication requirements but one. The exception is the category of information relating to the separation of individual family members. Advising the tens of thousands of separated families, specifically of the safety of respective loved ones, is not feasible by the proposed electrical means. Suggestions were made for partial resolution, and in this chapter recommendations are made regarding this matter.

A cost analysis of the primary and secondary communication system was effected. On the basis of cost per capita, the proposed communication system is economical, practical, and compatible with other major costs incident to a nation-wide fallout shelter program.

8.2 Recommendations Relative to Socio-Psychological Factors

Throughout the process of determining communication requirements, the question of justification was always present, particularly for those requirements relating to social effects of the thermonuclear attack. A proposal which ignores the contribution that communications can make to individual morale and solace on the grounds of austere, spartan necessity is not likely to prove a satisfactory one. There will be countless instances of suffering, death, and other appalling effects far transcending the morale problems of the non-injured survivors. This fact, nevertheless, does not detract from the usefulness of communications as a means of relieving tension among the sheltered population.

Considering that the surviving population will be the substance of the post-attack society and the primary instrument for national recovery, every effort should be made to insure that the survivors have the necessary morale, solidarity and direction to make an effective and concerted attack on the myriad of

recovery and rehabilitation problems that will confront them in the post-shelter environment. Effective handling of communications during the period of shelter confinement will be essential in fulfilling this goal.

Much more needs to be learned about how human beings behave in disaster. Even more pressing is the need for knowledge which will permit reliable predictions of behavior in post-nuclear attack situations. Finally, more research is needed with regard to the complex relationship between communication in all its forms and societal cohesion under conditions of stress. Certainly, leadership and the communication resources necessary for making leadership effective will be very much instrumental in bringing about the restoration of the essential elements of the pre-attack society.

While the results of this study have demonstrated that a command type telephonic circuit, operated efficiently, can provide for minimal control of and care for a sheltered population, it cannot meet the requirements of informationally uniting separated family members. Even with elaborate communication resources, the problems of meeting this requirement are manifold. It is possible, of course, that this requirement is not as urgent as our analysis has indicated. In any event, it deserves more study both with respect to the needs it is certain to impose and to the number of ways by which those needs can be met.

The question of how much of the communication resources should be devoted to all phases of plans and preparations for economic recovery while in shelter confinement is also one that we have not resolved to our own satisfaction. A conviction that the in-shelter phase is a crucial one and also one in which the surviving population can be sufficiently oriented and prepared for emergence into the post-attack environment, leads us to the conclusion that maximum coordinated effort for the planned utilization of surviving resources should be made during this time. In our view, a separate study devoted to this area is warranted.

8.3 Recommendation for a Shelter Communications Manual

It is recommended that consideration be given to the development and distribution of a "Shelter Communications Manual."

This Manual should contain all the information necessary for the training of operating personnel for the operation of the communications system developed in this report.

It would stress the principles of good operating practice, viz., brevity, the transmission of essentials only, the maintenance of discipline by the net control stations, and the preclusion of unauthorized transmissions and messages.

It would set up operating procedures for all levels up to and including County HQ.

Details of actual equipment use would be included as appendices as the development of specific pieces of equipment was carried out. It would not be intended to be a technical or troubleshooter's manual but would contain instructions for performing such tasks as connecting antennas, replacing antennas, and replacing batteries, and charging batteries where applicable.

Its language would be as non-technical as practicable. The instructions would be elementary enough so that a totally untrained person of normal intelligence and education could understand it sufficiently to

set up and operate shelter radio and telephone equipment. This is not to say that such operations would be efficient.

The manual would also set up procedures for the operation of other systems of communication, such as courier and air drop.

Specific methods for handling difficult categories of communications traffic—such as shelter censuses and location of family members—would be set out in detail. Message priorities would also be set up in the manual.

THE COMMUNICATION REQUIREMENTS SET OUT ELSEWHERE IN THIS REPORT ARE THOSE MINIMALLY ESSENTIAL AND IT IS EMPHASIZED THAT THE ESTIMATES OF REQUIRED CIRCUIT TIME ARE BASED ON EFFICIENT AND DISCIPLINED OPERATION OF THE COMMUNICATIONS SYSTEM. FOR THESE REASONS PREPARATORY TRAINING BASED ON CAREFULLY WORKED OUT PROCEDURES AND INSTRUCTIONS MUST BE CARRIED OUT IF THE COMMUNICATIONS SYSTEM IS TO FUNCTION SATISFACTORILY.

8.4 Recommendation for Radio Equipment Development

We have investigated the availability of radio equipment which will meet the needs outlined in this report. Our conclusion is that we should recommend that the Government should let contracts for development of prototypes of shelter radio equipment which for one or more reasons will be more desirable than any which now appears to be on the market.

On the basis that the general characteristics of power, size, weight, power sources, and stability of equipment now on the market and designed to work in the 27 Mc region, either in the Citizens Radio or other Radio Services, would be suitable, letters were sent to twelve manufacturers. (See the letter at the end of this chapter.)

Of the twelve, five answered with letters which said essentially "not interested." Five others disregarded the inquiry entirely. One of the first five forwarded our letter to another manufacturer on whom we had no data. The latter advised us that he was introducing to the market a piece of equipment which he thought would be about what we wanted at a price of approximately $900 per set.

Of the remaining two manufacturers, one wrote back for more definite specifications and another urged that we recommend operation in the 25 to 54 Mc region with amplitude modulation to suit equipment presently marketed by him.

One other manufacturer whom we contacted verbally demonstrated equipment which would be suitable for some shelter applications but which costs over $500 per unit. Still another sent us data on somewhat similar equipment selling for even more.

A conference with the development people of a large manufacturer produced a loose estimate of perhaps $300 for a two-frequency transceiver of the general characteristics described in the letter if the set were produced and sold in large numbers.

We have recommended the use of 950 Mc for the County-District circuits because more circuits could be set up by multiplexing if necessary and because better propagation control is possible, but the cost factor becomes important. The use of 450 Mc for District-to-Area and Area-to-Precinct would permit frequency duplications areawise to a much larger extent than would 150 Mc frequencies. However, as stated earlier in this report, no suitable equipment is available at prices which would put the system in the realm of realism.

The 150 Mc equipment would still be needed for use in situations where propagation paths might be unpredictable (as in mobile operations).

It is our recommendation, therefore, that research and development contracts be let for protypes of the following equipment:

(1) Transmitters and receivers to operate in the 950 Mc region, together with suitable multiplexing equipment. Power to be in the vicinity of 10 watts.

(2) Transceivers to operate in the 950 Mc region, power 3 watts

(3) Transceivers to operate in the 450 Mc region, power 3 watts

(4) Transceivers to operate in the 150 Mc region, power 3 watts

(5) Transceivers to operate in the 150 Mc region, power 1 watt

All the above equipment must use solid-state devices rather than vacuum tubes and be designed to sell in relatively large numbers at minimum prices.

8.5 Recommendation for Setting up of Prototype Shelter Communication Circuit

We believe that the technical recommendations in this report are based on sound engineering considerations and that they should prove satisfactory in actual practice. As engineers, however, we subscribe fully to the principle that the only way to be sure is to try the plan out.

It is our recommendation that, with the concurrence and cooperation of the Montgomery County Division of Civil Defense, a developmental shelter communication circuit be set up and actually operated under simulated shelter occupancy conditions.

In our opinion the circuit should begin in a designated shelter area in Wheaton or Bethesda and should run through the Precinct-Area-District levels to the Civil Defense Headquarters at Rockville. Both wire line and radio circuits should be provided.

Such a program should provide concrete data on such things as radio frequency and power requirements, radio and wire line circuit capacities, message handling procedures, personnel training methods, utilization of existing skills for shelter communication, and, if continued long enough, could be used to train a cadre of instructors who would, in turn, train sufficient numbers of persons to man the proposed communication system in Montgomery County.

Our conclusions regarding radio should be checked to a wider extent. A number of circuits should be established, not necessarily simultaneously, from various assumed shelter locations. As we state elsewhere, we do not consider available equipment suitable for general shelter communication system use. Existing equipment can be adapted to the recommended frequency, emission, and power criteria, however, and used for testing.

Letter dated August 17, 1962, from Gautney & Jones to 12 Radio Equipment Manufacturers

Gentlemen:

We are prime holders of Government Contract OCD-OS-62-123, Purchase Order 1505. Under this contract we are charged with developing a system to provide communications to and within shelters intended to house the civilian population in the case of nuclear warfare.

Consideration of such communication systems inevitably brings up the problem of short-range (10 miles or less) radio communications and the collateral requirement for suitable radio equipment.

As we see it, equipment of the general type now so widely used in the Citizens Radio Service would be ideal for many of the uses which we expect to develop in our execution of the contract referred to above. The term "general type" is used advisedly inasmuch as we consider 27 Mc Citizens Radio frequencies unsuitable because of their propagation characteristics in the first place; and, further, think that reliability demands that equipment more rugged and more resistant to heat, moisture, and abuse be developed for the purposes we have in mind.

Tentatively, we would lay down the following broad specifications:

1. Equipment would be of two types, one suitable for vehicular and base station use and another of such size, weight, and physical configuration as to be suitable for hand carrying. Both would be self-contained transceivers.

2. Operating frequencies would be those allocated by the FCC for non-Federal Government use in the 150 Mc region.

3. Power outputs would be from about 0.5 to 3 watts.

4. Power supplies would be interchangeably 110 V. A. C., 6 or 12 V. batteries (storage) and, in the case of the hand-held sets, small dry batteries in addition to the foregoing.

5. All sets should have attached antennas and provision must be made for the use of separate antennas.

6. Equipment must be fully transistorized.

7. Long storage life under moderately unfavorable conditions (particularly moisture) must be assured.

8. The equipment must comply with the appropriate provisions of FCC Rules, Parts 10, 11, and 16, in order that licensees (probably State and local governments in most instances) may conduct drills,

exercises, and tests under non-emergency conditions, as well as use the equipment for appropriate non-emergency communication requirements.

9. Operation must be so simplified that virtually any person who knows how to use an ordinary telephone may use the radio equipment.

10. Equipment of the base-station type should be operable on a number of switch-selected channels. Hand-held sets should be operable on at least two channels.

11. Prices must be below those now charged for comparable Citizens Radio equipment.

It seems to us that the foregoing tentative requirements represent a departure from present Citizens Radio standards only in a change of the operating frequency region, stronger and more reliable construction, tighter frequency tolerances in the case of sets of more than 3 watts input, and transistorization. Some manufacturers now offer completely transistorized Citizens Radio equipment, of course.

Since a knowledge of equipment costs and availability will vitally affect our recommendations to the Government, we would greatly appreciate your advising us what you think your unit costs for the production of each of the two types outlined above would be under the following conditions:

1. Production units to be 10,000 pieces or more.

2. The entire production unit to be taken by one purchaser.

Please understand that this is not a request for a bid and that your quotation will not be regarded as a proposal. An early reply will be appreciated as it will facilitate our completion of the contract as well as further the national Civil Defense program.

Very truly yours,

Carl T. Jones

CRW/sem

APPENDIX A

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APPENDIX B

FCC RULES APPLICABLE TO CIVIL DEFENSE ACTIVITIES

2.405 Operation During Emergency

The licensee of any station, except amateur, may, during a period of emergency in which normal communication facilities are disrupted as a result of hurricane, flood, earthquake, or similar disaster, utilize such station for emergency communication service in communicating in a manner other than that specified in the instrument of authorization: Provided:

a. That as soon as possible after the beginning of such emergency use, notice be sent to the Commission at Washington, D. C., and to the Engineer in Charge of the district in which the station is located, stating the nature of the emergency and the use to which the station is being put.

b. That the emergency use of the station shall be discontinued as soon as substantially normal communication facilities are again available.

c. That the Commission at Washington, D. C., and the Engineer in Charge shall be notified immediately when such special use of the station is terminated: Provided further:

d. That in no event shall any station engage in emergency transmission on frequencies other than, or with power in excess of, that specified in the instrument of authorization or as otherwise expressly provided by the Commission, or by law: And provided further:

e. That the Commission may, at any time, order the discontinuance of any such emergency communication undertaken under this section.

10.9 Civil Defense

A station licensed under this part may transmit communications necessary for the implementation of civil defense activities assigned such station by the local civil defense authorities during an actual or simulated emergency, including drills and tests: Provided, that such communications relate to the activity or activities which form the basis of the licensee's eligibility in the radio service in which authorized.

10.452 Disaster Relief Organizations

a. Eligibility. Organizations established for disaster relief purposes and which have an emergency communications plan involving the use of radio are eligible in this service.

b. Eligibility showing. The initial application from a disaster relief organization shall be accompanied by a copy of the charter or other authority under which the organization was established and a copy of the communications plan with a full explanation as to how the requested radio facilities would be used under such plan and integrated into any other communication facilities which normally would be available to assist in the alleviation of the emergency condition.

c. Class and number of stations available. Disaster relief organizations may be authorized to operate an unlimited number of base, mobile and fixed stations.

d. Permissible communications. Except for transmissions which are necessary for drills and tests as permitted by Section 10.151 (e), stations licensed to disaster relief organizations may be used only for the transmission of communications relating to the safety of life or property, the establishment and maintenance of temporary relief facilities, and the alleviation of the emergency situation during periods of actual or impending emergency, or disaster, and until substantially normal conditions are restored.

10.551 Eligibility

Authorization for stations in the Local Government Radio Service will be issued only to territories, possessions, states, other governmental subdivisions including counties, cities, towns and similar governmental entities.

10.552 Permissible Communications

Stations in the Local Government Radio Service are authorized to transmit communications essential to official activities of the licensee.

10.553 Points of Communication

a. Local government base stations are authorized to intercommunicate with local government mobile stations. Local government mobile stations are authorized to intercommunicate with local governmental base stations and other local government mobile stations.

b. Local government base and mobile stations are also authorized to intercommunicate with other stations in the Public Safety Radio Services and to transmit to receivers at fixed locations: Provided, That no harmful interference will be caused to the base-mobile operations of any authorized station.

c. Local government fixed stations are authorized to intercommunicate with other fixed stations in the Public Safety Radio Services and to transmit to receivers at fixed locations.

11.151 Permissible Communications

a. Stations licensed under this part may transmit the following types of communications:

1. Any communication related directly to the safety of life or the protection of property; and

2. Communications considered essential to the efficient conduct of that portion of the enterprise for which the licensee is eligible to hold a station license under this part, subject to the condition that harmful interference is not caused to safety communications of stations licensed under this part.

b. A station licensed under this part may communicate with other stations without restriction as to type, service, or licensee when the communications to be transmitted are of the type described in paragraph (a)(1) of this section.

12.200 Temporary Nature of This Service

a. The Radio Amateur Civil Emergency Service provides a temporary phase of amateur operation for Civil Defense communications purposes only, and the rules are limited in their force and effect to the period of the present national emergency, including any emergency which may necessitate invoking of the President's War Emergency Powers under the provisions of section 606 of the Communications Act of 1934, as amended.

b. Pursuant to the provisions of section 4(j) of the Communications Act of 1934, as amended, records relating to the Radio Amateur Civil Emergency Service shall not be open to general public inspection.

12.201 Definitions

Radio Amateur Civil Emergency Service. A temporary radio-communication service carried on by licensed amateur radio stations while operating on specifically designated segments of the regularly allocated amateur frequency bands under the direction of authorized local, regional, or federal civil defense officials pursuant to an approved civil defense communications plan.

16.151 Permissible Communications

a. Except as provided in Section 16.502, stations licensed under this part may transmit the following types of communications:

1. Any communication related directly to the safety of life or the protection of important property;

2. Communications required for the efficient operation of the transportation system, as described in the application for authorization and defined in the rule of eligibility for the particular service; subject to the condition that harmful interference is not caused to safety communications of stations licensed under this part, and further subject to the condition that the transmission of each message shall be accomplished as quickly as possible and without superfluous language.

b. A station licensed under this part may communicate with other stations without restriction as to type, service, or license when the communications to be transmitted are related directly to the safety of life or protection of important property.

16.405 Civil Defense Communications

In addition to communications permitted under the provisions of Section 16.151(g), stations in the Taxicab Radio Service may be used for the transmission of the following:

a. Messages relating to the dispatch of taxicabs which are temporarily diverted from their normal public passenger transportation activities to the performance of civil defense transportation functions.

b. Messages relating to the activities of the civil defense agency in those cases where other communications facilities including the Radio Amateur Civil Emergency Service, Disaster, or Domestic Public Services are inoperative or inadequate, either in fact or during a simulated civil defense emergency.

19.93 Civil Defense Communications

A licensee of a station authorized under this part may use the licensed radio facilities for the transmission of messages relating to civil defense activities in connection with official tests or drills conducted by, or actual emergencies proclaimed by, the civil defense agency having jurisdiction over the area in which the station is located: Provided that:

a. The operation of the radio stations shall be on a voluntary basis.

b. The operation of the station shall not conflict with CONELRAD requirements.

c. Such communications are conducted under the direction of civil defense authorities.

20.1 Purpose

The purpose of this part is to provide for the licensing or authorizing of radio stations to provide essential communications incident to or in connection with disasters or other incidents which involve loss of communication facilities normally available or which require the temporary establishment of communication facilities beyond those normally available.

20.3 Disaster Communications Service and Station Defined.

a. The disaster communications service is defined as a service of fixed, land, and mobile stations licensed, or authorized, to provide essential communications incident to or in connection with disasters or other incidents which involve loss of communications facilities normally available or which require the temporary establishment of communications facilities beyond those normally available.

b. A disaster station is defined as any government or non-government radio station able to function as a fixed, land, or mobile station and authorized, if government, by its controlling federal government agency or licensed, if non-government, by the Federal Communications Commission to operate in the Disaster Communications Service. A single disaster station may consist of more than one unit, each capable of being operated independently as a fixed, land, or mobile station.

20.6 Disaster Communications Defined

a. Communications essential to the establishment and maintenance of communication channels to be used in connection with disasters or other incidents involving loss of communications facilities normally available or which demand the temporary establishment of communications facilities beyond those normally available, including communications necessary or incidental

to drills and simulated disaster relief activity on the part of persons or organizations participating in the use of such communication channels; or

b. Communications or signals essential to the public welfare, or that of any segment of the public, including communications directly concerning safety of life, preservation of property, maintenance of law and order, and alleviation of human suffering and need, in the case of any actual or imminent disaster or other such incident.

21.209 Communications Concerning Safety of Life and Property

a. Handling and transmission of messages concerning the safety of life or property which is in imminent danger shall be afforded priority over other messages.

b. No person shall knowingly cause to be transmitted any false or fradulent message concerning the safety of life or property, or refuse upon demand immediately to relinquish the use of a radio circuit to enable the transmission of messages concerning the safety of life or property which is in imminent danger, or knowingly interfere or otherwise obstruct the transmission of such messages.

21.210 Operation During Emergency

The licensee of any station in these services may, during a period of emergency in which normal communication facilities are disrupted as a result of hurricane, flood, earthquake, or similar disaster, utilize such station for emergency communication service in a manner other than that specified in the instrument of authorization.

FEDERAL COMMUNICATIONS COMMISSION POLICY ON SAFETY AND SPECIAL RADIO SERVICES LICENSEES' HANDLING CIVIL DEFENSE COMMUNICATIONS

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by

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Shortly after the Federal Civilian Defense Administration was established, it appeared that Congress may have generated a new frequency management and regulatory problem. The FCDA, which had the job of organizing civil defense communications, desired to have allocated a pool of civil defense frequencies for use by various civil groups in connections with the civil defense duties assigned to them. Presumably the FCDA would have determined who would be authorized to use these frequences, for what purposes, and who would have designated particular assignments. Since the Communications Act gives to the FCC the responsibility of allocating frequencies, licensing stations, determining eligibilities and generally administrating and regulating the use of radio by civil entities, we had in effect, a conflict of government interests. When it is considered that the Act makes the President responsible for the assignment of frequencies to Federal Government users, it is obvious that we now had three competitors for the use of frequencies in a crowed spectrum. How to administer such a situation was indeed difficult. Since the FCC is required by law to determine the relative public interest involved in the various civil uses of radio and there is much congestion in the spectrum, it did not appear to the FCC that the setting aside of a large number of frequencies, to use only in time of emergency by especially authorized stations, would be an efficient allocation of spectrum space. After a considerable period of negotiation among the agencies involved, it was decided that the only practical way to meet the problem of radio facilities for civilian defense communications was to use existing facilities, both government and nongovernment. Accordingly, in 1956, an agreement was reached whereby the Federal Civilian Defense Administration dropped its request to the FCC and the IRAC for frequencies that it might authorize for civilian agencies and, simultaneously, became like any other agency in the IRAC. They obtain frequencies only for their own Federal Government use. Simultaneously, the FCC made the necessary changes in its rules and policy so that certain of its licensed radio services might carry Civilian Defense communications.

The authority an FCC licensed radio service may have to carry civilian defense communications is closely allied to two factors—(1) the essentiality of the normal communications of the licensee to the overall wartime economy and operation of the United States, and (2) to what extent civilian defense operations are inherent in its portfolio of normal operations. Obviously, any successful program of civilian defense cannot be achieved on a Federal level alone. The participation of units of government on the State, county and municipal levels are inherent in our civilian defense program. Consequently, the people in the Public Safety area of the Commission's licensing authority have the maximum authority to handle civilian defense

communictions. Simultaneously, with the implementation of this theory, the Federal Civilian Defense Administration set up the matching funds program which assisted these non-Federal Governmental organizations to implement the communications part of their civilian defense responsibilities. On the other extreme it was assumed that there are certain unessential radio services in wartime which can to some extent be eliminated, curtailed or diverted. For example, the Citizens radio service and the Taxi radio service might be diverted to other uses or eliminated, as the Amateur service has been in the past. However, since a pool of readily available communications equipment is available in Citizens and Taxi radio service, the Commission's rules were so changed as to allow local civil defense authorities to use such radio systems as they so desire, if, of course, they can make the necessary local arrangements. Therefore, it is possible to take a taxi and have the local civil defense authorities commandeer it as a mobile communications point that may be established anywhere within a city to communicate back to its base station which would be under the control of the civil defense authorities. In between these two extremes it was recognized that in industries such as transportation and manufacturing that radio is an indispensable tool to the efficient operation of that particular industry and, therefore, this industry must maintain its radio system in order to produce its essential product in wartime. In this case, civil defense communications would be limited to only those necessary communications which would permit that particular industrial function to continue operating in such an environment.

Another basic consideration in the FCC policy on Safety and Spcial Services licensees handling civilian defense communications is that, insofar as possible, it is desirable to have the authority to handle these communications available at all times so that the organizations involved may participate in civilian defense drills or day-to-day civilian defense work, and the authority shall not be contingent upon wartime conditions. This is not only desirable for drills, but for other minor and major natural disasters which occur from time-to-time, such as floods, hurricanes and fires.

The FCC rules have an across-the-board prohibition against any of the Safety and Special Radio Services licensees carrying program material of any kind for use in connection with radio broadcasting. Without going into the reasons for the adoption of such a policy, I would like to explain the way we interpret this policy. First, the above-mentioned services may not carry program material for **direct** rebroadcast by broadcast stations. For example, a police radio station cannot be used in lieu of a broadcast remote pickup facility to program a broadcast station. The rule does permit a broadcast station to record messages transmitted by Safety and Special Radio Services stations and use such recording for broadcast purposes.

Broadcast stations may operate their own remote program pickup equipment under licenses issued for that purpose. In the event of failure of wirelines, broadcast stations may dispatch mobile program pickup units to civilian defense headquarters for the purpose of broadcasting advisories and other information to the general public. Our present rules do not permit the permanent installation of remote pickup facilities at such locations. However, we have this problem under study.

Before I can explain our policy of handling civil defense communications in further detail, I must explain our policy of defining this type of communication. To my knowledge, there is no simple definition for the phrase "Civil Defense Communications". As far as the Commission is concerned, we have divided

this type communication into two categories. Our policy of handling such communications is based on this division, so it is very important that the type of communication permitted in each category be understood.

Category I. **Civil Defense Command and Control Communications.** By this type communication, I refer to types which do not relate to the licensees' normal activity.

As far as category I is concerned, only those stations in the Amateur, Disaster, Citizens Radio, Special Emergency (Section 10.452 only) and Local Government Services are authorized to perform the function of a "Civil Defense Communications Service". Amateur, of course, includes the Radio Amateur Civil Emergency Service (RACES), which was established solely for civil defense purposes.

To further clarify this category, I would like to cite a type of communication **NOT** permitted.

1. Communications between two police stations concerning administrative messages for local civil defense directors.

Any station permitted to handle messages in accordance with Category I is also authorized to handle messages in accordance with Category II.

Category II. Civil defense communications that **do** relate to the activity which form the basis of the licensees' eligibility in the radio service in which authorized.

For instance, civil defense authorities may plan to divert a trucking fleet into an exclusive medical, ambulance or evacuation service. It is felt that in such case the Motor Carrier radio system will continue to be used to operate trucks but toward the most effective handling of the new job assigned. It is important to note that the activity assigned by the civil defense authorities **shall not** include responsibility for providing a "civil defense circuit" as described under Category I.

Furthermore, when an established civilian activity is diverted to a civil defense purpose foreign to its normal function, the radio facilities of the activity **must** remain with it for use in accomplishing its civil defense mission.

With regard to Category II, the policy for each service is as follows:

(a) Public Safety Radio Service:

Police, Fire, Forestry-Conservation, and Highway Maintenance may transmit communications necessary for the implementation of civil defense activities assigned such stations by the local civil defense authorities during an actual or simulated emergency, including drills and tests: Provided, that such communications relate to the activities which form the basis of the licensee's eligibility in the service authorized. Since these services play an important part in Civil Defense, the Commission has been very lenient in granting requests for CD uses. For instance, some state police, Highway Maintenance and Forestry-Conservation stations are permitted to transmit attack warning, fallout and radiological data.

(b) Industrial Radio Services: Stations in this service include Power, Petroleum, Forest Products, Motion Picture, Relay Press, Manufacturers, Special Industrial and the Business Radio Services.

These stations may only conduct CD communications included in Category II.

(c) Land Transportation Services:

Motor Carrier, Railroad and Automobile Emergency Radio Stations may transmit civil defense communications as described in Category II.

Stations in the Taxicab Service may handle the following CD messages:

1. Messages relating to the dispatch of taxicabs diverted from their normal public transportation activities to the performance of civil defense transportation functions.
2. Messages relating to the activities of the civil defense agency in those cases where other communication services including RACES, Disaster and Domestic Public Services are not available, inoperative or inadequate.

In the Aviation and Marine radio services it is intended and necessary that stations in these services retain their basic scope of service in order to maintain and provide radio communications and navigation facilities for these services. Aviation and Marine communications are tightly linked to their operations; therefore, planning for civilian defense operations should not be predicated on the use of these frequencies. Since Marine and Aviation tend to be very closely associated to our military machine in times of war emergencies, it may well be assumed that a large part of Marine and Aviation facilities will in some degree be associated with our military operations. Therefore, it does not appear that one should plan on any appreciable civilian defense operation in these radio services. As far as we know there are only two or three exceptions that have been made that would allow civilian defense communications in these services. In Aviation the Civil Air Patrol would be allowed to carry civilian defense communications to the extent such communications are encompassed in their wartime emergency portfolio of operations.

The frequency 122.8 Mc/s is the only frequency specifically mentioned in Part 9, as being available in addition to its normal purposes, for communications with private aircraft engaged in organized civil defense activities in time of enemy attack or immediately thereafter, and on a secondary basis, for communications with private aircraft engaged in organized civil defense activities in preparation for anticipated enemy attack. When used for these purposes, aeronautical advisory stations may be moved from place to place or operated at unspecified locations, except at landing areas served by other aeronautical advisory stations or airdrome control stations, or both.

For example, a private aircraft on a civil defense mission, such as transportation of blood or plasma, or medical supplies, could communicate with aeronautical advisory stations on the ground.

In the Alaskan group of radio stations under Part 14 of the Commission's rules, which are partly Marine and partly internal point-to-point, both private and public correspondence, civilian defense messages will be allowed under the conditions that civilian defense messages would normally be carried over public correspondence facilities. In the case of public correspondence facilities related to the Marine radio facilities, and the Alaskan group, the control of the Department of Defense will be extended and censorship provisions will control.

PERMISSIBLE CIVIL DEFENSE COMMUNICATIONS 12583

CLASS	CATEGORY
CITIZENS & AMATEUR SERVICES	
Citizens	I, III, IV
Amateur	I
Disaster	I, IV
R.A.C.E.S.	IV, V
AERONAUTICAL SERVICES	
Aeronautical and Fixed Group	VI
Aircraft Group	II, VII
Aviation Auxiliary Group	VI
Aviation Radionavigation Land	VI
Civil Air Patrol	II
Aeronautical Advisory 122.8 Mc only	II
INDUSTRIAL SERVICES	
Business	II
Forest Products	II
Industrial Radiolocation	II
Manufacturers	II
Motion Picture	II
Petroleum	II
Power	II
Relay Press	II
Special Industrial	II
Telephone Maintenance	II
LAND TRANSPORTATION SERVICES	
Automobile Emergency	II
Interurban Passenger	II
Interurban Property	II
Railroad	II
Taxicab	I, III
Urban Passenger	II
Urban Property	II

CLASS	CATEGORY
MARINE SERVICES	
Alaskan Group (Part 14)	II
Coastal Group	VI
Marine Radiolocation Land	VI
Ship Group	VI
PUBLIC SAFETY SERVICES	
Fire	II
Forestry Conservation	II
Highway Maintenance	II
Local Government	I, IV
Police	II
Special Emergency	I, IV

I. Civil Defense Command and Control Communications which do *not* relate to the licensee's normal activity.

II. Civil Defense communications relating only to the activity which forms the basis of the license eligibility.

III. Communications system may be commandeered by Civilian Defense authorities for Civilian Defense Command and Control Communications.

IV. This radio service may be licensed for Civilian Defense Command and Control functions only.

V. Established solely for Civilian Defense purposes.

VI. No Civilian Defense Communications allowed.

VII. Part of this group may be taken over by the Federal Government in time of war emergency conditions. Those not taken over by the Federal Government may participate in Civilian Defense Communications relating only to the activity which forms the license eligibility.