A Framework for Utilizing Oakland County's Data Base in Natural Resources Management

by

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ABSTRACT

One of the primary policy objectives of the Oakland County Planning Division (Michigan) is the continued dissemination of helpful information to community planners and the public to aid in planning decision-making. Many of the maps and documents prepared by the Planning Division deal directly with natural resources and their management. However, it was found during research that this information has gone largely underutilized in the planning process. The main objective of this study was to construct a framework for the utilization of the Planning Division's data base in natural resources management.

To provide guidance in the structure of the framework it was necessary to review the perceptions of the primary information users; planners. Interviews, surveys and planning document review resulted in the conclusion that planners are interested in natural resources management but have yet to fully incorporate it into planning documents. A review of the Planning Division data base revealed the strengths and weaknesses of their environmental data. Due to the inconsistent nature of the maps' scales, geographic bases, levels of complexity and currency, the Planning Division data base was disjointed and difficult to use.

Based on literature review, planners' information needs and perceptions of natural resources management, and the state of the Planning Division's data base, a framework was proposed for improved utilization of environmental information. The framework involved preparing a prototype map and poster series that integrated the Planning Division's data, incorporated newly prepared maps, and portrayed the interrelationships of the natural physical system components. The framework emphasizes the practical applications of environmental data in the community planning process. Recommendations, including further research of geographic information systems, suggest future actions for continued improvement and increased public utilization of the Planning Division's natural resources data base.

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Chapter I

INTRODUCTION

In addition to stating the problem to be analyzed, and objectives and methods for analysis, this chapter provides a physical and characteristic setting of Oakland County. Unless otherwise noted, statistics and factual data concerning Oakland County were taken from reports of the Oakland County Planning Division (OCPD) and Economic Development Division (Hay, 1984; Kaczmarek, 1984). Many of the figures taken from these two reports are based on statistics enumerated in the 1980 federal decennial census.

1.1 AN OVERVIEW OF OAKLAND COUNTY

Located in southeastern Michigan, Oakland County is directly northwest of the City of Detroit, abutting the city's northern boundary (Figure 1 and Figure 2). It is approximately 900 square miles (2300 square kilometres) in area and has a population of a little over one million persons. The County was originally an agricultural and recreational area serving Detroit. It has progressed from those functions through a manufacturing support area phase to be a "bedroom" for Detroit and today functions viably as a retail and manufacturing center and as a suburban residential county.

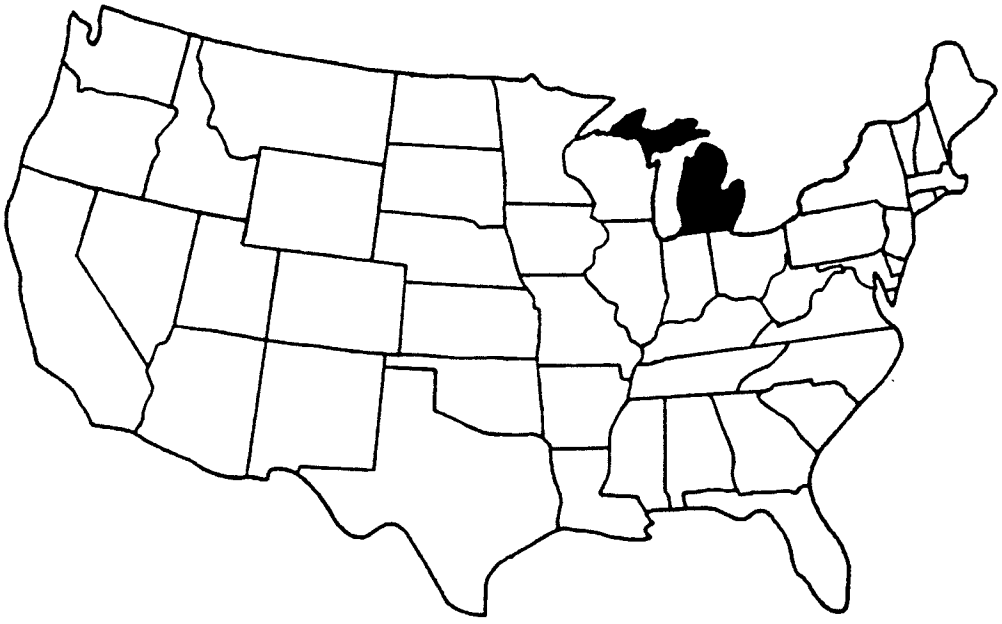


FIGURE 1

Location of Michigan in the United States
(Adapted from: Sommers, 1984)

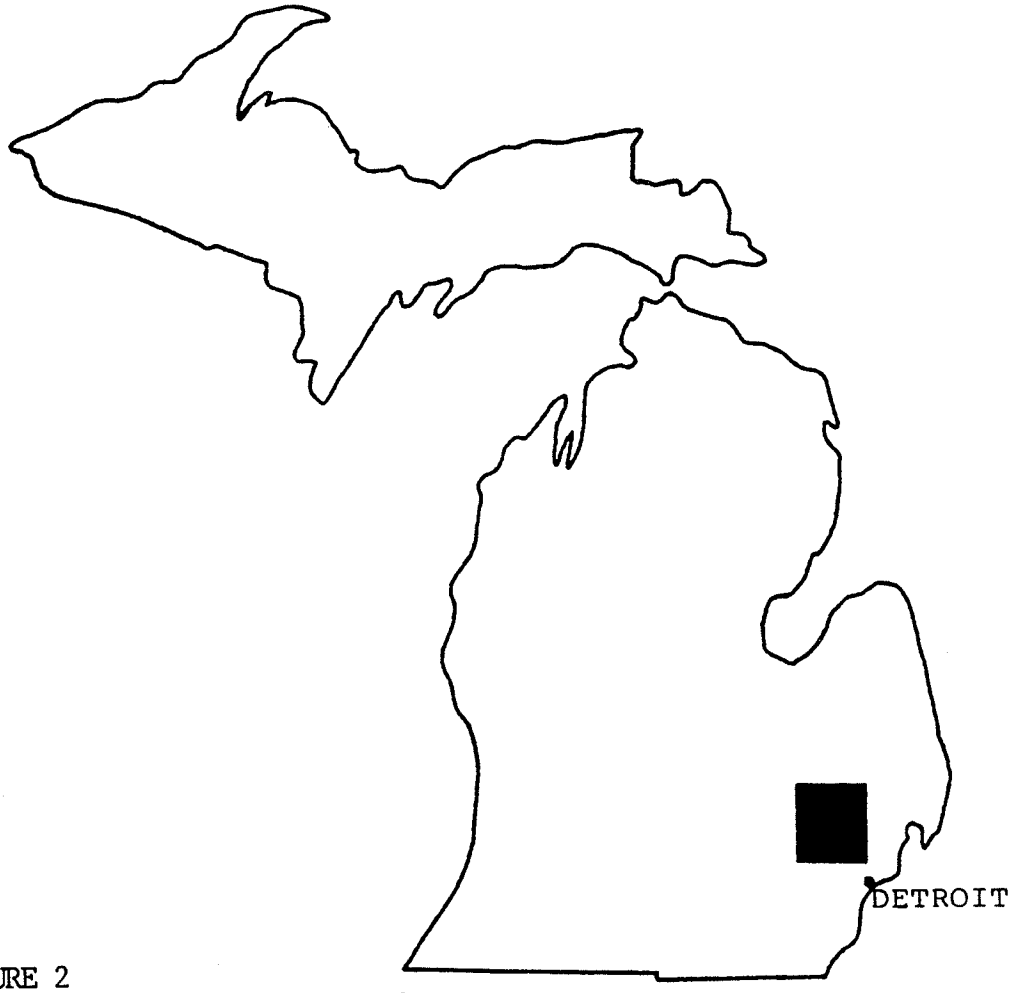


FIGURE 2

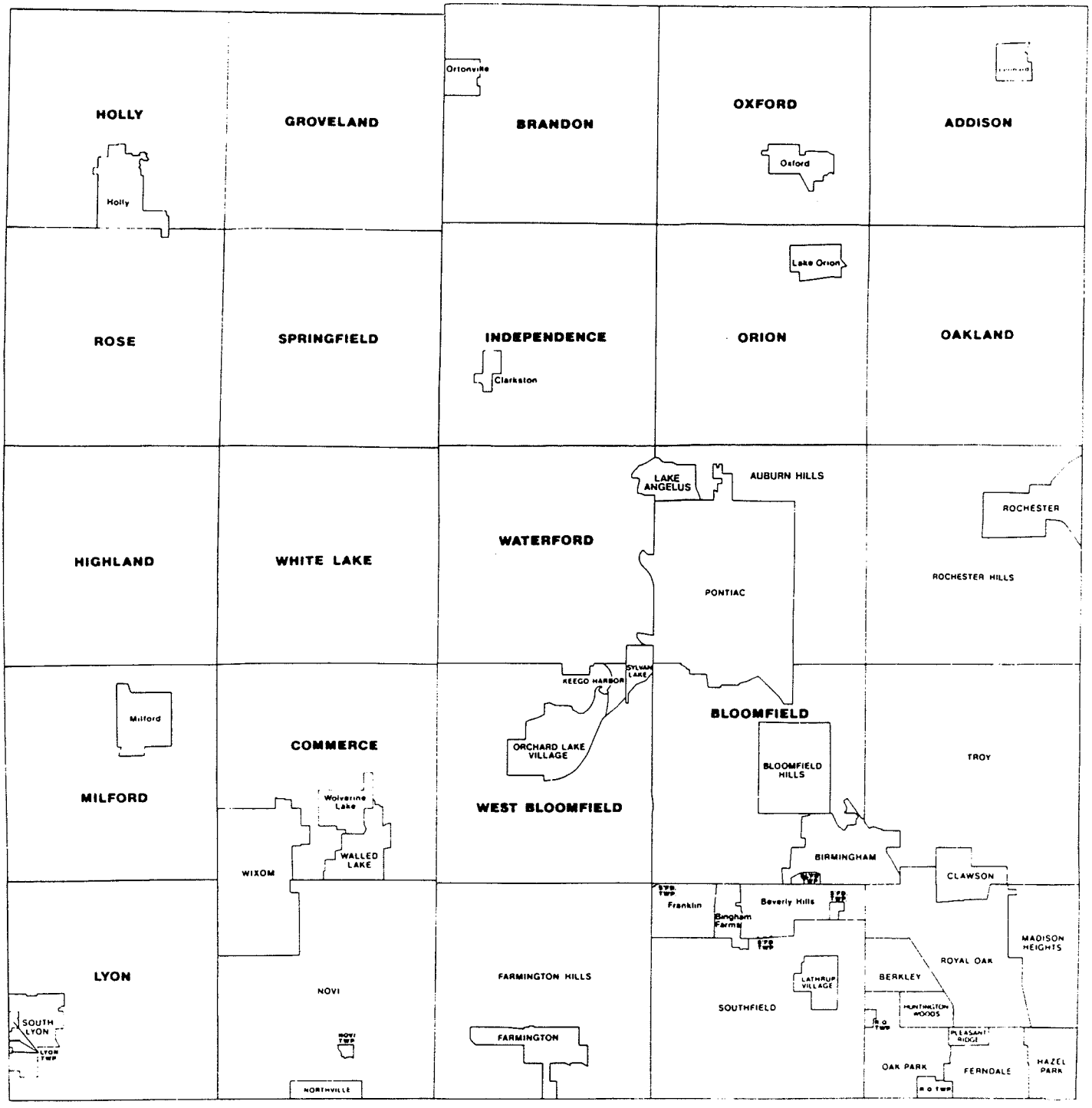
Location of Oakland County in Michigan
(Adapted from: Sommers, 1984)

There are 61 communities in Oakland County, ranging from urbanized areas such as Pontiac, to suburban areas such as Bloomfield Township, to more rural settings of Addison Township or the Village of Holly (Figure 3).

1.1.1 Population

The population of Oakland County is largely middle income and above. The County ranks as having the second highest average household income in the nation for counties over one million people. It also contains the highest income community in the United States - Bloomfield Hills. Other characteristics of the county population are typical for most suburban counties. The median age is 30 years, 46% of the population is married and the leading employers are the retail and service sectors. In contrast with other suburban counties, 70% of Oakland County's labor force works within the County's borders. In addition to acting as a major residential area, Oakland County has become an important business center in its own right. The corporate headquarters for Pontiac Motor Division of General Motors Corporation, American Motors Corporation and K-Mart International are located within the County. The County's economic climate has resulted in it having the lowest cost of living for a metropolitan area in the United States. Meeting some of the residents' educational needs are 14 colleges and universities. While the population of neighboring Detroit has declined, Oakland County has continued its high growth rate.

OAKLAND COUNTY, MICHIGAN



N

CITY
Village
TOWNSHIP

Figure 3: Oakland County Communities

SCALE IN MILES

0 5

(0 km) (8 km)

In the decade between 1970 and 1980 Oakland County's rate of growth was greater than 99% of all U.S. counties.

1.1.2 Natural Resources

Rapid population growth has not detracted substantially from the County's natural resources base. Many state, county, metropolitan and local parks exist because of the attractive natural resources base. Much of the recreational land draws upon features created by glacial action. Moraines running in a northwest to southeast direction are interspersed with outwash plains. The County's 450 lakes were created by glaciers and so too was the varied elevation, evidenced in community names and an elevation variation of 600-1,200 feet (185-370 m) above sea level. Another result of glaciation is large sand and gravel deposits.

Water is a dominant feature in Oakland County. As well as the numerous lakes, there are abundant wetlands, and five rivers have their headwaters within the County. Other major resource features are forested lands, comprising over 12% of the County's territory, and active agricultural land, also comprising over 12% of the County's territory. Cash grains, livestock, dairy and horticultural specialties are the primary agricultural products. Also, Oakland County leads the state in horse population. Wild animals in the County are those adaptable to impinging human populations: small mammals such as opossum, raccoon, red fox, rabbit, waterfowl,

freshwater fish, whitetail deer and many other species. Oakland County's natural resources are essential components of community character and recreational and economic bases. Regrettably, there is no single County map that clearly portrays natural resources. This fact gives an initial indication of the state of the County's data base. This practicum addressed the natural resources map problem, and initiates a program to provide County-wide natural resources map coverage.

1.1.3 Government

As was stated earlier, Oakland County's communities comprise a continuum from very urban to rural. Each of the 61 communities has its own government and therefore can be alternately termed municipalities, although their powers and organizational structures differ. Cities, villages and townships comprise the County. Cities and villages have population concentrations, while townships are largely rural without a specific concentration. In a geographic sense, a city or village can exist within the borders of a township (Figure 3). Many states have geographic survey townships, but only 20 of the 50 states have townships with political standing, and from state to state their powers may differ (Nathan and Nathan, 1979). In Michigan, townships are vested with relatively broad powers. In addition to cities and villages, the State of Michigan, through enabling legisla-

tion, has allowed townships the power of enacting zoning ordinances and master land use plans (Kaufman and Bronstein, 1977). The major differences between townships, cities and villages are related to taxation, annexation and services available. Townships are unable to annex land and have limited flexibility regarding taxation (Kaufman and Bronstein, 1977). Most townships in Oakland County are unsewered. Additional differences exist, but those mentioned above are the most prominent. The primary distinction stressed here is the fact that, unlike in most states, townships in Michigan have the power to pass zoning ordinances and adopt master plans.

The level of government directly above municipalities is that of the county. There are over 3,000 county governments in the U.S. (Nathan and Nathan, 1979). A county is the creation of the state and can only exercise powers given to it through legislation or constitution. State governments most often create counties to perform administrative functions with less difficulty. The smaller area makes it easier to collect taxes, conduct elections and provide sewage service, airports and hospitals. County governments function much like state or provincial governments by passing laws, levying taxes and providing services. However, in relation to planning and managing land uses, some of their powers have been superseded by local governments. Since all communities within Oakland County have zoning ordinances and varying

types of land use plans, the role of the County Planning Division, a creation of the County government, is largely advisory and informational in nature. Individual community planning efforts are supplemented by Planning Division review, advice, and provision of maps and documents.

1.2 THE UNDERUTILIZATION OF NATURAL RESOURCES DATA IN COMMUNITY PLANNING

The County has developed an extensive data base for planning purposes. A significant sector of Oakland County Planning Division's data deals directly with natural resources and their management. Foremost among the data sources is a document titled Conserve Oakland County's Natural Resources! (Smith, 1980). Its general purpose is to serve as a manual for planning and implementation of environmentally sensible development strategies. Supplemental information is available through maps and a soil survey. Also, model ordinances for the protection of woodlands and wetlands, and for the reclamation of mined lands have been prepared by OCPD.

Although considerable information exists, there is an underutilization of that information. An extensive review of documents produced by local planners throughout Michigan reveals a lack of effective utilization of these sources (Marsh, 1978). It is hypothesized that a review of community planning documents from constituent municipalities within Oakland County will show the same underutilization. A sim-

ple review of Planning Division document and map sales over the last few years supports the above hypothesis. A brief analysis of local master plans also indicates a need for more environmental consideration. An historical overview of the comprehensive community plan provides the representation of natural resources as a minimal part of the plan (Rodgers, 1976).

It is not presently proposed that by using environmental information, problems will disappear. To be most useful, any source of information must be integrated with other available sources. Previously, planners approached management issues on a single problem/single solution basis. The interrelatedness of the natural environment's living and non-living components provides direction in how to approach community planning and natural resources management. An understanding of natural resources and natural cycles is essential in solving local environmental problems. The mere existence of data concerning these problems though, is not enough. An integration of the numerous informational sources available and a guiding framework for their utilization in the planning process is necessary to insure improved natural resources management.

1.3 PROBLEM STATEMENT

The Oakland County Planning Division has as one of its policy objectives the dissemination of relevant and helpful information to individuals, developers, consultants, corporations and communities to aid in wise planning decision-making. This is expressly stated in 1985 Objectives of the Oakland County Planning Division. Within that document, the Lands Least Suited for Development Program is,

> aimed at permitting (encouraging) developmental growth with its associated economic rewards without disrupting or destroying the community natural resource base through the preparation, distribution and promotion of mapped data and proper planning procedures (Cousins, 1985).

There are many natural resources documents and maps available at OCPD, but because of their disjointed nature and the fact that they are difficult to use without advanced environmental and cartographic knowledge, they have largely been underutilized. Possible secondary reasons for less than maximum use of OCPD's data include a lack of awareness, or a lack of interest by data users, and a lack of marketing by the Division. As an indirect result the 61 communities within the County have differing levels of natural resources management within their comprehensive plans and regulations. Consequently, much suburban development has neglected the opportunities and limitations natural resources provide and pose to the populace. To implement a more effective conservation strategy throughout the County, the preparation of a comprehensive informational and directing framework was re-

quired. This provides users of the framework with an understanding of the data available, their potential uses, and methods of application for community planning and natural resources management.

1.4 RESEARCH OBJECTIVES

The primary purpose of this study was to provide the Planning Division and the constituent municipalities of Oakland County, Michigan with a framework for utilizing the County's data base in natural resources management. Specific research objectives were:

1. To investigate perceptions, expectations and needs of local community members regarding natural resources and their use of natural resources data in the planning process;
2. To determine common local natural resources management issues and areas of concern;
3. To define Oakland County Planning Division's available natural resources data base;
4. To establish goals and objectives that address issues from Objective No. 2;
5. To suggest a course of action for organizing the Planning Division's natural resources data base in an understandable and effective form and ways to promote, disseminate and increase use of the data throughout the County.

1.5 RESEARCH METHODS

In order to perform a study that did not take only one perspective into consideration, varied and numerous research methods were utilized.

Since the primary users of the framework will be planning officials of the County's numerous municipalities, their perceptions, expectations and needs in relation to natural resources and natural resources data, were reviewed. While it is beneficial to consider opinions of the general public, time and budget considerations limited this study to an analysis of opinions of only some of the community decision-makers. The interactions and communication between the public, community politicians and planners creates a decision-making process in which all parties are involved. This process, and how environmental information is utilized in it, are described in Chapter III. Perceptions of community planning officials were taken to represent an unbiased general community attitude. Planning commission chairpersons, professional planning consultants, and in a few communities, planning staff were considered decision-makers affecting natural resources management. The rationale for reviewing planners' perceptions is also described in Chapter III. To determine their perceptions, expectations and needs of natural resources data, complementary methods were utilized.

A mail survey was distributed to all 61 planning commission chairpersons, all 17 professional planning consultants and 16 planning staff members employed by County municipalities. Not only are these people decision-makers but they are also the primary users of environmental data. Closed-ended and rating questions were used. Design of the surveys was based on suggestions in two main sources (Babbie, 1973; Berdie and Anderson, 1974). A copy of the questionnaire can be found in Appendix A. Further discussion of particular questions and results is found in Chapter III.

In addition to questionnaires, personal interviews were conducted to garner more extensive and personal responses to questions. Open-ended questions and unstructured discussion were both used. A copy portraying the range of questions asked appears in Appendix B. Initially, it was hoped that a proportional representative selection of community officials would be interviewed. However, because of scheduling, and other difficulties, the list of interviewees was altered simply to interview as many officials, and gain as much response, as possible. Interview results are also discussed in Chapter III.

Another research method used to augment interviews and surveys in the pursuit of determining perceptions was community planning document review. One of the best sources of overall community perceptions and objectives related to natural resources management is the updated master land use

plan (Rodgers, 1976). Master plans, zoning and other ordinances from a proportional representative selection of communities were reviewed. The method used to determine which communities' documents were reviewed is described in Appendix C. Discussion of themes or trends noticed in these documents is found in Chapter III.

The three methods mentioned above were intended to determine perceptions, needs and expectations of planners of natural resources data, and natural resources. There are no hidden meanings in the term perceptions. The objective was simply to determine what people think about the subject.

Completing the first objective contributed to clarifying which natural resources management topics required the most attention and subsequent public education. Statistical analysis of results obtained above was the means employed for clarification. Another supplementary method used was a brief review of government department statistics that indicate natural resources management problems such as erosion, flooding and loss of farmland. Facts and figures concerning these problems were obtained from agencies such as Oakland County Soil Conservation Service, Great Lakes Basin Commission, Oakland County Health Division and OCPD. Review of related literature throughout the research project was used for supplemental information needs and to gain a broad-based understanding of the topic.

The objective of defining the Planning Division's natural resources data base was accomplished by performing an extensive review of the available and relevant documents, maps, and guidelines. Selected sources provided by other agencies, that were produced at appropriate levels of accuracy, were also summarized. The review details the benefits and shortcomings, and, if applicable, environmentally and economically advantageous practical applications of each data item. Also, by defining the data base and comparing it with user needs, inadequacies of the data base were identified.

After perceptions were investigated and the data base defined, information gaps, public education or communication problems became apparent. Comparison of information obtained by achieving the first three objectives was the method used for identifying gaps or problems. Goals and objectives to address these problems and issues were formulated, keeping the Planning Division's mandates and objectives in mind.

The final component to a goals and objectives listing is that of action. Steps taken before suggesting a course of action required organizing existing, and new or updated data, into a comprehensible format. Based on the extent and nature of the problems and data base, this involved preparation of a mapped prototype and accompanying educational posters. The prototype exercise was essentially the creation of a physical framework for utilizing Oakland County's

data base for suburban natural resources management. The conceptual aspects of the framework are contained in ideas expressed on posters, and found as the central theme of recommendations. To complete the framework and course of action, recommendations for further promotion and dissemination of data were made.

1.6 ADDITIONAL RESEARCH CONSIDERATIONS

The primary client benefiting from the detailed research described above is the Oakland County Planning Division. The Planning Division in turn distributes the information to County communities, planning consultants, planning commissioners, developers, environmental activist groups and the interested public. It is difficult to say which secondary client benefits most. Since government decisions affect development and the public's actions affect community character, the general public, as well as governmental decision-makers, are important audiences. Therefore, the diversity of audiences was considered when preparing the final product.

Since this study was performed during one summer and written following that, certain limitations arose. Since Oakland County contains 61 distinct communities, a framework that addressed specific resources issues in each municipality would be voluminous and time consuming to produce. Therefore, not every management issue was addressed, only

the prevalent ones, as determined through research. Recommendations, and the framework generated from this study and literature review are not meant to be definitive answers to particular issues, but rather guidelines for all communities within the County.

One of the research objectives was to inventory all relevant information sources. Again, the list was too long to address thoroughly, so only most often used, most helpful sources were reviewed. The primary objective addressed the subject of natural resources management. The many natural resources that exist were not all covered by this report. The decision as to which resources were covered was based on information and perceptions gathered during early research.

1.7 SUMMARY

Suburban growth can be deleterious to the environment or be in harmony with existing natural resources. If community representatives legislate appropriate master land use plans and ordinances, opportunities the natural environment offers and limitations it poses are recognized, and the advantages are seen and felt. In Oakland County, the suburban planning agency exists to aid constituent communities in their pursuit of wise resources management. The agency provides many maps and documents for this purpose, yet they have gone largely underutilized for various reasons. It is the objective of the proposed research to present the client with a

framework for utilizing the County data base in natural resources management.

Document and literature review, surveys, and personal interviews were the primary methods used to determine issues, perceptions, needs, management alternatives and a solution to the County's problem. The literature review follows in Chapter II. In Chapter III, survey and interview results and statistics gleaned from various government departments are discussed, and major natural resources issues are determined by analysis of this information. Chapter IV addresses the definition of Oakland County's environmental data base. The proposed informational and guiding framework is described from conceptual and physical perspectives in Chapter V. Finally, in Chapter VI, conclusions and recommendations are presented.

Chapter II

PERSPECTIVES ON SUBURBAN NATURAL RESOURCES MANAGEMENT

This chapter provides an overview of natural resources management in the suburban environment. After analyzing the need by planning officials for environmental information, and more specifically, an integrated natural resources data base, different approaches to suburban natural resources management are outlined. Proven effective applications of environmental information for planning purposes are then described. Finally, the concepts and practices outlined in this chapter are put in the context of Oakland County.

2.1 ENVIRONMENTAL INFORMATION AND SUBURBAN PLANNING NEEDS

2.1.1 The Suburban Dilemma

In the late 1940s, with the return of multitudes of war veterans, and with the baby boom in its infancy, an important trend in North American human settlements began. In contrast with earlier suburbanization that occurred in very close proximity to the central city and trolley lines, suburbanization since World War II spread out across vast tracts of land. The affordable automobile, and super-highways constructed for it, allowed city dwellers to move to a cleaner, more open and natural environment. Nobody antici-

pated the occurrence of flooding, erosion, waste problems, or environmental degradation in what appeared to be a new utopian frontier. It is now about forty years later and most large North American cities have accompanying them large suburban areas. An extreme example of suburbanization is noted on the eastern United States seaboard. Suburbanization is so extensive there one author termed the area a "megalopolis." Gottman (1961) called the area BOSNYWASH because it extends from Boston, through New York, to Washington. Instead of having the utopian features expected of them, suburbs have experienced many of the same environmental problems that beset cities, e.g., drainage problems, loss of natural lands. Orville Freeman has outlined the suburban dilemma well:

> It isn't rural, it isn't urban. Yet it's both. And because it is neither and yet both, it's apt to be a kind of no man's land where development is too often unplanned. (United States Department of Agriculture and United States Department of Housing and Urban Development (USDA), 1968).

Careless development is costly. Some suburban expansion is directed towards quickly accommodating large incoming populations, and consequently it often ignores natural patterns. Reshaping the environment for settlements has often resulted in clogged and inoperative septic systems, flooded basements, and eroded yards. Soil erosion on one square mile (1.6 square kilometres) being developed can be as high as 2300 tons (2086 tonnes) per year (USDA, 1968). Building on groundwater recharge areas and withdrawing large amounts

of water have caused many urban and suburban regions to import drinking water at high costs (Fabos, 1979). The costs of development that does not analyze environmental effects are borne not only by the homeowner, but by all of society. Communities have attempted to direct orderly growth and avoid these costs by instituting master land use plans. Too frequently though, master plans have not addressed natural resources thoroughly.

2.1.2 Natural Resources in Planning

Previously, planners approached natural resources management issues on a single problem/single solution basis. They have also taken a crisis response; waiting until a small problem becomes a crisis, which has had a long and ignoble tradition (Spirn, 1984). Many authors have suggested that planning officials approach the suburban community as a part of the natural ecosystem (Dasmann, 1972; Odum, 1969), and that the inherent constraints and opportunities of natural resources be considered (Fabos, 1979; McHarg, 1969; Rodgers, 1979; Spirn, 1984). The interrelatedness of the natural environment's cycles and components provides direction in how to approach natural resources management. For example, the hydrological, atmospheric, and nutrient cycles evident in a suburban forest are multi-purpose in nature. In addition to being of aesthetic value, the forest acts as an air filter and coolant, a noise buffer, a stormwater detention basin,

and has a variety of other functions. It is ignorant not to have physical and natural constraints and opportunities as the premier bases for all development questions (Spirn, 1984). The constraints and opportunities of natural resources must be inventoried during master plan and ordinance preparation periods.

National, State and County agencies have developed extensive reservoirs of natural resources information to aid developers, and planning consultants while preparing master plans and ordinances. Soil surveys, aerial photographs, vegetation and land use maps are examples. Aerial photographs are used for various land surveys, and soil surveys describe bearing capacities and suitability for different land uses. There are many other environmental data sources available and their applications are numerous. The sources relevant to Oakland County, and their applications are critiqued in Chapter IV. Many useful sources of environmental information exist, but some criticisms of their nature and extent are also evident.

2.1.3 The Need for Comprehensible Data

Vink (1983) believes instead of leaving large urban areas blank on geological and soil maps more research should be completed. Wildlife data are deficient in many planning agencies' data bases. Water quality data are often unavailable, or based on poorly kept records (Carey, 1972). Per-

haps more important than the extent of information is the form it takes for users. Fabos (1979) states that although available environmental information is technically sound and suitable for environmental specialists, most decisions affecting natural resources are made by other non-specialists. Therefore, information should reflect the education level of its intended users.

For information to be practical, it must be comprehensible for intended users. Inventories are simply tables full of numbers, and maps merely pretty pictures until they are utilized. The professionals who use environmental information and control development in urbanized regions (planners, engineers, lawyers) have usually had limited environmental training (Dorney, 1975). In addition to implementing education programs, an effective means of enabling professionals to use natural resources information is to have the data in an understandable form. Selman (1981) explains that some suburban resource problems have resulted because planners do not have straightforward and readily comprehensible resource assessments. Preparing scientific data in a discernable form is essential if county planning agencies are to assist community planners. This need is apparent in the field of soil science for example. The growth of scientific knowledge on soils has made it harder to directly interpret the practical aspects of the basic scientific maps for practical purposes (Vink, 1983). Effective natural resources data must be made understandable for those using it.

2.1.4 The Need for Integrated Data

A second essential facet of effective data is their coordination into an accessible format. In addition to putting data into laymen's terms, this facet means integrating the numerous data so users derive the advantages of all data. It has been noted that the prime cause of governments' inability to deal with resource problems (e.g. pollution, resource depletion) is the lack of ability to collate and comprehensively understand the great amount of environmental data already in existence (Beatty, 1978). The need for taking an interdisciplinary approach to natural resources information gathering and presentation is not new. The single problem/single solution approach mentioned earlier might have been due to a lack of integrated data. It is difficult for users to combine many disjointed data items so that knowledge is gained from each source. Officials and professionals have not become accustomed to gathering and understanding data on a large scale (Palmer, 1981).

Resource assessments are required for planning documents, and assessments require much environmental data. The data have to be presented in a systematic manner, and not an individual problem basis if they are to be employable by planners and resource managers. The gap between existing information and its users has to be eliminated (O'Callaghan, 1984).

Some suburban community planners have written environmentally sensible planning documents with the aid of integrated natural resources data bases. Approaches to suburban natural resources management include planning documents such as master and recreation plans, and sensitive land and zoning ordinances.

2.2 APPROACHES TO SUBURBAN NATURAL RESOURCES MANAGEMENT

2.2.1 Traditional Planning Tools

The tools available to suburban community officials for managing natural resources are basically those used for guiding land use. Prominent among them are the master land use plan and zoning ordinance. Briefly, the master plan projects growth patterns 15 to 25 years into the future and suggests desired land allocations to accommodate expected population and land use changes. The master plan does not control land use, it is an advisory tool. The zoning ordinance is much more definitive. It is a highly legal document describing property setback and density requirements, and allowable land uses and variances. The zoning ordinance is based on desired land uses described in master plans. Other ordinances that strictly control land use are sensitive lands ordinances such as wetlands and woodlands protection ordinances. These regulations usually include restrictions on intensive development in the protected areas. Most communities have master plans and zoning ordinances, yet

very few have sensitive lands ordinances. The latter manage natural resources more directly, but are more recent in development and have not yet been widely adopted (Smith, 1980), so for the majority of suburban communities, the master plan and zoning ordinance are the present tools for natural resources management. A commentary on the strength of master plans is that "so long as the plan is advisory, its chance of realization will be illusory" (USDA, 1968). Although master plans are essentially suggestive in nature, their strength can be improved by containing more site specific data. If there is supportive evidence for recommended uses on particular tracts of land, less conflict and more validity will result.

Supplemental instruments for guiding land use, and thus natural resources use, are the recreation plan and the site or development plan review. Recreation plans normally target lands with high resource values to be set aside for parks. This is an effective tool, yet can only address certain sites within a municipality and not the entire municipality. The site plan review is an administrative step forcing developers to meet zoning ordinance requirements, and in a sense can control whether or not soils are eroded, water is polluted or natural resources are mismanaged. Dean (1985) calls the site plan review "the keystone to sensitive land protection". These other methods are fairly effective, but still the master land use plan receives most attention

at planning commission meetings, and is in the public eye more often. Snyder (1981) states that "it is through local master plans and appropriate provisions in zoning and other local ordinances that the full range of environmental elements can be given adequate protection". Therefore, methods used to make the plan more environmentally sound are outlined.

2.2.2 Master Plan Preparation

Various approaches to master plan preparation can be taken. The simple path of planning future development adjacent to existing roads might be taken, or one so complex that only the designer understands its rationale. An approach that recognizes that certain lands are more appropriate for certain uses than others is one that is compatible with effective natural resources management. Consequently, this approach to suburban planning is recurrently suggested by various authors (Fabos, 1979; McKibbon, 1981; Selman; 1981; Vink, 1983), but was most eloquently described by McHarg (1969). The approach has variably been termed land classification, land capability and land suitability. The concepts and procedures recommended by the authors differ somewhat but are essentially similar.

This method relies on thorough resource inventories and maps obtained from county and state agencies or prepared by the planner. After community objectives are considered, so

too are the constraints natural resources pose and the opportunities they present. Constraints include natural hazard areas such as floodplains and landslide areas, and sensitive resource areas such as wetlands. Soil and slope suitability are two opportunities the environment provides. A ranking system is then utilized, which assigns low to high quality values for each feature. Mapping of feature values follows. Graphic techniques involving shading and overlays are used in the mapping process. This process is also discussed in Chapter V. The final product is a composite of information on one map that portrays different areas and levels of development suitability. From this map, appropriate intensities of development are proposed for the appropriate lands. An example of the overlay process is shown in Figure 4. The information shown is not the same as that used in master plans, rather this information was used under another method that utilizes an environmental data base for natural resources management. However, the procedure is the same.

2.2.3 A Computerized Approach

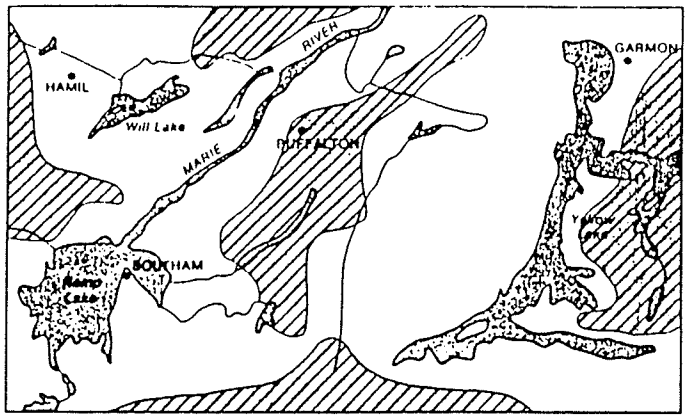
The overlay method described above has now been implemented in geographic information systems (GIS). The recent advent of widespread computer utilization has hastened the development of many computerized GISs. O'Callaghan (1984) defines a GIS as an automated tool for the efficient stor-

age, analysis, and presentation of geographic data. Since most natural resources data are depicted on maps, the applications of GISs for natural resources management have been numerous. Figure 4 is an example, more are given below.

A GIS stores information on different environmental and social topics on magnetic disks. Through computer manipulation information can be overlayed in graphic or tabular form. Essentially the same overlay procedure as described earlier can be implemented with a GIS for master plan preparation, only everything is automated. Other applications are numerous. For example, Environment Canada has used their GIS for environmental impact statements, national parks planning, definition of conflicting resource use areas, and many other studies (Environment Canada, 1981a).

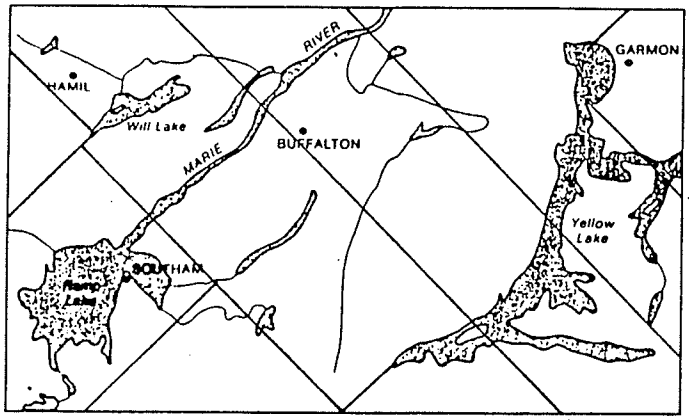
In addition to the advantage of multiple applications, a GIS is effective because of compact storage, easy retrievability, time saving, and custom organization of data to the user's needs. Overlays may be interchanged and viewed without producing hardcopies. GISs are also suggested as effective data base organizers because as Beatty (1978) wrote about the manual alternative "there are too many variables and processes for integrating data from several maps and sources, and those processes are too weak." The difficult and tedious task of conventional map analysis results in less than full use of the data (Environment Canada, 1981a). Further discussion of the GIS concept is included in Chapter V.

Theme 1. Land Capability Classification

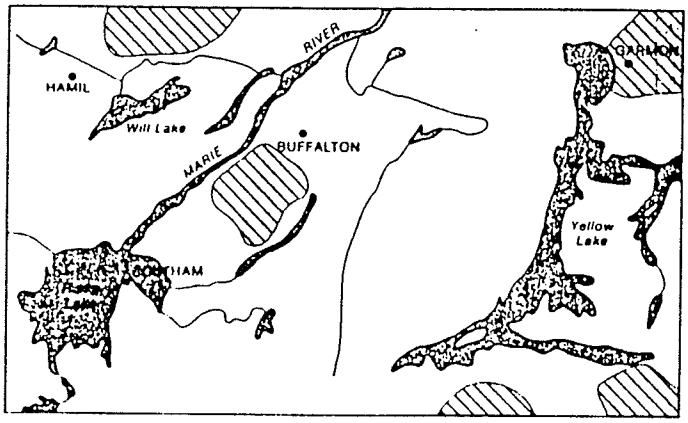


High capability agricultural land

Theme 2. Census Boundaries

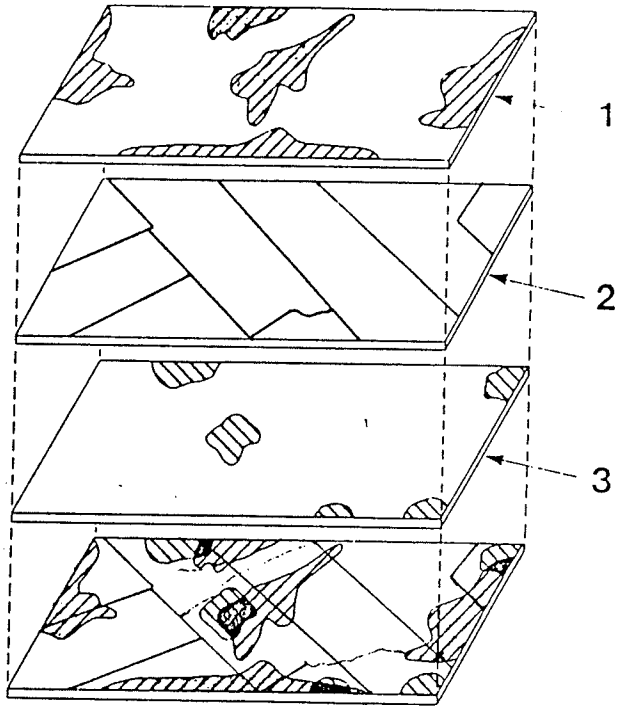


Theme 3. Present Land Use

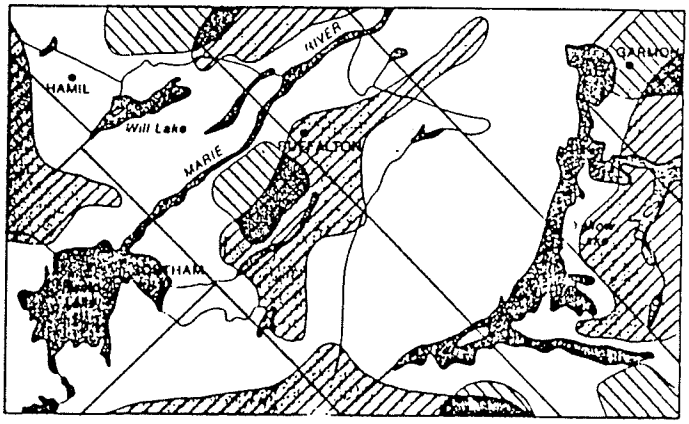


Mine tailings disposal areas

Overlay of Map Themes



Final Product



Mine tailings disposal areas on high capability agricultural land

(Source: Environment Canada, n.d.)

Figure 4: The Overlay Process

Whether it is aided by computers or done in the McHarg manner, the future use of spatial information systems to aid natural resources management will increase dramatically.

2.3 THE OAKLAND COUNTY PERSPECTIVE

The conservation of Oakland County's natural resources is a major concern of the Oakland County Planning Division. To assist constituent municipalities in similar pursuits the Division has prepared maps, documents, and model ordinances related to the environment. Therefore, OCPD already has an existing data base. The research objective of this study was to arrange their data in a format that is accessible and comprehensible to the public.

Although the Planning Division's data base is extensive, agriculture and wildlife are treated in a topical manner. Another consideration for the County is data related to water. Since there are over 400 lakes and much in the way of wetlands in the County, water is an important consideration. A detailed analysis of the County data base is found in Chapter IV. The analysis examines data sources and identifies data deficiencies. After the data base is complete, to be helpful to communities it has to be easy to use.

In the preceding discussion, methods of data manipulation were briefly reviewed. Further research clarified the data needs of users, and the nature of the data base. The fol-

lowing chapter addresses the natural resources data needs of users, and significant natural resources management issues in Oakland County.

Chapter III

INFORMATIONAL AND ENVIRONMENTAL ISSUES IN OAKLAND COUNTY

Suburban community planners require environmental information for assistance in managing the land and natural resources of their communities. The preceding chapter touched upon some of the general data needs of planners. This chapter specifically addresses the perceptions, expectations and needs of planners within Oakland County of natural resources and data concerning their management. Along with statistics documenting environmental problems within the County, these data signify the major informational and environmental issues in the County.

Various research methods were complementarily utilized to determine perceptions, expectations and needs of planners. Questionnaires, interviews and planning document review were combined to achieve a balanced research approach and to eliminate a reliance on only one research method. The application of varied research techniques is termed "triangulation of methods" and is deemed desirable (Babbie, 1973). Questionnaires were employed to review opinions of a large population. Interviews provided more comprehensive answers and added a personal touch to data. Review of community planning documents resulted in an understanding of mutually

agreed upon statements reflecting community-wide approaches to natural resources and their management. Findings from each method were considered equally valid, and no single method was accorded more credence than any other in this study.

3.1 A SURVEY OF INFORMATION USERS

3.1.1 Rationale for Surveying Planners

In an effort to determine environmental information needs and to limit the number of survey recipients, it was most appropriate to survey the primary users of that information, and persons representing larger populations.

The decision-making process in community planning involves the public, planners and community politicians. Figure 5 portrays the process and the interaction between participants and OCPD. Throughout the process, concerned citizens provide input, and ultimately politicians (the city council or mayor, township board or supervisor etc.) make the final decisions. Planners derive authority to plan and to consider the public's concerns from elected officials and from the populace they serve. Planners interpret public desires and incorporate them into plans. Public input is required from the outset, otherwise the resultant plan is ineffectual and not representative (Altshuler, 1966). Although politicians have the final say in decisions, it is the planners who synthesize environmental information and

affect the specific aspects of natural resources management more closely. Politicians depend on their planning staffs to provide them with accurate and sound plans.

In addition to being an intricate link in the planning decision-making process, planners are the primary users of environmental information. Figure 5 shows that developers, lobby groups and individuals also use environmental information, but planners utilize it to the greatest extent. An integrated and comprehensive data base would aid planners in preparing sound plans.

Based on their role in the decision-making process and as primary environmental information users, planners were considered the most appropriate group for surveying. Planners come in the form of private planning consultants, community staff planners, and community planning commissioners. Planning commission chairpersons were considered to represent the commission, thus lowering the number of persons surveyed. In total, 94 persons received surveys. This number includes planning commission chairpersons from all County communities (61), any planning staff director associated with the communities (16), and all private planning consultants retained by numerous County communities (17). In a sense then, a sample population was not chosen, rather, all primary users were surveyed.

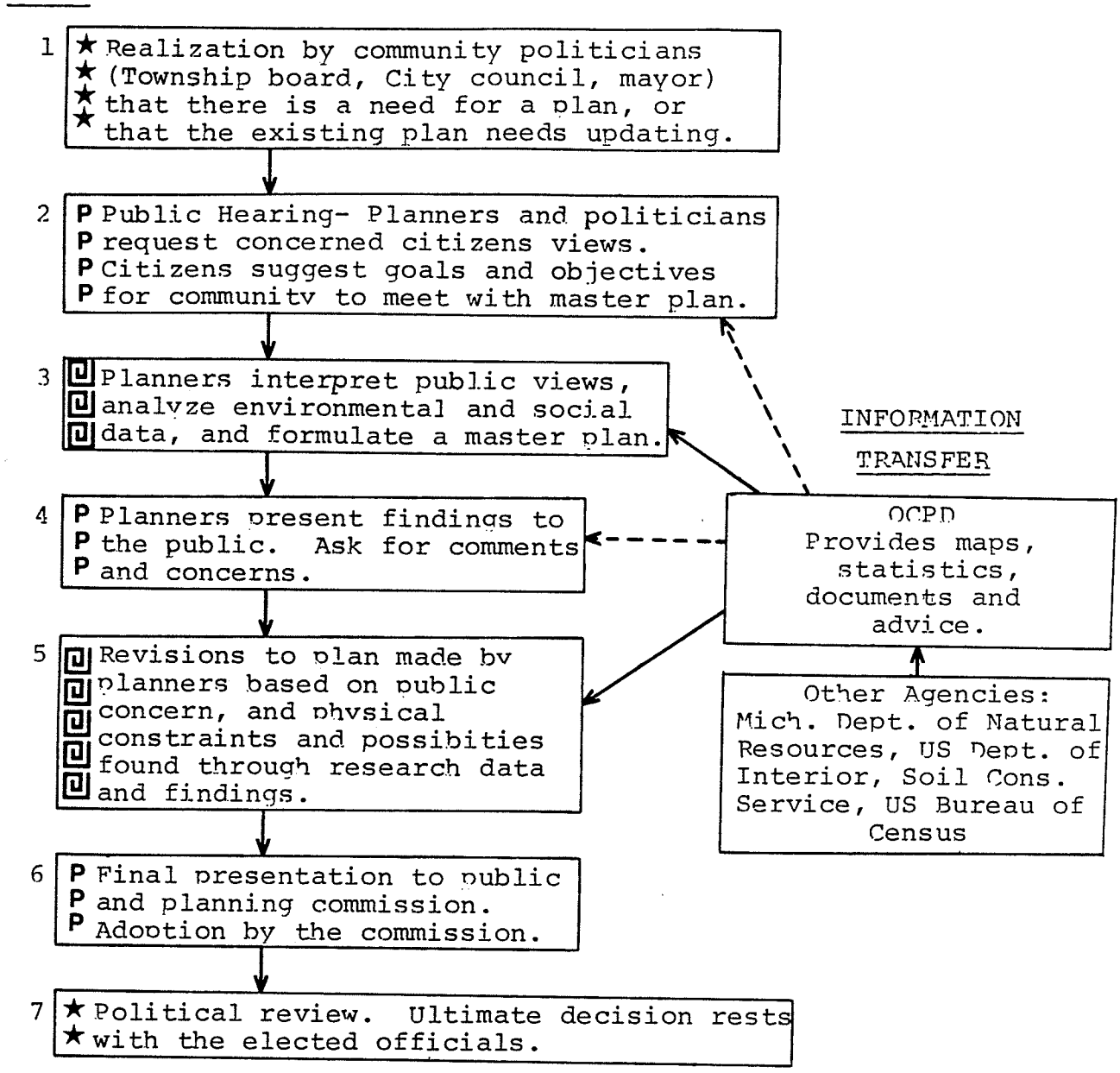


Figure 5: Planning Decision-Making Process and Information Users: Master Plan

3.1.2 A Few Facts About the Questionnaires

Three different questionnaires were designed to survey the three unique populations. Since the objective of the questionnaires was to determine the same thing (perceptions) for all populations, only slight variations exist among them (See Appendix A for a copy of the survey and minor alterations to it, and the accompanying letter sent to recipients). Certain guidelines were considered during the questionnaire design stage. Babbie (1973), and Berdie and Anderson (1974) suggest statistically computable closed-ended questions, exhaustive response categories, concise instructions, the use of clarifying statements, ample white space, and pre-testing. Attention was given to all of the above suggestions. Guidelines proposed by Berdie and Anderson (1974), and followed during preparation of the accompanying letter were discussion of the questionnaire's purpose, how a respondent was chosen and might benefit, offer of assistance, additional copies and survey results, inclusion of a stamped, self addressed envelope, and a plea for prompt completion and return. Care was taken in questionnaire and letter design based on the assumption that a well designed questionnaire would result in a higher response rate.

Surveys were sent between May 30 - June 10, 1985 and were returned over the period of June 4 - August 8, 1985. The response rates for the three unique populations varied by less than 15%. The highest response rate (59%) was from

private planning consultants. Response was 56% by planning staff directors, and 47% by planning commission chairpersons. An overall response rate of 51% was reached. Babbie (1973) considers a 50% response rate adequate. It is interesting to note, and is perhaps reflected in the response rate, that about 28% of County communities appointed new planning commission chairpersons within the survey period, i.e., June to September, 1985.

Statistics are customarily reported throughout survey results, and are often referred to as precise indicators of public opinion. In this report, statistical analysis was confined to calculations of arithmetic means for each population group for the various questions, and statistics are used to simplify survey recipients' responses. Caution should be taken when attempting to use the arithmetic means as indicators of general trends. Since two of the subgroups, planning staff directors and planning consultants, consisted of only 9 and 10 respondents respectively, their responses cannot be extrapolated to reflect public opinion. The small number of total respondents characterize this survey as more of a census than a general opinion survey. As was stated earlier, surveys were used in conjunction with other research methods to complement and supplement each other. Therefore, the following discussion of survey questions and results should be viewed as but a portion of the needs, expectations and perceptions review.

3.1.3 Questions and Answers

The structure of the following discussion of results is a listing of the question posed, followed by the relevant findings for each population. More extensive survey statistics appear in Appendix A. Most questions involve a rating scale of 1 to 5, with a negative response being 1 and a positive response being 5. Other questions involve brief written responses or checking of boxes.

One of the first questions asked survey recipients their tenure in their positions. Planning commission chairpersons had been commissioners for an average of 8 years, with a range of responses from 2 to 30 years. Consultants had been practising for 16 years and planning staff directors had been in their positions for an average of 13 years. These figures imply that respondents have had sufficient time to become acquainted with the planning process, environmental issues and data needs.

The next question asked "How important are the following environmental issues to the citizens of your community?" It was understood that some recipients may initially not have an opinion on this and numerous subsequent questions. By not including a "no opinion" column, the questions forced respondents to form opinions. For this question, water pollution received the highest mean score by chairpersons and consultants. Directors responded that loss of woodlands was

a very important issue to the citizenry. Another important issue receiving a high mean rating was groundwater contamination. Resource recycling received the lowest marks for this and the following question.

Question 4 asked about staff and commission involvement in environmental issues. Both populations responded they were most involved with addressing decreased landscape aesthetics. Flooding was another issue receiving high rating. The means for this question were considerably lower than those for the previous question. This discrepancy implies that involvement in an issue by planners could be improved to become more representative of public interests.

One question queried respondents on how they perceived their colleagues' understanding of environmental concepts. The wording of this question allowed respondents to group themselves with their peers without feeling embarassed by having to answer how well they themselves understood the concepts. All populations responded that the natural functions of wetlands were most understood and nutrient cycles were least understood. Scores for planning commissioners were invariably lower, indicating that professionals are more versed in the concepts, and commissioners would benefit from education in this field. On a scale of 1 (do not understand) to 5 (understand well), not one concept on the commissioners' surveys received an average higher than 3.

Question 6 asked respondents to write down particular natural resources management issues requiring more attention in their community. Problems ranged from weed control in lakes to groundwater contamination, air pollution, decrease in landscape aesthetics, and also the issues that were noted most often, flooding and stormwater management, and the protection of woodlands and wetlands. These listings illustrate present environmental issues in Oakland County.

After inquiring about environmental issues and concerns, the surveys then addressed information issues. The next question asked respondents whether or not they knew of the existence of environmental data at Planning Division offices. A very high rate of the professional respondents knew of the data. Planning directors rated highest, with 91% informed. Consultants were close behind at 88% of respondents answering yes. A 62% majority of planning commission chairpersons were cognizant of the data's existence.

Although most people surveyed knew of the Planning Division's environmental data, many had never contacted OCPD for this data. Approximately 70% of the chairpersons surveyed and 90% of the directors, had never contacted OCPD for environmental data. The earlier hypothesis that the Division's data is underused is supported by these figures. Contrasting with these figures are those reported for consultants. Only 10% had never contacted the Division for environmental data.

Respondents were then questioned on the quality of OCPD's environmental data sources. Consultants and directors rated aerial photographs as very good sources. Actually, consultants unanimously rated airphotos 5 on a scale of 1 to 5. Also rated highly was the County soil survey. Chairpersons were quite generous in their rating, with 5 of the 8 sources listed scoring higher than 4. They rated the document Conserve Oakland County's Natural Resources! highest. Model environmental ordinances were rated lowest by all. It is ironic to note that a source not yet available to the public and deliberately listed in this question, received scores higher than 3 by all three populations. One might conclude that respondents were confused about source titles, or about available sources. The above figures were considered when the data base review and final framework were prepared.

Information needs were addressed in Question 10. One similarity recognized in the results of this question was that consultants and chairpersons rated waste management highest in the respect of more information needed. Also, all three populations rated information need about agriculture as lowest. No perceivable trend existed in consultants' responses. Excluding waste management, the mean for information needs for consultants ranged only from 3.4 to 3.7. This lack of trend is evident in the other populations as well, yet not to this narrow extent.

The importance of natural resources in various planning activities was gauged in the next question. All three populations felt natural resources were very important in community master plan preparation. They rated it upwards of 4.5. The generally high ratings all activities received (none less than 3.8) may be construed as a high level of awareness of natural resources in planning, or more likely, a reflection of the leading nature of this question. However, the ratings do portray the generally agreed upon idea that natural resources are important in planning activities, especially the master plan. Conflicting data concerning the inclusion of natural resources in planning documents is found later in this chapter.

Finally, the questionnaires inquired on the subjects of the forms information could take and how it is best presented. It was unanimous that the map is the easiest used form of natural resources information. Also consistent among the three populations was the belief that statistics about natural resources were most difficult to use. These findings were helpful in design of the framework.

Consultants and directors rated information bulletins and pamphlets as the most effective means of public education. A video or slide presentation was rated most effective by chairpersons. The remaining methods of presentations included workshops, documents and others. For the remaining methods, no trend emerged among the responses as to their

effectiveness. The variation in scores for these means of presentation suggests the use of complementary means to achieve effectiveness. This suggestion was examined during framework preparation.

3.1.4 Significant Survey Findings

The preceding discussion of questionnaire results suggests some general conclusions about environmental and informational issues within Oakland County. It was determined at the outset of the results section that respondents were experienced in the field of community planning, having an average of at least eight years of planning background. The major environmental issues expressed differed for the citizens and the community planners. It was felt that citizens think water pollution, groundwater contamination, and the loss of woodlands are important issues. Planning commissions and staffs have been involved with flooding and decreased landscape aesthetics problems. Planners feel that even more attention should be devoted to flooding, and the protection of woodlands and wetlands. It was determined that some type of environmental education would be beneficial for planning commissioners.

On the topic of informational issues, it was concluded that although a sizeable majority is aware of the existence of environmental data at OCPD, of the three populations, only consultants contact OCPD for data. Two County informa-

tion sources stand out as very favourable; Conserve Oakland County's Natural Resources! and the County soil survey. Unfortunately, there were no trends in information needs besides two populations rating waste management high. It was generally acknowledged that consideration of natural resources was very important during master plan preparation. The final two conclusions signify the effectiveness of visual presentation of information. Of the different forms that natural resources information can take, maps were deemed easiest to use. Also emphasizing the visual aspect was the preference for video or slide presentations and informational brochures. A combination of presentation methods was determined most effective.

The findings described above were utilized in association with interview and document review findings for determination of major natural resources management issues within the County and as background material during framework preparation. Results from interviews follow.

3.2 INTERVIEWS WITH INFORMATION USERS

It was initially proposed that a proportional representative selection of communities would have their planning documents reviewed and an official interviewed to glean comprehensive information regarding natural resources. A methodology was devised that classified County communities as urban, suburban, or rural. Then, a random proportional

selection of communities to be reviewed was performed. The rationale for this methodology, and a map depicting the final community typology utilized are found in Appendix C. The communities chosen represent 25% of the County communities and are listed below. (Please see Figure 3, p.4 for geographic locations).

SUBURBAN	URBAN	RURAL
Bloomfield Hills	Berkley	Lyon Twp
Bloomfield Twp	Huntington Woods	Oakland Twp
Independence Twp	Keego Harbor	Oxford Twp
Milford	Lathrup Village	Springfield Twp
Sylvan Lake	Pleasant Ridge	
Troy		
West Bloomfield Twp		

Difficulties with scheduling interviews because of summer vacations and new chairpersons taking office prompted an alteration to research plans. All of the above communities' planning documents were reviewed. However, after it was realized that not all community representatives could be interviewed, the basis for interviews was altered to simply discuss environmental and informational issues with representatives of any community or organization possible. Officials from some of the communities listed above, Bloomfield Hills, Independence Township, Berkley, Pleasant Ridge, Oakland Township and Springfield Township, were interviewed, but so too were representatives from Southfield, Novi and environmental agencies. A complete list of interviewees appears in Appendix B. Instead of achieving a representative proportion, the interviews redefined objective was to garner as much public input as possible.

Interviews were loosely structured to create a positive atmosphere. Some questions were directly posed, and comments were aired for discussion. As usual, with personal interviews, adherence to a definitive listing and ordering of questions seldom occurred. A list of potential questions and points for discussion appears in Appendix B.

3.2.1 Interview Notes and Quotes

Interview results are not easily quantified or typified, but general feelings and perceptions can be identified through review. General comments emphasized below are not attributed to any particular person unless they are direct quotes. This is done for purposes of summarization.

Most interviews emphasized natural resources informational issues, with some discussion of environmental issues. Similar to survey results, the main environmental issues mentioned were groundwater quality, flooding, and the protection of wetlands. A tendency noticed in the southeastern urbanized communities (Berkley, Bloomfield Hills, Pleasant Ridge and Southfield) was that public participation in natural resources and planning issues was quite low.

Comments relating to the planning process also amplified findings of the surveys. Many persons interviewed told of the rapid turnover of planning commission members and how this translates into a need for constant re-education of

members of environmental and planning concepts. Joe Brett, former City of Novi Planning Commission chairperson, felt the frequent reorganization of planning commissions is beneficial since "it brings in new ideas". The need for a better use of planning tools, e.g., master plans, to help manage natural resources was suggested by several.

Since informational issues are major subjects in this study, most of the interview questions and comments relate to what information is needed and the best ways of informing people. Again, answers from the interviews support survey findings. Maps were praised as excellent forms for displaying and communicating natural resources information. However, many people felt that maps alone were not enough. A number of persons proposed that maps be followed up with some type of education. Posters, charts and workshops were proffered as effective educational tools. Ken Delbridge of Independence Township suggested a group workshop where planning commissioners and planners from many communities could meet and learn of the importance of natural resources information in the planning process. Others expounded on this concept and proposed the use of a factual scenario to portray the practical implications of this information. Two people said that in all educational efforts, OCPD should emphasize the idea that conserving natural resources means management and use, not preservation. The need for additional Division efforts other than information production

was tersely summarized by Helen Willis of Oakland Township when she said "don't sit on your information, get it out".

The numerous perceptions and suggestions offered by interviewees are quite similar to survey findings. Comparable results in perceptions of environmental issues, the planning process, and maps were achieved. Dissimilar results relate to public education and presentation techniques, and the importance of natural resources in planning activities. It was felt that natural resources could be incorporated more into planning tools. Also, workshops were accorded much importance as a presentation method. This point further supports the previous proposition that a combination of complementary presentation means would be effective. These two findings differ slightly from those determined through surveys. All findings were reviewed before framework preparation. Also considered were document review results. A discussion on that subject follows.

3.3 A REVIEW OF SELECTED COMMUNITY PLANNING DOCUMENTS

The master plan and other planning documents were accorded much importance for natural resources management in the surveys and in Chapter II. Since they are such important sources for community natural resources management, a brief review of selected documents was performed. Master plans provide good information regarding overall community perspectives of natural resources (Rodgers, 1976). Therefore,

this review contributes to achieving the first research objective, stated in Chapter I. The representative proportion described concisely for interview selection and fully in Appendix C was utilized here as well for determining which communities' documents were reviewed. The list of communities appears on page 46. Each document is not reviewed separately, rather, only exceptional ones are granted more discussion. The other documents are grouped together and summarized.

3.3.1 Master Plans

Since most other planning documents are based upon the text and maps of master plans, master plans were reviewed first. A standard master land use plan contains descriptions of the physical and built environments and the population, forecasts future population and land use growth, lists community goals and objectives, and suggests future patterns of land use. Some of the master plans reviewed were simply maps with no explanation. Others were standard in presentation. A few master plans differed by including natural resources considerations. Out of the 16 documents reviewed, 8 contained some reference to environmental concerns. Most of these 8 considered natural resources only for park and recreation purposes. Two documents had sections entitled natural features or natural resources, and two others even had entire chapters devoted to the subject. However, even

though 8 documents mentioned natural resources, only three out of 16 (Milford, Oakland Township and Oxford Township) had community objectives directly related to natural resources management. Exemplary among those three is Oakland Township's Master Land Use Plan. The first community goal stated is "To preserve or utilize the natural resources to benefit the whole township". This master plan differs from all others reviewed because it was based on the development suitability index concept described in Chapter II. The carrying capacity of the land was considered. This plan is exceptional though, and one of only three that incorporated natural resources in community-guiding objectives.

3.3.2 Zoning Ordinances

The master plan is largely advisory, but zoning and other ordinances are legally binding documents that influence development and the use of natural resources. The structure of zoning ordinances is even more standard than master plans. They can be easily adapted for different communities by simply changing a few names and figures. The legal descriptions contained in zoning ordinances cover all land use zones within the community. A few of the ordinances reviewed contained agriculture, parks and recreation and planned unit development zones that strictly limit development. Again, only three of the 16 community documents directly addressed natural resources. The zoning ordinance of

Troy contains an environmental protection district that "shall provide open space, protect the area from erosion and flooding and generate clean water and air". West Bloomfield Township has a Floodplain, Floodway, Watercourse and Wetland Protection Ordinance at present and officials are now drafting a woodlands protection ordinance. Other exceptions to standard zoning practice are the natural resources ordinances embellished in Oakland Township's ordinance system. The Township has a Conservation of Natural Resources Ordinance and a Floodplains and Wetlands Protection Ordinance. These three communities have legally acceptable means for managing natural resources within their borders.

While the preceding was but a review of 25% of the County communities, it does indicate that very few communities have adopted documents that utilize natural resources limitations and opportunities as guiding development forces. Even though ordinances and plans are the best sources for protecting environmental elements (Snyder, 1981) they are seldom utilized. Their potential has largely gone untapped. Comparing these results with survey results that indicate planners feel natural resources are important in planning documents, suggests a conflict. If the interest exists, why are natural resources not incorporated more fully into documents? One might conclude that the problem is associated with a lack of information or knowledge on application of environmental data. This issue is addressed in Chapter V.

The following section details the fourth, and last, method employed to investigate environmental and informational issues, needs and perceptions in Oakland County.

3.4 A REVIEW OF ENVIRONMENTAL STATISTICS

The previous sections mentioned some major environmental issues predicated on perceptions of persons who were interviewed or surveyed, and on planning documents. Perceptions is the key word here. Perceptions do not always reflect real life. Statistics produced by various government agencies that portray environmental problems within the County are discussed to portray actual problems. Not all extant natural resources issues are measured by statistics. The topics mentioned below are those for which statistics were available on a County level. The absence here of statistics portraying significant issues previously discussed does not imply those issues are insignificant. For example, groundwater contamination has been discussed throughout this chapter but statistics regarding its quality require analysis of a multitude of well logs. This has not been done on a County-wide level.

Starting with a review of unpublished statistics produced at OCPD, it was noted that farmland loss has been quite extensive over the last two decades. A study that examined this topic over the 15 year period between 1966 and 1981 shows that over 20,000 acres (8200 ha) that were actively

cultivated in 1966 had been fully developed in urban uses by 1981. This figure can be restated as 32.6 square miles (82.8 square kilometres) or over 3.6% of the County's land area. Two townships each lost over 4 square miles (10 square kilometres) of farmland. See Appendix D for a complete listing of figures and a visual representation of farmland loss in Oakland County.

Another County government division that has produced environmentally related statistics is the Health Division. The Division took over 800 water samples at 59 lakes in the County in 1982 to measure water pollution. Lakes with geometric averages below 200 fecal coliform (an undesirable human bacteria that indicates pollution) are considered acceptable for total body contact. All lakes tested well below the 200 level. Although citizen interest in water pollution was perceived to be high in the surveys, fortuitously there is not a water pollution problem within the County.

Information regarding soil erosion is recorded by the County Soil Conservation Service, United States Department of Agriculture. As a part of the 1982 Natural Resources Inventory, the Service sampled over 260 sites and concluded that some soils were eroding as fast as 16 tons/acre/year (36 tonnes/ha/year). Results from the Inventory indicate that 82,600 acres (33,441 ha) in the County require soil conservation practices to reduce soil erosion. This equates to over 14% of the County's land area, a significant amount. Erosion statistics appear in Appendix E.

The only non-County agency that has produced statistics regarding natural resources on a County level is the Great Lakes Basin Commission Floodplains Work Group. In 1975 the Commission calculated estimated average annual damages by floods. The damages were reported in 1970 dollars and were:

> computed on the basis of the expectancy in any one year of the amounts of damage that would result from events throughout the full range of potential magnitude (Great Lakes Basin Commission Floodplains Work Group, 1975).

Damages in 1970 were estimated at $150,000 and forecasted for 2000 at $550,000 (1970 dollars). These dollar figures are factual evidence that support the perceptions reported earlier that accorded flooding and floodplains much importance. See Appendix F for more flood damage statistics.

The above figures were presented simply to augment the previous three review methods. Results from all four methods were compared and analyzed and became the basis for the primary environmental and informational issues within the County. A concise listing of these issues follows.

3.5 THE ISSUES

The varied research methods of surveys, interviews, document and statistical review generated a considerable amount of data regarding perceptions, needs and expectations of natural resources data and environmental issues. Based on analysis of research results, the following issues became apparent:

Environmental

1. The loss of woodlands and wetlands.
2. Groundwater contamination.
3. Flooding and floodplains.
4. Agricultural issues - erosion, farmland loss.

Informational

1. Natural resources are considered a vital component in planning documents, but their management is seldom entrenched in those documents.
2. Some form of environmental education is desirable for planning commission members.
3. The Planning Division's data are underutilized.
4. The County soil survey and Conserve Oakland County's Natural Resources! are beneficial data sources.
5. A visual presentation of environmental data is effective. Maps and posters are suggested.
6. A presentation or education program should involve a combination of methods, e.g., workshops, video programs, scenarios.

3.6 SUMMARY

The dual role Oakland County Planning Division must play in relation to environmental information became apparent in the analysis in this chapter. In addition to producing accurate and current data, the Division must also act as an

educator when distributing information. There are many environmental issues that the Division can become involved with by providing information. Guiding concepts for the County to consider when producing information are that it must be easily understood, and provide users the ability to understand natural resources management and incorporate it in community planning. A framework integrates these concepts. Before a framework is proposed, the present status of the data base is described. Deficiencies and benefits of the data base are detailed in the following chapter.

Chapter IV

THE NATURAL RESOURCES DATA BASE OF OAKLAND COUNTY PLANNING DIVISION

All data are not created equal. As was noted in the previous chapter, maps were rated as the easiest source to use and some of OCPD's maps were rated more informative than others. Maps as data sources are stressed in this study because they are excellent means of communication (Keates, 1982), and research points to their prominence in the planning process. An earlier investigation into information provision for planners determined that 75% of the practising planners surveyed responded that maps are their most often used information sources (White, 1970). Environmental information is effectively depicted by graphic and geographic methods on maps. Reports and statistics are other methods employed to describe an area's natural resources.

Over the years, members of the Planning Division staff have prepared many maps and documents that are available to the public and are related to natural resources. Also held at OCPD offices are sources produced by other agencies that detail environmental components, (e.g., wetlands, soils) at an acceptable level of accuracy for the County. In an effort to define OCPD's data base, all relevant data sources are reviewed in this chapter. Comments address their accu-

racy, currency, complexity, inadequacies, and importance in the data base. The structure of the review follows three major environmental components: water, land, and biotic related resources. Miscellaneous data sources and, because of its encompassing nature, the document Conserve Oakland County's Natural Resources! (Smith, 1980), are reviewed separately following the three components. A concise written summary of OCPD's data base appears at the end of this chapter. Also, Table 1 on page 74 is a comparative summary of attributes of many data sources discussed in this chapter.

Aerial photographs are not specifically critiqued here. Their importance to the data base is not disputed. Actually, aerial photographs are extensively employed in the production of numerous maps and are essential to OCPD's data base. However, a review of aerial photographs as data sources would be superfluous. Essential facts concerning the Planning Divisions's aerial photographs are: they are updated every five years; they are black and white; and their scale is 1:12,000 (1"=1000'). This scale is standard throughout most of the Division's maps, and attests to the importance of the photographs. Aerial photographs are essential to the Division's data base.

4.1 DATA ON WATER RELATED RESOURCES

The hydrological component of our biosphere sustains life, and is therefore accorded much significance in this, and other county data bases (Dane County Regional Planning Commission (DCRPC), 1984; Snyder, 1981). Water related features and resources include surface water, wetlands, groundwater, and in a sense, floodplains.

4.1.1 Surface Waters

Natural resources such as lakes, ponds, streams and creeks, and man-made reservoirs and lakes have been mapped by the Planning Division. This information is contained on the County and Township base maps and many others. Linear bodies (streams) and lakes of 5 acres (2 ha) and larger are mapped. While surface water is not a highly dynamic resource, because of man's ability to create impoundments and alter lake levels, the most updated depiction of the County's surface waters is desirable. The County and Township base maps are updated annually for road changes, but do not incorporate minor surface water changes as well. At the time this report was being researched, Adrian Haas, the Planning Division's mapping unit manager, indicated that the most recent aerial photography that delineated surface waters was flown in 1980. These photographs were utilized in the production of the Land Use/Land Cover maps mentioned earlier. These maps cover the entire County and show water

bodies of 2.5 acres (1 ha) and larger, but do not depict rivers. The Land Use/Land Cover maps, produced in 1983, are the most current and detailed sources showing County surface waters such as lakes, and the base maps are the best sources showing rivers and creeks.

4.1.2 Wetlands

The term wetlands encompasses ecosystems known as bogs, marshes, swamps, potholes, wet meadows and so on. A legal definition of wetlands appears in the Michigan Wetland Protection Act (1979) and reads as follows:

> ...land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support wetland vegetation or aquatic life...

The significance of wetlands in performing natural functions such as wildlife habitat, stormwater retention, nutrient filtration, and groundwater discharge areas has been expounded upon in numerous ecology texts and need not be further discussed. Their importance is recognized in the statement that "wetlands are among the most environmentally sensitive and important areas" (Snyder, 1981). Community officials require accurate wetlands data to help them assemble wetlands protection ordinances and master plans.

There are three maps available at OCPD that display wetlands locations. The first map to delineate wetlands was drafted in 1977, and is titled Natural Resource Features.

This map was the County's first effort at integrating information about several natural resources (wetlands, woodlands, surface waters, sloped lands, and floodplains) on one map. The Natural Resource Features map is discussed in other sections of this chapter as well. Unfortunately, because so much is addressed on this map some features are difficult to distinguish. Prints of this map appear cluttered with many lines, tones and symbols. The map was originally produced at a scale of 1:48,000, making it less detailed than the other two wetlands sources. It has since been enlarged to a 1:12,000 scale. This procedure only amplified initial inaccuracies. The Natural Resource Features map does not subdivide wetlands into different categories based on vegetation. This simplifies data for the general public but has limited applications for ordinances and plans. Another feature of this map that limits its use as an official map in wetlands ordinances is that only wetlands of 5 acres (2 ha) or larger are mapped. As was determined through interviews, at a community level, officials desire more detail, i.e., areas less than 5 acres (2 ha). The criterion used to define wetlands on this map were established before the Michigan Wetland Protection Act was passed, and consequently, consistently wet, poorly drained soils was used instead of vegetation as a criterion.

A second source portraying wetlands is the National Wetlands Inventory, prepared by staff of the United States De-

partment of Interior in 1978. This map is quite extensive in coverage. Wetlands of 1 acre (0.405 ha) or larger are shown. Also, each separate wetland is described in geological, vegetative and temporal terms by a code, e.g., PSSY = a palustrine, shrub-scrub, intermittent wetland. This map utilized vegetation as a criterion for defining wetlands. While this map is extensive in coverage and classification of wetlands, it is perhaps too complex for many users. The coding system covers numerous variables, and from a graphic standpoint, the presence of several four-letter codes and arrows pointing to outlined wetlands creates a disarray. The National Wetlands Inventory maps were produced at a scale of 1:24,000, and not on a geographic township base, as are most other County maps. The United States Geological Survey quadrangle base used for this inventory makes it possible that as many as four separate maps have to be joined together to comprise one geographic township. The problems of different scale and base used on the National Wetlands Inventory maps results in difficulties when trying to combine this data with other County sources. Compatibility of particular sources is an important aspect of an integrated data base.

The third map that deals with wetlands is the Land Use/ Land Cover map produced in 1983 by the Planning Division under contract with the State of Michigan. This map shows wetlands of 2.5 acres (1 ha) and larger. Similar to the Na-

tional Inventory map, the Land Use/Land Cover map utilizes vegetation as a criterion and codes for classification. However, there are only two distinct wetland categories on this map: wetlands with emergent plants, and those with shrubby growth. Based on State guidelines within the contract, wooded wetlands were classified as forests, not wetlands. Therefore, although the data is simplified, some wetlands are omitted from the Land Use/Land Cover map.

Comparing and contrasting the three data sources, advantages and disadvantages of each become apparent. The simplicity of the first source is desirable in some instances, while the detail and accuracy of the second source are desirable in others. The relative currency of the third source is attractive. To acquire the favourable attributes of each source, a combination and refinement of the three should be considered. If the National Wetlands Inventory source was altered in a way that the maps were on a geographic township base, at a scale of 1:12,000, and the complex coding system was eliminated, the resulting source would be more beneficial to users. At the same time though, more complex information would still be available at the OCPD offices. The suggested manipulation involves various procedures that are discussed in the following chapter.

4.1.3 Groundwater

The recent public awareness of toxic and hazardous wastes has prompted many to question their effects on groundwater quality. Since much of rural Oakland County depends on groundwater for drinking supplies, information regarding its quality and geologic occurrence is helpful. Interview and survey results indicated that groundwater contamination is a major concern of County residents. A nearby county that recently completed organizing their data base used sensitive groundwater recharge areas as an integral component (Snyder, 1981). Unfortunately, at present there are no available map sources in Oakland County addressing the topic of groundwater. A review of two reports describing groundwater resources in Oakland County provided no direct information on how a map depicting groundwater depth or quality might be obtained or created (Mozola, 1954; Twenter and Knutilla, 1972). Contact with Dr. George Kunkle of the engineering consulting firm Neyer, Tiseo and Hindo, Ltd. of Farmington Hills, Michigan indicated that preparation of maps portraying groundwater flow and depth could be arranged by the firm at no charge except material costs. Information regarding the County's groundwater resources is highly desirable.

4.1.4 Floodplains

This area of concern could be termed a natural feature or a natural resource. It can also be debated as to whether it is a land or water related resource. Because floodplains are so closely linked to water levels of lakes and streams, this study approaches floodplains as water related. Furthermore, if reasoning along the argument of classifying floodplains as land related resources is applied, then forests, terrestrial wildlife and anything else dependent upon land for existence would be classified as land related. Simply stated, floodplains are low lying land areas adjacent to water bodies that are inundated with water when existing channels and bodies are unable to accommodate spring melt or rain waters. Floodplains can be classified according to the probability of occurrence of various flood intensities. Hence, a 100 year floodplain is the land area needed to accommodate floods that occur once every 100 years. In one particular year, the probability of a 100 year flood occurring is 1%. Additional designations for 50 and 500 year floodplains are often used. Based on government regulations, floodplains are officially considered areas of critical environmental concern in at least 24 states (Institute for Environmental Studies, 1975), and data regarding them are considered imperative for a natural resources data base.

The Planning Division has two sources depicting floodplain areas. Unfortunately, one source, Floodway Insurance

Rate Maps (FIRM), prepared under the direction of the National Flood Insurance Program, does not cover the entire County. Over one-third of the County is not covered on these maps because many communities are not members in the insurance program (see Appendix G for a map depicitng those areas covered). The FIRM source shows both 100 and 500 year floodplains.

The Natural Resource Features map, mentioned earlier, covers the entire County. Prepared in 1977, this source shows 100 year floodplain areas registered by the United States Geological Survey, the federal Department of Housing and Urban Development, local private consultants, and communities with floodplain protection ordinances. As was described earlier, this map appears cluttered with much information, and floodplain delineations conflict with other lines depicting rivers, wetlands, woodlands and other features. However, since this source is complete and based on reputable sources, it is considered the best floodplain source. Again, graphic manipulation might be considered to separate floodplains data and show it alone. To produce the most updated, accurate and easily understood data base, it is required to extract, refine and modify existing data if the "perfect" source does not exist.

4.2 DATA ON LAND RELATED RESOURCES

The land on which we live is really the backbone of the environment, supporting man, wildlife, plants and many more components of the natural physical environment. Other county data base analyses consider sloped lands, problem soils and geological resources as important land related resources (DCRPC, 1984; Snyder, 1981). This analysis considers sloped lands, various aspects of soils and geological resources.

4.2.1 Sloped Lands

The building of any type of structure on steeply sloped lands has been denounced repeatedly in landscape architecture and ecology texts. Removing vegetation on slopes for building and harvest increases erosion on these fragile lands. Slope is measured in terms of percent gradient. For example, a 10% gradient translates into a 10 unit vertical increase for every 100 unit horizontal change. Since the Natural Resource Features map is the only sloped lands source, and there are no conflicting criteria used to map slopes, this source is as accurate as any other that might be produced. This map shows land that is sloped 10% or greater. Other maps portraying slope have used 10,12,18, 20% or others as a benchmark. A conservative figure of 10% results in more land being considered sensitive. To make slope information from the Natural Resource Features map more legible, it could be extracted and portrayed singly.

4.2.2 Soils

The shrinking and swelling of clays is undesirable for building purposes, yet the water holding capacity of clay is welcome in agriculture and other pursuits. The porosity of sand is needed for rapid drainage, but sand's weak bearing capacity limits development. The diversity of soils and potential land uses upon them requires site and use specific information. Soil tests are usually conducted before any large developments occur.

In an effort to provide preliminary guidance to individuals and organizations before costly soil tests are conducted, County and national agencies have prepared soil information. Because of the various applications this data may be used for, the Oakland County Planning Division has grouped complicated soil type information to address the general topic of development suitability (discussed in Chapter II). The Soil Associations map was prepared in 1976, and used data from a previous soil survey of the area (Veatch, 1953). Although this map is easily read, and gives the user an uncomplicated view of where the soils are least and most suitable for development, it is predicated on a soil survey which has since been updated.

The updated version of the Soil Survey of Oakland County, Michigan (1982) was published by the U.S. Department of Agriculture. This source incorporated new findings since 1953

about soil characteristics, and contains extensive tables and maps. Each geographic section within the County has been mapped for soil types, and is shown in the survey by the use of numerous aerial photograph-based maps. Tables within the survey detail the behavior of soils under agricultural and various urban land uses. The tables illustrate limitations of the different soil types. While the number of non-agricultural applications of soil survey data have increased dramatically over the last few decades (Rogoff, 1979), it would require extensive analysis by community officials and individuals to translate the numerous tables into development suitability information. At present, the wealth of information contained in the soil survey has not been interpreted and mapped. In addition to creating a development suitability map, based on the tables other maps might include suitability for wildlife, forestry, recreation and of course agriculture. A map called Important Farmland applies the data listed in the survey tables for agricultural suitability and is available from the County Soil Conservation Service. To produce other maps it would require an analysis and consolidation of data in the tables, and a change in scale and combination of the numerous section maps to achieve a 1:12,000 scale on a township base. It is logical for counties to produce this information since it eliminates a repetition of effort (Stearns and Montag, 1974).

4.2.3 Geological Resources

Oakland County's landscape and geological composition were significantly affected by glaciation. In addition to hills, another result of glaciation was the deposition of sand and gravel. Mining operations in the County have extracted sand and gravel for many years. A map titled Extractive Sites (1982), shows the location of mining operations. Other available maps relating to geology include Bedrock Topography (1981, 1984), and Surficial Geology (n.d.). The applications of these sources in the planning process are limited. They are more relevant for academic pursuits. One area of geology already addressed in this chapter that is mapped in other studies is groundwater (McHarg, 1969; Snyder, 1981; Stearns and Montag, 1974). However, the Planning Division has no information regarding groundwater.

4.3 DATA ON BIOTIC RELATED RESOURCES

The living portion of the natural environment contains elements that interact with each other, and the land and water related resources as well. Animal and plant life are the two distinct categories into which living resources are divided.

4.3.1 Wildlife Resources

There is no source addressing wildlife in the County at OCPD at present. Contact with officials at the State Department of Natural Resources, and the Southeast Michigan Council of Governments indicated no mapped information regarding wildlife is available. Discussion with officials from the Michigan Wildlife Foundation and the Oakland County chapter of the Audubon Society resulted in information regarding rare sightings within the County, but again no mapped information. Two methods that could produce mapped information are: the use of soil survey tables for wildlife habitat suitability, or some form of public involvement inventory. As was noted in survey results, loss of wildlife habitat was not considered very important by surveyed planners.

4.3.2 Vegetative Resources

Approximately 12% of the land in Oakland County is covered by forests. Woodlands are the most visible and economically important of the vegetative resources, other than crops. Woodlands within the County include both deciduous and coniferous trees, although deciduous forests predominate.

There are three woodlands data sources held at OCPD offices. A vegetation map produced in 1966 by University of

Michigan students, and termed nothing more than "Vegetation", portrays individual woodlots and indicates species dominance. Even with its extensive species coverage, this source is unfavourable because of its age. Forests are often altered or harvested over the years, therefore this source is outdated.

The Natural Resource Features map of 1977, shows coniferous and deciduous forests of 5 acres (2 ha) or larger. The third source, the Land Use/Land Cover map, produced in 1983, is the most current and accurate. Woodlots of 2.5 acres (1 ha) or larger are shown and identified by major species. This map utilizes codes for the numerous divisions and contains numerous other land uses and covers in addition to vegetation. To put this woodland information in a comprehensible form, codes need simplification, and extraction of the woodland category from the map is necessary. More extensive data, including species differentiation, would still be available at OCPD if required.

TABLE 1

Overview of Data Sources

Source (Map)	Date	Update Needed	Scale	Base	Smallest Unit Mapped	Entire County Covered	Comments
SURFACE WATERS							
County & Twp. Bases	1985	no	1:12000	Twp.	5 acres	yes	
Land Use/Land Cover	1983	no	1:12000	Twp.	2.5 acres	yes	rivers not shown
WETLANDS							
Natural Resource Features	1977	yes	1:12000*	Twp.	5 acres	yes	soils used for criteria
National Wetlands Inventory	1978	yes	1:24000	Quad.	1 acre	yes	complicated codes
Land Use/Land Cover	1983	no	1:12000	Twp.	2.5 acres	yes	wooded w/1 not incl.
FLOODPLAINS							
Floodway Insurance Rates	many years	no	1:24000	Quad.	1 acre	no	1/3 county omitted
Natural Resource Features	1977	no	1:12000*	Twp.	5 acres	yes	cluttered
SLOPES							
Natural Resource Features	1977	yes	1:12000*	Twp.	5 acres	yes	
SOILS							
Soil Associations	1976	yes	1:48000	Cty.	5 acres	yes	based on old soil assns.
Soil Survey	1980	no	1:10000	Sec.	1 acre	yes	extensive unused info.
WOODLANDS							
Vegetation	1966	yes	1:48000	Cty.	5 acres	yes	outdated
Natural Resource Features	1977	yes	1:12000*	Twp.	5 acres	yes	
Land Use/Land Cover	1983	no	1:12000	Twp.	2.5 acres	yes	codes used

* Enlarged from 1:48000

4.4 THE USER'S MANUAL

The title of this section is the colloquial term applied by staff at OCPD to the document Conserve Oakland County's Natural Resources. This document was prepared in conjunction with the Natural Resource Features maps. The two were designed to be used together. However, because of its extensive nature, the User's Manual is considered the foundation of the County's natural resources data base, and is meant to be used in concert with any natural resources map.

The User's Manual explains the natural physical system, its functioning, environmental problems faced by community planners, and some solutions to the problems. The User's Manual is basically a discussion of environmental concepts and methods for implementing natural resources conservation on a community level. The technique of overlaying a few clear plastic resources maps is described in the document and is implemented later in this practicum. Conserve Oakland County's Natural Resources! was used throughout this study as a sourcebook.

4.5 MISCELLANEOUS DATA

Other maps and documents directly or loosely related to natural resources not mentioned previously include the maps: Farmland Loss (1982), Septic System Problems (1982), Landfill and Facility Sites (1983), Land Use (1985) and model ordinance documents. The maps are all somewhat applicable, but limited, for planning purposes. The model ordinances for woodlands protection, wetlands protection, and surface mined land reclamation, supply community planners with examples of legally acceptable and environmentally sensitive worded documents. Guidelines within the model ordinances suggest standards as well. Model ordinances can be used as illustrations of appropriate final documents when community members are considering and drafting their own ordinances. Lacking in their text though, is any explanation of the reasons why communities should draft such ordinances.

4.6 SUMMARY

The preceding discussion identified deficiencies and benefits of the Planning Division's data base. Gaps within the data base include the lack of information about groundwater and wildlife. Also, the soil survey could be utilized more thoroughly to generate new information. This review established that although OCPD has current and accurate data, they are often inaccessible, except through manipulation of maps or by having advanced technical knowledge on the particular resource. Extraction of single attributes from some maps and changes in codes would improve some sources. In other cases, changes in scale and geographic base used are necessary to be able to use two different sources together. Table 1 shows the variations in scale, base, level of detail, and currency of the various data sources, and signifies the difficulty of combining disparate sources. The overall objective of creating a practical framework for using the data base requires modifications to the existing County data base.

A comparison of data needs and expectations, determined in Chapter III, with the state of the data base, points to actions OCPD could take to improve the data base. These actions are addressed in the following chapter and in the recommendations section of the final chapter. Also discussed in Chapter V are the goals and objectives OCPD would like to achieve with the implementation of a framework, and the structure of the framework.

Chapter V

THE FRAMEWORK

From the very beginning of this practicum, the title, and throughout the first four chapters, the term framework has been mentioned, alluded to, and praised. In this chapter the idea of a guiding framework that is organized, streamlined, and applicable, is finally explained. As well as providing a definition and discussion of the term itself, this chapter presents other types of frameworks that have been effective in the past, and the framework that was fashioned to make full utilization of Oakland County Planning Division's data base.

Only with the preceding research into data needs, environmental issues, and the status of the data base, however, could a framework be structured. The shape and focus of the framework were designed by conclusions generated from research. To further aid in the planning of the framework a series of goals and objectives for it was prepared.

5.1 GOALS AND OBJECTIVES

The following framework goals and objectives were prepared after taking all research findings into consideration. The important points discovered through literature review, the environmental and informational issues listed at the close of Chapter III, and the major findings about the existing County natural resources data base were reviewed prior to preparation of the following list.

1. Goal - To create a better understanding of environmental issues.
   Objectives
   - educate planners on the basic concepts and components of the natural physical system and its management
   - emphasize the interrelationships of the environment's numerous components

2. Goal - To create a better understanding of environmental information.
   Objectives
   - portray information in an uncomplicated manner
   - integrate data sources to limit confusion

3. Goal - To provide users with increased ability for information utilization.
   Objectives
   - produce information that is accurate, accessible, and easily correlated with companion sources, and into the planning process
   - emphasize the practical implications of the information

4. Goal - To create a flexible, yet consistent, data base.
   Objectives
   - allow easy additions to the data base
   - adopt information design standards
   - provide various levels of information analysis

The above list of framework goals and objectives is not meant to be all inclusive. It is however, complete for the immediate needs of this study. Long term objectives for a framework are stated as recommendations in the final chapter. Actions are necessary to meet the goals and objectives just listed. Subsequent to a definition of framework and a brief description of two other frameworks, the actions taken to meet the above goals and objectives are discussed in the context of Oakland County's framework.

5.2 THE DEFINITION OF A FRAMEWORK

The term framework is defined here by utilizing two dissimilar approaches. The definition found in the Oxford Dictionary is as follows, "frame, structure upon or into which casing or contents can be put" (Sykes, 1982). This is a very literal explanation of the physical aspect of a framework. Based on this definition OCPD's framework should be able to accommodate all the contents of the data base. If this definition were used solely during preparation of a framework, the resulting product would not integrate, correlate or organize information, it would merely hold or contain information. It would basically be just an inventory.

The second approach to defining framework involves a discussion of the figurative, or conceptual, aspects of the word. Framework connotes the idea of a standardized technique or means of applying information. It suggests the im-

plementation of certain guiding principles when new situations are encountered. A framework is a structured response to organize unstructured attributes. It can be said that a framework is a way of thinking, a manner of analysis when tackling a problem. The conceptual facet of the term framework involves these and other unstated meanings. Taking a conceptual approach to defining framework results in a structured and consistent means of addressing the data base.

This more philosophic appraoch to defining a framework was amalgamated with the strict dictionary definition of the word during framework design. Adherence to the dictionary definition resulted in a standard physical structure within which natural resources data fit. Implementation of the conceptual aspect of framework produced a standard manner of analysis, and is expressed in written portions of the framework. The two together produce a physical and conceptual framework within which users of the Division's natural resources data base can address natural resources management issues.

5.3 OTHER FRAMEWORKS

Features in the design of OCPD's framework were patterned after similar programs found in other counties, and in the academic literature. The two fundamental approaches to solving organizational and integrational problems of data bases were discussed laconically in Chapter II. They are

discussed further here as a preface to how the ideas were interpreted and applied to the Oakland County Planning Division situation. The two approaches are termed a geographic information system (GIS), and the McHarg approach.

5.3.1 Geographic Information Systems

In our technological, information-based society, it is difficult even to come close to making full use of available information without the assistance of a computer. The difficulties faced by planners in assembling and utilizing environmental data were elaborated in Chapter II. Moreover, the incompatibility of combining maps of different scales and complexity was referred to in Chapter IV. Problems of this sort were also evident in the mid-1960s when the Canada Land Inventory was established to organize and analyze the country's natural resources base. In an attempt to efficiently organize and analyze gathered data, out of this program grew one of the first geographic information systems ever (Taylor, 1976). The acceptability and eventual desirability of these systems have grown, so that now many countries, states, and some larger municipalities use them in everyday planning functions (Dangermond, et al, 1984).

What is a GIS? In most definitions the term "system" is emphasized. A GIS is used to assemble data in a form that is accessible, augmentable and updateable (Lang and Armour, 1977). The goal of a GIS is to store, manipulate and dis-

play data with geographic references (Puecker, 1980). In order to achieve that goal and use a GIS, a computer system is employed. Simply stated, a GIS is a computer data system that contains geographically coded information that can be manipulated through the employment of software and displayed on a video screen (CRT) or on hard copy (paper maps or tables). In addition to producing maps and tables, a GIS is used through modeling and manipulation to enhance the administrative process and to support decision-making, not replace it (Loucks, et al, 1982; Symons, 1973). Instead of creating a "collection" of maps, statistics and reports, a computerized GIS creates a "system"; a standardized framework within which one may synthesize data and perform more comprehensive analysis.

The numerous advantages assigned to a GIS have been touted for many years and in many books and articles. When suggesting the use of a computer system to augment information analysis and production, saved time is the reason most often given. A GIS replaces the "tedious" and "onerous" conventional methods of map compilation and analysis, and saves much time (Environment Canada, 1981b; Taylor, 1980). The saved time allows cartographers and others utilizing a GIS to spend more time in creative and analytic endeavors. In a survey of practising planners, 75% reported that maps were needed within one week (White, 1970). The speed of a GIS meets the needs of planners, especially if the map theme is a unique one.

The ability to create totally unique information by combining two or more seemingly incompatible data items has been suggested as one of the most important features of geographic information systems (Environment Canada, 1981a). The aspect of overlaying several disparate themes in a visual manner produces a multitude of correlations for the data base. Using a GIS for overlaying census with land use data for example, means that after initial input of data into the system, subsequent manipulation creates new information.

Two other often quoted advantages of geographic information systems are their ease of use and their several environmental applications. The user-friendly nature of a GIS is evidenced by simple commands, menus, lists and default systems that correct user mistakes (Taylor, 1976; Taylor, 1980). Much of the GIS literature utilizes case studies to portray the range of applications of these systems. They have been used for property record keeping (Symons, 1973), census statistics analysis (Taylor, 1980), and many natural resources related projects (Environment Canada, 1981b; Loucks, et al, 1982; Manire, 1985; Muessig, et al, 1983).

Predicated on all the foregoing advantages assigned to a GIS, such a system seems the logical answer to a data base problem such as the one at OCPD. However, after initial meetings with GIS vendors, Planning Division officials were disheartened over the system's expensive nature. One of the first prices quoted to them was greater than the Division's

annual budget (Cousins, pers. comm.). Since the Planning Division was interested in the least costly solution possible at the time, a GIS was eliminated from consideration as a framework. Although it does require a couple of years of capital investment, because of innovative cost-sharing arrangements and decreasing prices, a GIS is becoming more feasible (Manire, 1985; Muessig, et al, 1983). A feasibility study for the implementation of a GIS at OCPD reveals cost estimates much lower than those first received by Division administrators (Brownlie, 1985). A more immediate and less costly solution to the Division's data base difficulties is outlined below.

5.3.2 The McHarg Approach

The McHarg method of data base organization is in essence the same as the overlay capability of a GIS. The approach has been named in this study after the author and landscape planner who popularized its use and applications (McHarg, 1969). It has been described as an approach that "allows detailed environmental information to be presented in a relatively simple fashion to various audiences" (Stearns and Montag, 1974). The popularity and effectiveness of this type of framework are evidenced by the varied and continued uses of it, mentioned in Chapter II, and by two relevant examples described herein.

The McHarg approach to establishing a natural resources framework utilizes the overlaying of separate clear plastic maps, each depicting a unique environmental attribute. This approach depends on an extensive resources inventory and numerous graphic techniques. Each overlay depicts the location of significant environmental attributes by the use of outlines and light shading in the appropriate geographic area. All overlays have to be of the same scale. When overlays for attributes are combined and laid one on top of the other, on top of a base map, the resulting dark and light areas show where significant environmental areas are located. A dark shaded area shows how various natural elements are interrelated. A visual depiction of how overlays work appears in Figure 4 on page 30. A series of overlays can be used for aid in preparing master plans or other planning documents. The McHarg approach provides a physical framework for correlating and eventually utilizing natural resources data.

The different attributes, or resources, depicted on the overlays in McHarg's first description of this process were: surface waters, floodplains, wetlands, aquifers, aquifer recharge areas, steep slopes and forests. Two counties that adopted the McHarg approach for improving their data bases used different resources lists. Officials at Washtenaw County, Michigan combined overlays showing wetlands, floodplains, groundwater recharge areas, woodlands and slopes to

create the end product of their Fragile Lands Study (Snyder, 1981). Dane County, Wisconsin officials employed the McHarg approach for their Environmental Corridors study and had overlays delineating surface waters, wetlands, floodplains, woodlands, steep slopes, and unique vegetation or geology (DCRPC, 1984). Both mapping programs were designed to be utilized in protecting and managing the identified areas. The list of mapped elements varies from one project to another, but these examples suggest some of the more predominant elements. The numerous mapped resources elements listed above were considered during map and framework preparation.

The above county examples were mentioned to indicate that the McHarg approach has been chosen to integrate and enhance other county data bases. Reasons given why this approach was chosen include the various zoning and master plan applications created by the information and the effective means of showing environmental interrelationships (DCRPC, 1984; Snyder, 1981). The McHarg approach was also chosen to create Oakland County Planning Division's physical framework. Additional symbology and written material were produced to become the more conceptual portion of the framework.

5.4 A FRAMEWORK FOR OAKLAND COUNTY

The framework described herein is based upon findings from the foregoing, and by no means exhaustive, research. The various features of the framework were designed to meet the goals and objectives formulated earlier in this chapter. Different portions of the framework do not relate directly to those goals and objectives, rather they are predicated on survey, interview, document and literature review findings that were secondary to the major findings and issues noted. That is to say, reasons for inclusion of a certain framework characteristic often related to minor research findings. Major research findings that influenced the shape of the framework were issues mentioned at the end of Chapter III and the status of the Division's data base. Foremost among those findings that affected framework design decisions were the discoveries that maps and visual presentations are effective and desirable, and that education also plays a large part in this framework.

Another distinction about the framework is that it was not prepared on a County level. Waterford Township (see Figure 3) was chosen as a prototype community for which the maps were prepared. However, the ideas expressed within the framework and the mapping methods used are applicable throughout the County. The choice of Waterford Township as a prototype stemmed from four considerations: its proximity to County government offices allowed for convenient field

checking and meetings; it is located in the exact geographic centre of the County; it has typical suburban characteristics and problems; and officials there expressed deep interest in comprehensive environmental information for practical applications (i.e., master plan preparation) prior to the beginning of this project. Based on the success and effectiveness of the framework in Waterford Township, future actions by the OCPD might involve preparing the map series for other interested communities. The framework has one consolidated structure but can be divided, although not evenly or easily, into the two earlier defined components of physical and conceptual.

5.4.1 The Physical Aspect

The process used to create the physical framework, "a structure upon which contents can be put", included refinement of maps, the choice of a consistent scale and level of complexity, and construction of a windowed frame. Figure 6 shows the physical features of the framework. Which natural resources were shown on the maps was determined by a number of considerations. Since the framework utilized the McHarg approach to mapping, the resources depicted on the previous framework examples were reviewed. The availability and accuracy of existing information, and the potential for creating new information, discussed in Chapter IV, were also considered. Another determining factor was the principal theme

of the User's Manual. Finally, previous research into needs of information users was taken into account. These considerations are discussed earlier in the text.

To remain consistent with the three principal areas of natural resources information described in Chapter IV, and to fit within conceptual aspects of the framework, yet to be described, it was decided that three main natural resources groupings were appropriate. The categories are: water related resources, land related resources, and vegetative resources. A total of seven unique attributes were mapped on overlays and conform to the above three categories. Below is a listing of the attributes, the reasons for their inclusion, the sources they were extracted from, and the cartographic process utilized that made the information correspond to pre-determined cartographic standards. The cartographic standards were: a constant 1:12,000 scale, all data on a township base, and elimination of confusing ancillary data.

Surface waters - Water is an important cleanser and transporter, and is essential to biotic existence. The updated version of the Waterford Township base map shows all natural rivers and water bodies over 5 acres (2 ha). This map shows new and altered bodies as well. Since this product is straightforward, and on a 1:12,000 township base, no changes are necessary. The Land Use/Land Cover map supplements the base map by depicting smaller water bodies, 2.5 acres (1 ha)

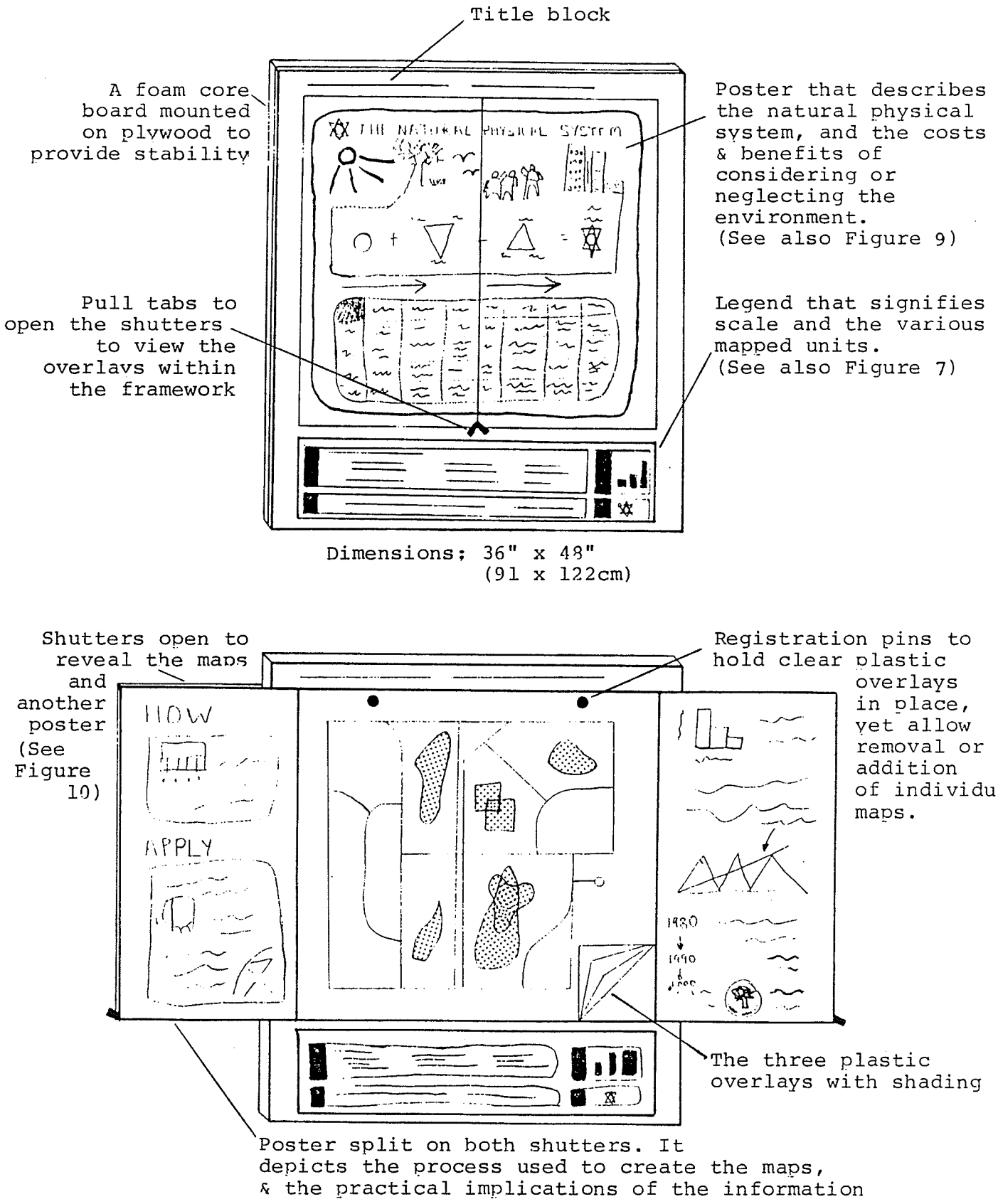


Figure 6: Physical Features of the Framework

and larger. Extraction of this information involves identifying appropriate coded areas on the Land Use/Land Cover map.

Wetlands - These areas were accorded importance in planning documents, surveys, interviews, and other framework studies. The National Wetlands Inventory, explained in the preceding chapter, produced extensive data on County wetlands. In order to render this source more comprehensible though, complicated codes and arrows were removed. After the wetlands were traced from four separate quadrangle maps that were spliced together, a photographic enlargement resulted in the appropriate scale and base.

Floodplains - Throughout research floodplains were repeatedly suggested as significant resources. The issues listed at the close of Chapter III, and the other frameworks discussed in this chapter all contained references to floodplains. The source used to identify floodplains was the Natural Resource Features map. Because of the map's cluttered nature, the floodplains information was extracted from it by means of tracing and eliminating codes. Fortunately, this information was originally drawn at the appropriate scale.

Sloped lands - This attribute was included because of its inclusion in other frameworks, its inclusion in the User's Manual, and its indirect relation to the erosion issue mentioned in Chapter III. The Natural Resource Features map was used for this information as well. Therefore, similar extraction methods to those above were utilized.

Prime farmlands - The tremendous loss of agricultural land, noted in Chapter III, prompted inclusion of this attribute. The Important Farmland map, produced by the County Soil Conservation Service, was used for determining the extent of this resource. Again, tracing of particular areas on this map resulted in the information needed. Photographic enlargement put this data on a 1:12,000 scale.

Unsuitable soils - As a result of the surveys it was determined that the Soil Survey was a favourable data source and should be used more. To remain harmonious with the User's Manual, the survey was used to determine the location of soils unsuitable for development. The methodology employed to create this map is explained in Appendix H. As with most of the other overlays prepared, tracing and splicing were required to produce a township base map.

Vegetation - Based on the interest shown over woodlands in the surveys, interviews, protection ordinances, and other frameworks, they were included in this study. Forests shown on the Land Use/Land Cover map were traced on to an overlay. However, this source shows forests by species associations which involves detailed numerical coding. Therefore, the overlay was refined to simply portray deciduous and coniferous woodlands. Since the Land Use/Land Cover map was first produced on a 1:12,000 scale and a township base, no splicing or enlarging was required.

As can be noted by the above discussion, the compilation of a comprehensive natural resources inventory for a township involved much refinement, alteration and extraction of existing data. It also involved preparation of an entirely new map. The difficulties experienced proved an earlier statement that the Division's data base was disjointed. A guiding framework that allows utilization of the data base follows the steps taken for the prototype.

The next step after production of the seven overlays was to combine them and place them within the framework. However, working with seven overlays became cumbersome and confusing. Consequently, only three categorical overlays were used. Surface waters, wetlands and floodplains were combined on the water related overlay. Sloped lands, prime farmland, and unsuitable soils were combined on the land related overlay. Finally, woodlands were depicted on the vegetative resources overlay. These three overlays correspond to characteristics described later in the Conceptual Aspects section.

To combine the three overlays graphically, and show important interrelationships among the resources, further changes were required. If the three overlays were combined in the state described above, the result would be a series of confusing criss-crossing lines that really do not communicate much data. Shading is an integral portion of the McHarg approach. Instead of using standard black and white

shading, color screens were used to portray each resource more vibrantly, and representatively (see Figure 7). In addition to using color as identifiers a simple one letter code was applied for each attribute. These two techniques were employed to ensure that each element remained individually identifiable even after three overlays were combined. This is a desirable trait for overlays (Snyder, 1981). Another desired, yet opposite, result of combining overlays and shading is the aspect of portraying interrelationships between the resources (Dean, 1985). The overlays show for example, how wetlands are often located within floodplains and how woodlands are frequently found in conjunction with both. This visual portrayal of the interactions among resources is part of the education directed towards planners. More discussion of education and resource interrelationships appears in the next section.

The construction of the physical framework thus far, illustrated with text and figures, meets some of the goals and objectives stated at the beginning of this chapter. The refinement and amalgamation of many environmental data sources makes the data and features of an interrelated environment more easily understood. A standardized design format for future information production might include the criteria of a 1:12,000 scale, use of a township base, and drafted on clear plastic so new maps can be correlated and added to the framework. By simplifying some of the data, complications

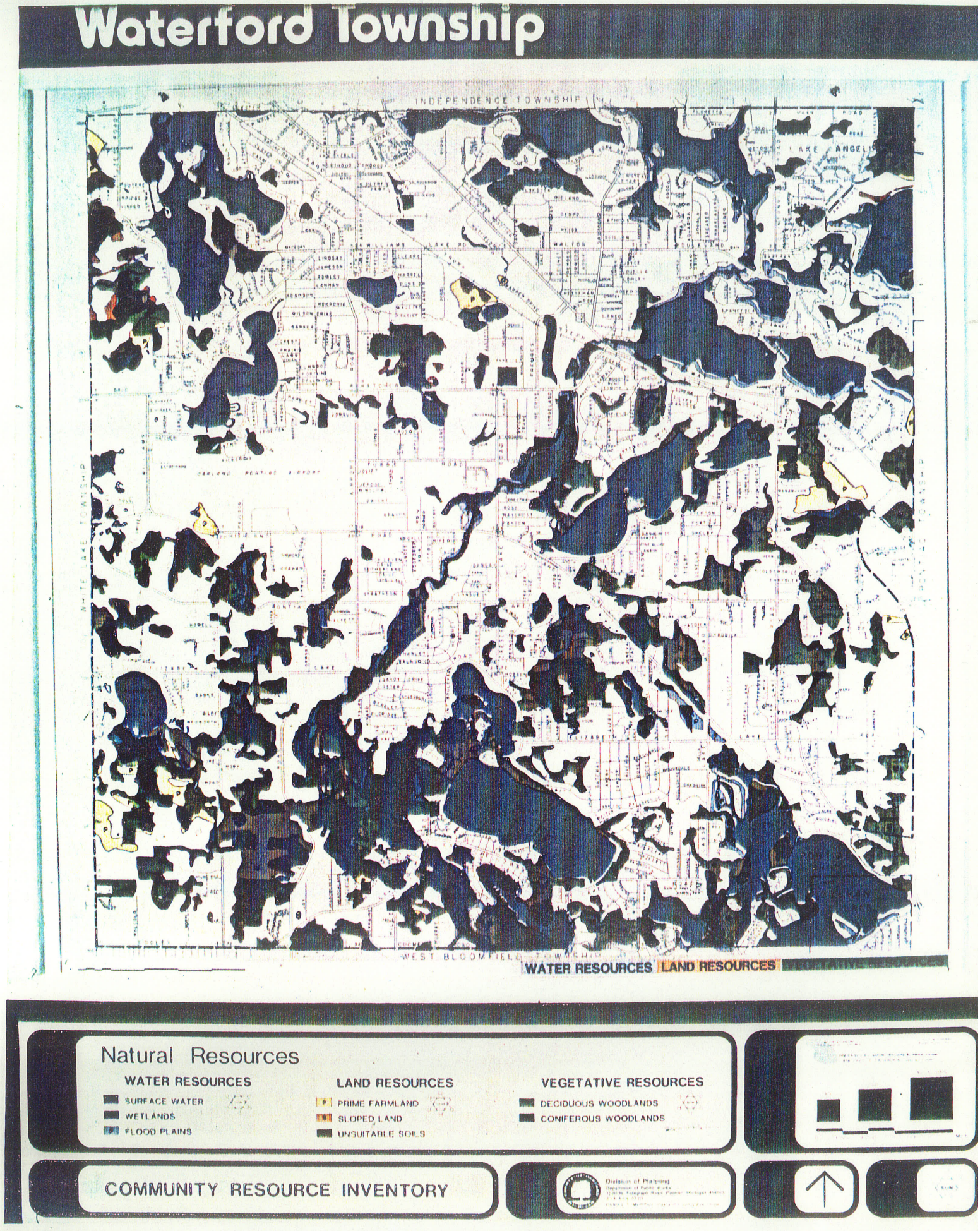


Figure 7: The Waterford Township Map Series

are eliminated and understanding is improved, yet the former more complex data still exists and can be utilized by persons needing more detailed analyses. Not all goals and objectives though, are met by the physical aspects of this framework. Educational and applicational goals are addressed by the guiding principles expressed by the conceptual aspect of the framework.

5.4.2 The Conceptual Aspect

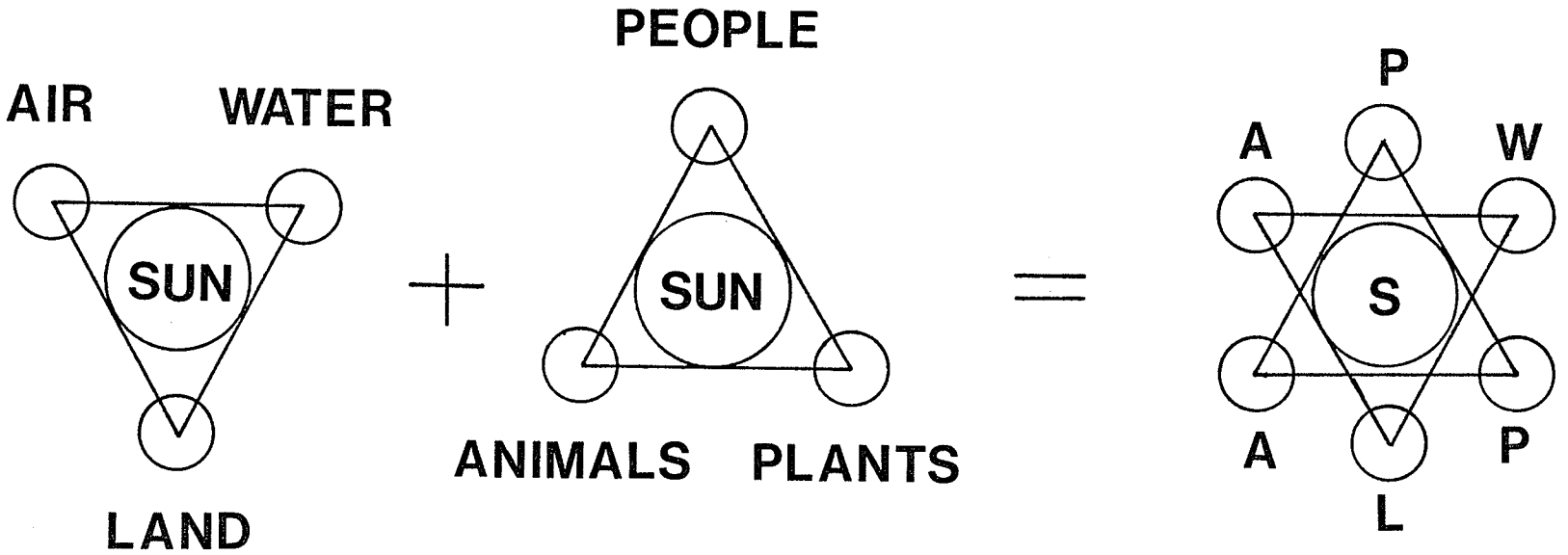
It is the conceptual aspect that really coordinates environmental information with guiding principles to create a consistent approach to environmental problems, a way of thinking. In this respect, this study became more than just a natural resources inventory; it became a guiding framework.

One environmental concept in particular was utilized and considered throughout the preparation of the framework. The fact that environmental components are intricately interrelated has been stated earlier. Here, it is described more fully and shown with symbology (see Figure 8). Lawrence Falardeau, a landscape architect with OCPD, formulated this symbol and its associated explanation in early 1985. The extensive use of this star symbol and meanings assigned to it, resulted in the symbol becoming the primary feature of the conceptual aspect of the framework. The symbol suggests a way of approaching the environment.

The natural physical system is driven by a source of energy, our star the sun. This energy powers all actions of inhabitants and components of the earth. The natural physical system, or the environment, is comprised of two primary divisions, the non-living or abiotic elements, and the living or biotic elements. The non-living components can be likened to the raw materials for life. They are shown in Figure 8 as the inverted triangle. Air, water and land (atmosphere, hydrosphere, and lithosphere) are the three vertices of the triangle and make up the entire non-living portion of the environment. The use of a triangle to join these elements together signifies the interrelationships among the elements. No element exists alone without being affected by one, or both of the other elements.

The upright triangle in Figure 8 portrays the relationships between the living elements of the environment. The vertices are people, animals and vegetation. Although people are really animals, we have separated ourselves from the animal realm through our distinguishing actions. Man's unique ability to radically alter the environment has set him apart. In Figure 8 people form a vertex separate from animals. However, since human actions affect wildlife and vice versa, and both are interrelated with plants, the three components are connected. Again, the triangle is used to portray the interrelationships of the three elements.

THE NATURAL PHYSICAL SYSTEM



NON-LIVING ---------- LIVING » » » » THE TOTAL SYSTEM

FIGURE 8. The Natural Physical System in Symbols

The two triangles cannot stand apart. Living elements depend on non-living and consequently interact with them. The two triangles combined create a star. This star is equivalent to the whole natural physical system. All elements are inexorably interrelated and every one affects one another. A very important conclusion based on the star is that whatever man does to the environment, all elements are affected. For example, man cannot simply remove plants without other effects. Soil erosion, decreased water quality, altered atmospheric conditions and other impacts might result. John Muir put it succinctly when he wrote "When one tugs at a single thing in nature, he finds it attached to the rest of the world" (Bade, 1923).

The principles expressed by this star concept are ones that information users could use as a guiding framework when addressing environmental or natural resources management issues. The star concept was applied throughout the framework to reinforce the idea of interrelatedness. The three overlays described earlier were named after three points of the star. Another place the symbol is found is on educational posters that accompany the framework.

The decision to use posters within the framework was influenced by survey results pointing to a preference for visual presentation of natural resources information. The posters are a part of both the physical and conceptual aspects of the framework. Figure 6 shows where they are

placed within the framework. Figures 9 and 10 are examples of the posters.

In addition to explaining the star, the exterior poster discusses some of the benefits and costs of including or neglecting natural resources in the planning process. It stresses the practical and economic implications of natural resources to man. The interior poster explains how the framework could be applied to incorporate natural resources management into the planning process. This point was emphasized on the poster because of the disparity noticed between surveys and planning document review, where it was shown that although planners feel natural resources are very important in the planning process, they are infrequently included in official documents. It was emphasized on the interior poster that the overlays do not become the plan itself (McHarg, 1969), rather they are a tool with which decision-makers can apply environmental data more easily to practical situations and understand the environment better. The symbols, diagrams and brief narrative found on the posters follow many similar points stressed in the User's Manual. The User's Manual is intended to be used in conjunction with the framework to further strengthen guiding principles.

With the addition of posters containing concepts and applications, to the physical aspect of the framework, the components meld together and augment each other to become one unified framework. Both the maps and concepts direct

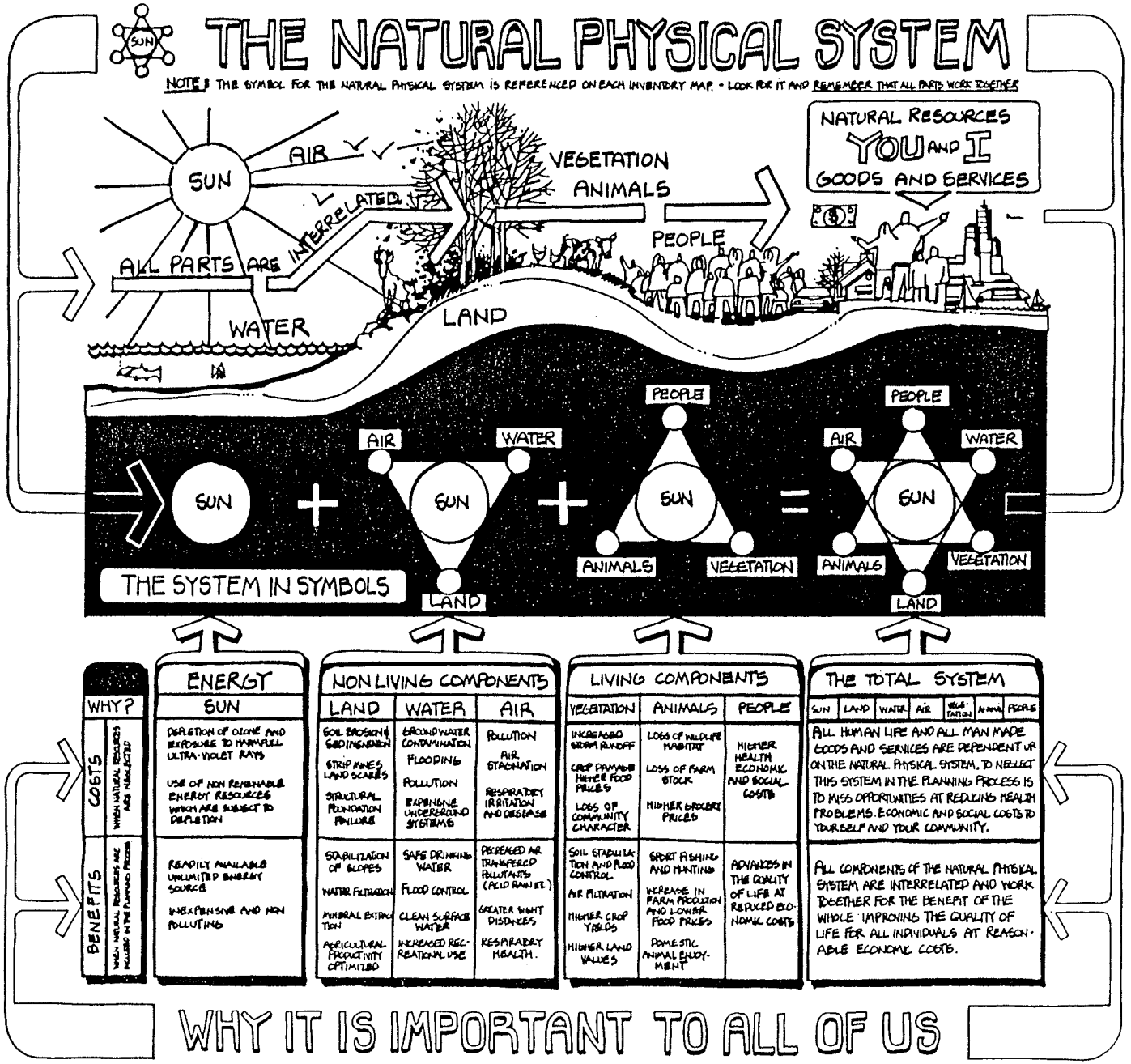
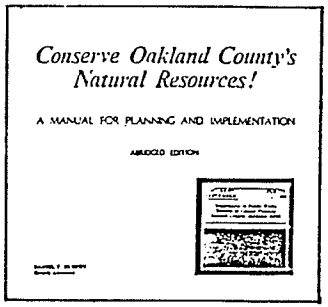


Figure 9: The Exterior Poster

Division of Planning · **Oakland County, Michigan** — **1200 N. Telegraph Road · Pontiac, Michigan 48053**

Resource Conservation Through Community Planning



The Oakland County Planning Division has developed a relatively simple process to help individuals, organizations, planners and community officials ensure a quality environment. The steps in the planning process are outlined below and expanded upon in the document "Conserve Oakland County's Natural Resources".

Step I: Identify Natural and Cultural Resources

Step II: Identify, Map and Quantify Natural Resource and Jurisdictional Open Space Areas

Step III: Review Collected Data

Step IV: Formulate Development and Resource Conservation Policies

Step V: Develop Classifications

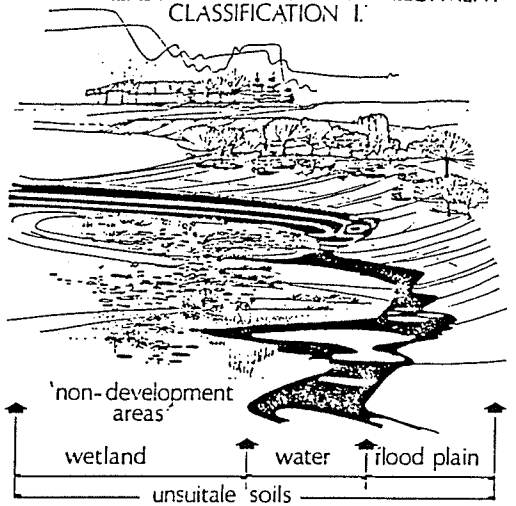
Step VI: Establish Development Priorities

Step VII: Identify Linkages or Resource Connecting Areas

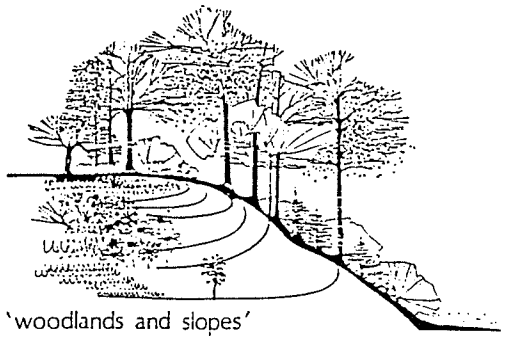
Step VIII: Identify Options Available to Accomplish Resource Conservation

DEVELOPMENT CLASSIFICATIONS

AREAS LEAST SUITABLE FOR DEVELOPMENT
CLASSIFICATION I.



LIMITED DEVELOPMENT AREAS
CLASSIFICATION II.



CLASSIFICATION III.
OPTIMAL GROWTH AREAS

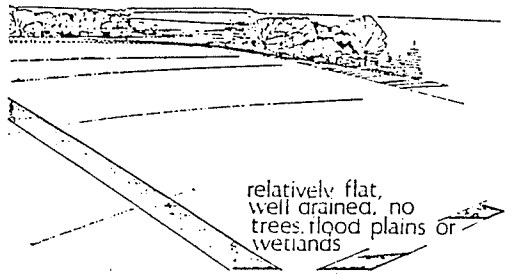


Figure 10: The Interior Poster

information users in their approach to the environment. The User's Manual serves as an important complementary data source. All goals and objectives stated at the outset of this chapter are met with this final framework.

5.4.3 Future Aspects

Although the framework is complete, its effectiveness has yet to be proven. Officials of the community for which the prototype was prepared, Waterford Township, intend to utilize the framework in an update of the Township master land use plan.

Figure 5 on page 36 depicts the master plan decision-making process and where environmental information fits into the process. A comprehensive and comprehensible source of environmental data, such as the framework, helps planners coordinate public concerns with factual physical data. The decision-making process is improved with the addition of accurate data. Monitoring the performance of the framework for Waterford Township's master plan application will suggest whether the framework is a valid planning tool, and if particular features of it need adjustment.

In the future, the framework could be utilized in the preparation of environmental ordinances. One County community has already employed the overlay process to prepare a Wetland and Watercourse Protection Ordinance (Dean, 1985).

Recent requests sent to OCPD by community representatives for detailed natural resources data (Johnson, 1986; Nayh, 1986) suggest that the framework could be applied immediately and practically. If the framework is deemed successful, further promotion of it would allow other community officials access to a new Planning Division product. Survey and interview results indicated preferences for various promotional techniques. A plan of action for the Planning Division is listed in the following chapter.

5.5 SUMMARY

A similar framework to that described in this chapter might have been proposed without the help of detailed research. However, the findings obtained through surveys, interviews, literature and document review, were essential to the ultimate design of this framework. Without research, certain areas may not have been emphasized, when rightly they should. The framework discussed herein combined environmental information and education to provide users the ability to apply Oakland County Planning Division's data base in natural resources management. The numerous research findings though, did not all relate to the structure of the framework, some point to further action by the Planning Division. These actions are addressed in the following chapter after brief concluding remarks about this study.

Chapter VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

The term summary suggests some type of final or closing statements. In most research endeavors though, there is no way to measure where they began and if they will ever end. This is also true for the research undertaken for this project. Therefore, any concluding remarks discussed here apply only to a small part of a research project that has no perceivable bounds.

It was realized early in this study that, although the Oakland County Planning Division has numerous data sources related to natural resources, the sources are infrequently used. This underutilization was expressed in planning documents, and survey results. The reasons for the problem of underutilization stem from the disjointed nature of the Division's data. Different data sources have different scales, use different geographic bases, often employ complicated codes to identify attributes, and range in levels of complexity. Hence, comprehensive understanding of the data does not occur.

A review of related literature indicated that planners need information in an understandable and accessible form. This translates to uncomplicated and integrated data. The gap between information and its users has to be eliminated. The literature also implied that natural resources data can be applied practically during ordinance and master plan preparation. Within the County however, this capability has not been extensively applied. Research suggested that planners feel natural resources are important considerations for planning purposes, but this was not reflected in planning documents.

Some major environmental and informational issues were determined in Chapter III. The loss of wetlands and woodlands, flooding, groundwater contamination, and agricultural issues were noted as important in Oakland County. Also recognized in Chapter III was the dual role the Division must play in information provision. In addition to producing maps and reports, the Planning Division has a role as an educator. Based on survey and interview results, a need was identified for education of planning officials on environmental concepts. Certain natural resources data sources were identified as favourable in Chapter III. A preference for visual presentation and a combination of presentation methods was noticed throughout the research process.

A major objective of the Oakland County Planning Division is to provide natural resources information to planners so

they may propose environmentally sensible master plans. The Division's data base was reviewed to determine where deficiencies existed and which sources should be emphasized. The critique resulted in the realization that numerous modifications to the data base were needed to make it a coordinated, effective, communicating system. Some shortcomings were noticed by the absence of information regarding groundwater and wildlife.

Combining research findings with ideas portrayed in other data base studies provided the foundation for framework design. The framework incorporated the use of maps and posters with educational material to meet some of the goals and objectives listed at the beginning of Chapter V. Practical applications of natural resources information were stressed on the posters, especially applications related to planning documents. The most accurate information available was presented in an uncomplicated and integrated manner to limit confusion and increase understanding. The framework proposed in Chapter V was based upon research findings listed throughout the chapters. In so doing, a framework was constructed that allows people to effectively utilize the Division's data base for natural resources management. In the near future the effectiveness of the framework can be gauged by monitoring the progress of the prototype community. However, a long term dedication to the framework concept is necessary for its success.

6.2 CONCLUSIONS

Several general conclusions relating directly to the research objectives listed in Chapter I result from this study's research and preparation. Conclusions are listed below in the same order as the original research objectives.

1. Planners perceive natural resources management as an important planning consideration, but it is seldom implemented in written plans. Planners information needs centre around the issues discussed in 2.
2. Planners perceived the environmental issues of groundwater contamination, the loss of woodlands and wetlands, and flooding and floodplains as important.
3. Oakland County Planning Division's natural resources data base consists of many maps, the User's Manual, model ordinances and the soil survey. In its original state it was disjointed due to inconsistencies of scale, geographic base, currency, and level of complexity.
4. To address information needs, four goals were formulated for the framework. They are: to create a better understanding of environmental issues, and of environmental information, to provide users with an increased ability for information utilization, and to create a flexible yet consistent data base.
5. Finally, a course of action has been suggested; a framework was prepared. The framework integrated

OCPD's natural resources data into a comprehensible and accessible form. The goals listed above are met by the framework. Promotion and dissemination of the framework are addressed in the following section.

6.3 RECOMMENDATIONS

The future actions proposed below make this research project a dynamic process. These recommendations have been alluded to throughout the text as means of improving the Division's data base and data users' understanding.

1.

> I recommend that close contact be maintained with Waterford Township during their master plan preparation period, and measurement of response by planning officials and citizens to the prototype.

This will help to eliminate any deficiencies and perfect the framework. The best possible product should be presented to the general public.

2.

> I recommend that the framework be presented to planning officials at a series of group workshops that stress the practical applications of natural resources data in the planning process.

3.

> I recommend that videotapes be made of the workshops, and later spliced together with accompanying narrative to produce a high quality video program for further educational needs of interested information users.

4.

> I recommend that the Planning Division produce physical frameworks for those communities whose officials express interest and are willing to share costs. Adherence to framework design standards established in Chapter V for all maps is necessary.

Recommendations 2,3, and 4 relate to means of promotion and dissemination of information, instead of just "sitting on" information. Some recommendations addressing specific ways the data base might be improved follow.

5.

> I recommend that future maps be coordinated within the framework by the institution of a standardized cartographic format. All future maps should be drafted on a geographic township base at a 1:12,000 scale, and produced on clear plastic. The use of complicated codes should be discouraged.

Recommendation 5 is aimed at allowing users the ability to use future maps as overlays within the framework, and view the interrelationships among resources.

6.

> I recommend that shortcomings of the data base be eliminated by producing or arranging production of maps detailing wildlife and groundwater information. This might involve discussion with an engineering consulting firm, and/or use of the County soil survey.

Finally, in place of relying on a largely manual integration of data, the next recommendation suggests an alternative.

7.

I recommend that the idea of implementing a GIS at the Oakland County Planning Division be further researched.

The previous recommendations are designed to allow the citizens of Oakland County a more complete use of Oakland County Planning Division information, and possibly a resultant improvement of environmental quality, and the quality of life.

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Appendix A

LETTER AND QUESTIONNAIRE SENT TO PLANNING COMMISSION CHAIRPERSONS, PLANNING DIRECTORS, AND CONSULTANTS AND SURVEY STATISTICS

The letter sent to recipients was standard for all three populations. However, very slight modifications were necessary to tailor the questions directly to the particular population. A few words were changed but the meaning remained the same. Questions were structured as similarly as possible for the three populations so that viable comparisons could be made.

The following questionnaire is a copy of what was sent to planning commission chairpersons, with the addition of footnotes to clarify two other forms the questions might take for consultants or planning staff directors. Footnotes appear on a page following the questionnaire. Survey statistics follow the footnotes. The statistics consist of arithmetic means for the responses from the three populations.

COUNTY OF OAKLAND

DANIEL T. MURPHY, COUNTY EXECUTIVE

May 29, 1985

Dear :

This summer the Oakland County Planning Division is conducting an update of the Land Least Suited for Development Program. The program is aimed at permitting (encouraging) growth without destroying the community natural resource base, through the preparation and distribution of mapped data and proper planning procedures. The update involves an analysis of the natural resources data available at our office and how it can be made more directly useful to you. Before this can be done, we feel it is essential to know what you and your community think about natural resources and natural resources data. Your perceptions, expectations and needs of natural resources data would contribute substantially to our update, and the eventual improvement of our (and your) information. The results of this survey will be used to make natural resources data more accessible and understandable to you. Survey results will be available to you upon request.

Complete instructions are listed at the beginning of the questionnaire. In order to complete an effective update, we would appreciate your completion of the questionnaire as soon as possible. There is a stamped self-addressed return envelope enclosed for your convenience. If you have any questions, please feel free to contact me at 858-0720. Thank you for your time and assistance, and your prompt response.

Sincerely,

Mark W. Brownlie
Planning Assistant

MWB/meg

Enclosure
P5

Division of Planning, Executive Office Building
1200 NORTH TELEGRAPH ROAD, PONTIAC, MICHIGAN 48053
(313) 858-0720

QUESTIONNAIRE

LANDS LEAST SUITED FOR DEVELOPMENT UPDATE

The following survey will be used to help update natural resources data available from the Oakland County Planning Division. It consists primarily of rating items on a scale of 1 to 5. Please circle the appropriate figure. Other questions involve brief written answers, and checking boxes for multiple choice questions. Space is provided at the end of the survey for comments. We appreciate your input.

1. At what level of development would you term your community? 1

( ) Urban
( ) Suburban
( ) Rural

2. To the closest year - How long have you been a planning commissioner? 2

___ Years

3. How important are the following environmental issues to the citizens of your community? 3

		Very Important				Not Important
A.	Air Pollution	5	4	3	2	1
B.	Water Pollution	5	4	3	2	1
C.	Groundwater Contamination	5	4	3	2	1
D.	Soil Erosion	5	4	3	2	1
E.	Loss of Wetlands	5	4	3	2	1
F.	Loss of Woodlands	5	4	3	2	1
G.	Loss of Wildlife Habitat	5	4	3	2	1
H.	Flooding	5	4	3	2	1
I.	Decreased Landscape Aesthetics	5	4	3	2	1
J.	Energy Conservation	5	4	3	2	1
K.	Resource Recycling	5	4	3	2	1
L.	Other (Please specify) _____	5	4	3	2	1

4. How involved has the planning commission been in the following issues? 4

		Very Involved				Not Involved
A.	Air Pollution	5	4	3	2	1
B.	Water Pollution	5	4	3	2	1
C.	Groundwater Contamination	5	4	3	2	1
D.	Soil Erosion	5	4	3	2	1
E.	Loss of Wetlands	5	4	3	2	1
F.	Loss of Woodlands	5	4	3	2	1
G.	Loss of Wildlife Habitat	5	4	3	2	1
H.	Flooding	5	4	3	2	1
I.	Decreased Landscape Aesthetics	5	4	3	2	1
J.	Energy Conservation	5	4	3	2	1
K.	Resource Recycling	5	4	3	2	1
L.	Other (Please specify) _____	5	4	3	2	1

5. How well do you feel the planning commission members understand the following environmental concepts? 5

		Understand Well				Understand Not At All
A.	The Water Cycle	5	4	3	2	1
B.	Nutrient Cycles (e.g. nitrogen, etc.)	5	4	3	2	1
C.	Natural Functions of Forests	5	4	3	2	1
D.	Natural Fucntions of Wetlands	5	4	3	2	1
E.	Natural Functions of the Atmosphere	5	4	3	2	1
F.	Soil Conservation Practices	5	4	3	2	1
G.	Other (Please specify) _____	5	4	3	2	1

6. Is there a natural resource management issue(s) in your community that require(s) more attention? 6

( ) YES

( ) NO

Briefly Describe it (them) _____

_____

_____

7. Have you been informed that Oakland County has information on:

Soils	YES ( )	NO ( )
Wetlands	YES ( )	NO ( )
Woodlands	YES ( )	NO ( )
Floodplains	YES ( )	NO ( )
Agricultural Lands	YES ( )	NO ( )
Natural Resources Conservation	YES ( )	NO ( )

8. Have you ever contacted Oakland County Planning Division for natural resources information?

( ) YES

( ) NO

(If NO skip to question 9)

(If YES) What type of information were you seeking?_____

Were we able to provide the needed information?

( ) YES

( ) NO

If we were unable to provide the needed information were you able to obtain it elsewhere?

( ) YES WHERE? _____

( ) NO

9. Rate the quality of the following Oakland County Planning Division data sources. If you have never used the source please circle Zero.

	Very Good				Very Bad	Never Used
Soil Surveys	5	4	3	2	1	0
Soil Suitability Maps	5	4	3	2	1	0
Land Use Maps	5	4	3	2	1	0
Land Use/Land Cover Maps	5	4	3	2	1	0
Natural Resource Features Maps	5	4	3	2	1	0
"Conserve Oakland County's Natural Resources" Manual	5	4	3	2	1	0
Aerial Photos	5	4	3	2	1	0
Model Environmental Ordinances	5	4	3	2	1	0
Other Sources (Please Specify) _____	5	4	3	2	1	0

10. Rate your community's need for information on these subjects. 7

		More Info. Needed		Adequate Info.		No Info. Needed
A.	Agriculture	5	4	3	2	1
B.	Wildlife	5	4	3	2	1
C.	Soils & Erosion	5	4	3	2	1
D.	Wetlands	5	4	3	2	1
E.	Water Bodies	5	4	3	2	1
F.	Woodlands	5	4	3	2	1
G.	Floodplains	5	4	3	2	1
H.	Economics of Natural Resource Mgt.	5	4	3	2	1
I.	Waste Management	5	4	3	2	1
J.	Recreation	5	4	3	2	1
K.	Other (Please specify) _____	5	4	3	2	1

11. How important do you feel natural resources are in the following planning activities:

		Very Important				Not Important
A.	Community Master Plan Preparation	5	4	3	2	1
B.	Community Zoning Ordinance Preparation	5	4	3	2	1
C.	Community Recreation Plan Preparation	5	4	3	2	1
D.	Site Plan Review	5	4	3	2	1
E.	Residential Development	5	4	3	2	1
F.	Commercial Development	5	4	3	2	1
G.	Industrial Development	5	4	3	2	1
H.	Institutional Development	5	4	3	2	1

12. Natural resources information can be communicated in various forms. Rate the ease of use for the different forms of data.

		Very Easy				Very Hard
A.	Maps	5	4	3	2	1
B.	Statistics	5	4	3	2	1
C.	Graphs	5	4	3	2	1
D.	Diagrams	5	4	3	2	1
E.	Reports	5	4	3	2	1

13. The Planning Division is interested in distributing data to municipalities, citizens, developers and consultants by the most informative medium. Rate the effectiveness of the following means of public education:

		Very Effective				Not At All Effective
A.	Information Bulletins/Pamphlets	5	4	3	2	1
B.	Documents	5	4	3	2	1
C.	Video/Slide Presentation	5	4	3	2	1
D.	Lectures	5	4	3	2	1
E.	Question/Answer Period	5	4	3	2	1
F.	Workshops	5	4	3	2	1
G.	Other (Please specify) _____	5	4	3	2	1

14. If you have any additional comments on how Oakland County's natural resources information could be of better use for you, please write them below.

Again, thank you for taking the time to complete this questionnaire. Your answers will be reviewed, and will provide the basis for our information update.

P5

FOOTNOTES

1: This question was not asked of consultants since many are retained by more than one community.

2: For the other two populations "planning commissioner" was changed to "planning consultant" or "planning or community development director".

3: This question was reworded for consultants to "Based on your experience with Oakland County municipalities, how important do you feel the following environmental issues are to the general public?"

4: This question was not asked of consultants, and changed to address the planning staff's involvement.

5: "The planning commission members" became "your staff" for planning directors and "planners in general" for consultants.

6: This question remained the same for planning directors but changed for consultants to "Through your contact with Oakland County communities have you noticed any natural resources management issues that require more attention?"

7: For consultants the word "community's" was removed.

SURVEY STATISTICS

The following survey statistics are listed for those questions shown on the preceding questionnaire and discussed in the text. Most questions involved rating on a scale of 1 to 5, where 1 is an unfavorable/low response, and 5 is a favorable/high response. Arithmetic means of the responses for each population are organized in the order of Planning Commission Chairpersons(PCC), Planning Staff Directors(PSD), and Planning Consultants(PC). As was stated earlier, slight variations in question design exist. Please consult the footnotes above.

To the closest year - How long have you been a planning commissioner/ planning director/planning consultant?

PCC - 8.4 years
PSD - 13.3 years
PC - 15.6 years

How important are the following environmental issues to the citizens of your community?

	PCC	PSD	PC
Air pollution	3.86	3.40	3.40
Water pollution	4.20	4.11	4.60
Groundwater contamination	4.10	3.00	4.30
Soil erosion	3.13	3.55	3.20
Loss of wetlands	3.62	3.25	3.90
Loss of woodlands	3.48	4.22	3.60
Loss of wildlife habitat	3.31	3.11	3.10
Flooding	3.34	4.11	3.70
Decreased landscape aesthetics	3.93	3.77	3.90
Energy conservation	3.03	2.77	2.70
Resource recycling	2.75	2.44	2.40

How involved has the Planning Commission/Staff been in the following issues?

	PCC	PSD
Air pollution	2.06	1.77
Water pollution	2.51	2.66
Groundwater contamination	2.62	2.33
Soil erosion	2.24	3.11
Loss of wetlands	2.62	3.00
Loss of woodlands	2.51	3.33
Loss of wildlife habitat	2.24	2.44
Flooding	2.62	3.55
Decreased landscape aesthetics	3.17	4.11
Energy conservation	1.75	2.88
Resource recycling	1.72	1.66

How well do you feel the Planning Commission/Staff/planners in general understand the following environmental concepts?

	PCC	PSD	PC
The water cycle	2.86	3.37	3.11
Nutrient cycles	2.17	2.87	2.30
Natural functions of forests	2.68	3.75	3.10
Natural functions of wetlands	2.93	3.87	3.60
Natural functions of atmosphere	2.62	3.12	2.90
Soil conservation practices	2.55	3.25	3.40

Have you been informed that Oakland County has information on the following? (percent responding YES)

	PCC	PSD	PC
Soils	75	100	90
Wetlands	68	100	90
Woodlands	68	89	100
Floodplains	64	78	90
Agricultural lands	50	89	90
Natural resources conservation	54	89	60

Have you ever contacted Oakland County Planning Division for natural resources information? (percent responding YES)

PCC - 31
PSD - 11
PC - 90

Rate the quality of the following Oakland County Planning Division data sources:

	PCC	PSD	PC
Soil surveys	4.11	4.00	4.55
Soil Suitability maps	4.12	4.00	4.28
Land use maps	3.82	3.12	3.55
Land Use/Land Cover maps	3.66	3.00	3.85
Natural Resource Features maps	4.30	3.00	4.00
"Conserve Oakland County's Natural Resources!" manual	4.33	3.50	3.80
Aerial photos	4.18	4.66	5.00
Model environmental ordinances	3.66	3.33	3.22

Rate your community's need for information on these subjects:

	PCC	PSD	PC
Agriculture	2.07	1.57	3.40
Wildlife	2.57	2.57	3.60
Soils and erosion	2.96	3.14	3.60
Wetlands	3.11	3.14	3.70
Water bodies	3.11	2.85	3.50
Woodlands	3.00	2.85	3.70
Floodplains	3.15	3.00	3.50
Economics of nat. res. mgmt.	2.55	3.28	3.60
Waste management	3.53	3.00	4.11
Recreation	3.39	2.85	3.55

How important do you feel natural resources are in the following planning activities:

	PCC	PSD	PC
Community master plan preparation	4.57	4.77	4.90
Community zoning ordinance preparation	4.17	4.11	4.20
Community recreation plan preparation	4.48	4.66	4.80
Site plan review	4.34	4.11	4.20
Residential development	4.13	4.55	4.50
Commercial development	4.00	3.44	4.10
Industrial development	3.96	3.88	4.20
Institutional development	3.89	3.88	4.30

Rate the ease of use for the different forms of data:

	PCC	PSD	PC
Maps	4.41	4.88	4.80
Statistics	2.82	3.33	3.10
Graphs	3.55	4.00	3.10
Diagrams	3.79	3.88	4.20
Reports	2.92	3.66	4.10

Rate the effectiveness of the following means of public education:

	PCC	PSD	PC
Information bulletins/pamphlets	3.71	4.33	4.80
Documents	2.82	4.12	4.22
Video/slide presentation	3.92	3.62	3.33
Lectures	3.23	3.00	2.11
Question/answer period	3.69	2.66	2.55
Workshops	3.61	3.00	3.60

Appendix B

INTERVIEW QUESTIONS AND LIST OF INTERVIEWEES

After brief introductory remarks regarding the reasons for an interview, and what the Planning Division was attempting to accomplish with interview results, a combination of the various questions listed below was posed. Some of the persons interviewed were also surveyed. Therefore, questions relating to the questionnaire were only posed to certain individuals. Other questions apply only to consultants. This list portrays the range of probable questions. Often, discussion became unstructured and additional queries not listed here were used. Unrestrained discussion produced excellent insights.

1. Are there any initial feelings or comments you would like to express that you could not on the questionnaire?

2. Do any of the "5s" or "1s" not express the actual intensity of your answer? That is, do you feel real strongly about any of your answers?

3. By using the questionnaire we were trying to get information on two primary subjects. The first being what natural resources management issues are important and need attention, and secondly, in what manner is information best communicated to you. That is, how can it be most useful? Firstly, what are important natural resources issues in your community and what areas do you think need more information and attention?

4. How can natural resources information be made most useful to you?

5. This is an example of something we've been thinking about for putting natural resources information together (show example, explain overlay system). What do you think of this; does it broadcast information to you or is it difficult to understand?

6. Will this information be useful to you? Do you foresee it being implemented in the planning process? How?

7. We asked a question on the questionnaire regarding your commission's involvement in environmental issues. One of the reasons we asked that was to help us determine if new natural resources information should be in a form immediately useable by the commission or if they should be structured so that the commission and citizens could work with and refine the information. What do you think of citizen and commission involvement in refining your own environmental information? What do you think the public role is in planning?

8. What do you think the consultant's role is in interpreting and applying natural resources information?

9. What do you feel is the most effective means of ensuring a quality environment: site plan review, ordinances, master plan, other plans and policies?

10. Is there a high turnover of commission members in your community? Do you think occasional workshops to inform new members of available data at the Planning Division would be helpful? Or a video program? Other?

11. Do you think communities are interested in natural resources management on an ongoing basis or only at crisis times?

12. Would better and/or more environmental information help communities adopt environmental protection ordinances, new master plans etc?

13. Do you think you could get more contracts as a result of detailed natural resources information? If not, how can you get more work, or better use out of our natural resources information?

14. Have you noticed any recent trends in the type of environmental related work that communities desire?

15. One of Oakland County Planning Division's primary objectives is to disseminate relevant information. More specifically, with this program we are trying to get to you useful environmental information. Do you have any suggestions on how we can do our job better? In producing information (topics, ways of mapping), getting it to users, updating information?

LIST OF INTERVIEWEES

Joseph Brett - former Planning Commission Chairperson; City of Novi
Alan Craddock - Planning Commission Chairperson; City of Berkley
Lillian Dean - Planning and Management Consultant
Kenneth Delbridge - Director of Planning and Building; Independence Township
Victoria Fudurich - Planning Commission Chairperson; City of Pleasant Ridge
Elizabeth Harris - Executive Director; East Michigan Environmental Action Council
Tod Kilroy - Planning and Economic Development, City of Southfield
Dr. George Kunkle - Engineer; Neyer, Tiseo and Hindo Ltd., Farmington Hills
Joseph Luellen - Oakland County Soil Conservation Service, United States Department of Agriculture
Michael Scieszka - Land Resource Programs Division, Department of Natural Resources, State of Michigan
George Shampo - Planning Commission Chairperson; City of Bloomfield Hills
Robert Stadler - Administrator; City of Bloomfield Hills
Colin Walls - Planner; Springfield Township
Helen Willis - Planning Commission Chairperson; Oakland Township

Appendix C

METHODOLOGY FOR SELECTION OF REVIEW COMMUNITIES

In order to develop a representative proportion of different types of communities for interview and document review purposes, the extent of development of all communities (i.e. urban, suburban, rural) was determined. This involved analysis of various approaches to community development typology. Some methods utilize the total community population figure as a basis for classification. However, this does not take into account community land area and population density. Other methods utilize population density as a single indicator of type of community. The disadvantage of this approach is that while a community may have few persons per square mile it should not be termed rural simply on those grounds. The percent of vacant, agricultural and developed lands should be considered. Infrastructure within the community is also an important indicator for community typology. As can be noted by the above, and as was stated by Bollens and Schmandt (1965), no definitive list of criteria for metropolitanism exists.

For purposes of this study, a blend of two approaches was applied. The Oakland County Planning Division established a development typology in 1976 that defined levels of urbanization (Kaczmarek and Hay, 1976). It instituted population density, infrastructure and land use figures. The Southeast Michigan Council of Governments established a similar typology involving population figures, vacant land acreages and infrastructure in 1978 (Duddleson, 1978). Since the mid-1970s many of the County's communities have grown and changed their development patterns. Therefore, classifications assigned to communities in 1976 and 1978 were reviewed and compared to the most recent land use and density figures. A combination of both typology systems was utilized for this study.

Listed below are the criteria used for determining development typology, and how each community was classified. A map on the accompanying page illustrates the typology utilized for this study.

Urban - Communities classified as such must:

1. Meet the density requirement of greater than 2500 persons/square mile; and one of the following:

a) Have a central business district as defined by the U.S. Bureau of the Census

b) Have a mix of land uses, that is, no particular land use (i.e. residential, commercial) comprises greater than 75% of the total area,

c) Is extensively developed, i.e. greater than 80%.

Rural* - Communities must meet:

1. The density requirement of less than 500 persons/ square mile, and

2. Greater than 50% agricultural and vacant land.

Suburban** - Communities must meet:

1. The density requirement of 500-2500 persons/square mile; and one of the following:

a) Have a mix of land uses but residential is predominant, i.e. highest percentage,

b) Less than 80% developed.

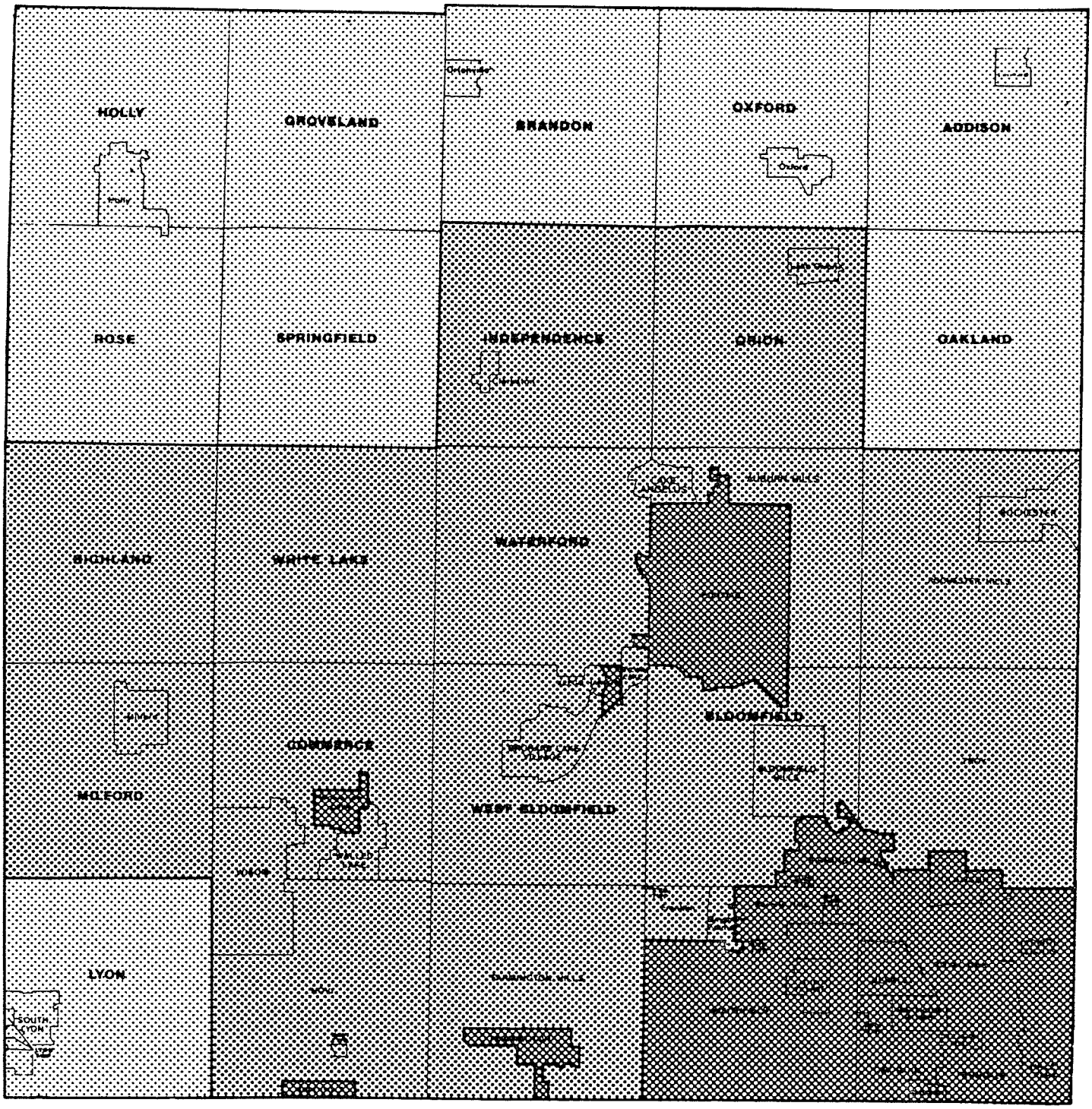
* This category includes rural service centers such as villages.
** Since suburbia has been described as neither urban or rural, and yet both, any communities that do not fit into a particular category will be classified as suburban.

Based on the above mentioned criteria, Oakland County as a whole would be classified as suburban. Individual communities were classified as follows:

URBAN	SUBURBAN	RURAL
Berkley *	Auburn Hills	Addison Twp.
Beverly Hills	Bingham Farms	Brandon Twp.
Birmingham	Bloomfield Hills *	Groveland Twp.
Clawson	Bloomfield Twp. *	Holly
Farmington	Clarkston	Holly Twp.
Ferndale	Commerce Twp.	Leonard
Hazel Park	Farmington Hills	Lyon Twp. *
Huntington Woods *	Franklin	Oakland Twp. *
Keego Harbor *	Highland Twp.	Ortonville
Lathrup Village *	Independence Twp. *	Oxford
Madison Heights	Lake Angelus	Oxford Twp. *
Northville	Lake Orion	Rose Twp.
Oak Park	Milford *	South Lyon
Pleasant Ridge *	Milford Twp.	Springfield Twp. *
Pontiac	Novi	
Royal Oak	Novi Twp.	
Royal Oak Twp.	Orchard Lake Village	
Southfield	Orion Twp.	
Southfield Twp.	Rochester	
Wolverine Lake	Rochester Hills	
	Sylvan Lake *	
	Troy *	
	Walled Lake	
	Waterford Twp.	
	West Bloomfield Twp. *	
	White Lake Twp.	
	Wixom	

A random selection of 25% of each category was performed. The communities chosen are marked with asterisks.

COMMUNITY TYPOLOGY



N

CITY
Village
TOWNSHIP

Urban

Suburban

Rural

OAKLAND COUNTY
MICHIGAN

SCALE IN MILES

0 5

(0 km) (8 km)

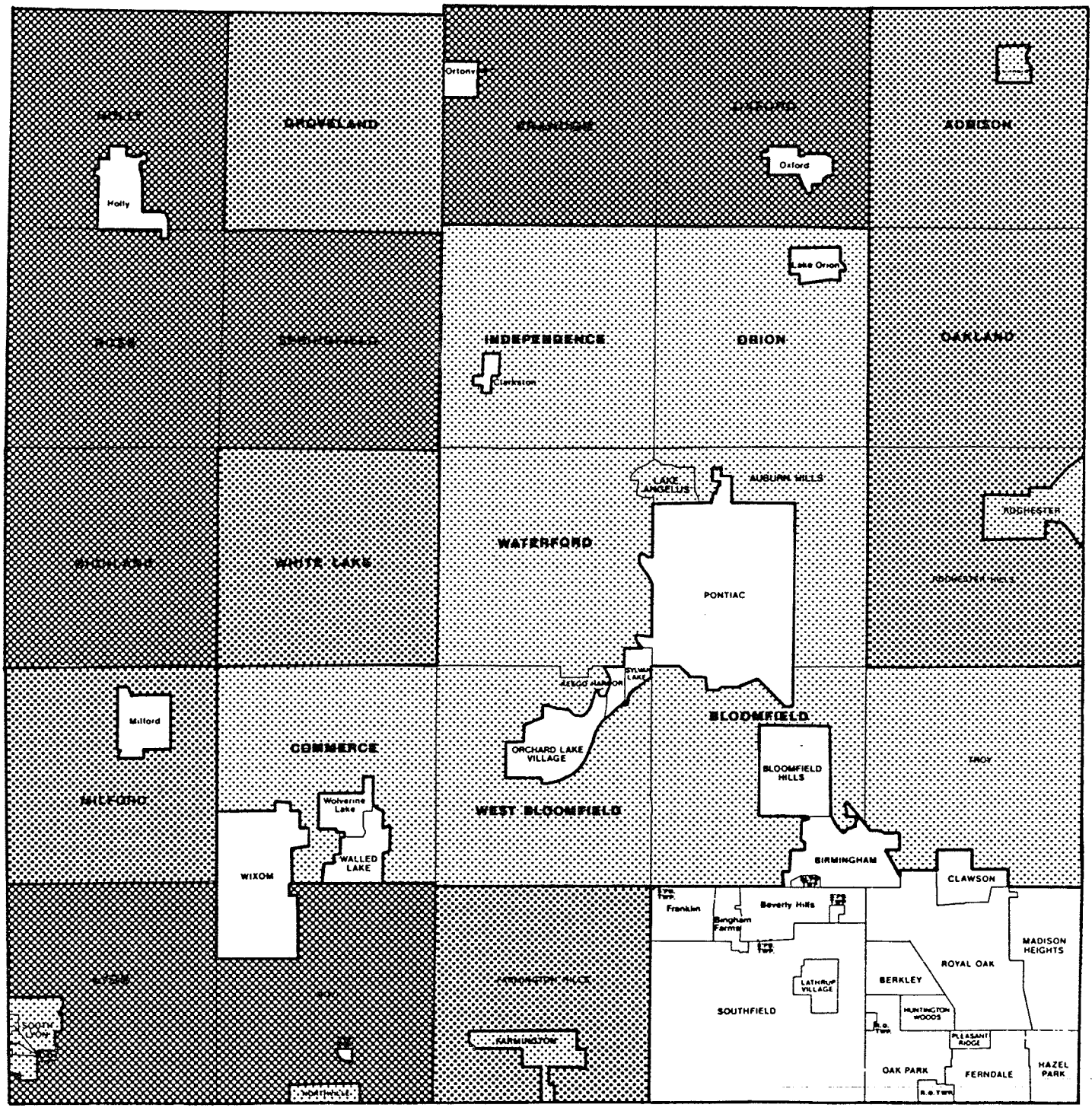
Appendix D

IRREVERSIBLE FARMLAND LOSS 1966-1981

Communities listed below had land actively cultivated in 1966 but fully developed in urban uses by 1981. These data were compiled from unpublished Planning Division statistics, used to produce a wall map.

COMMUNITIES	ACRES
Highland Twp.	2,657
Springfield Twp.	2,631
Lyon Twp.	1,611
Brandon Twp.	1,585
Novi	1,318
Rose Twp.	1,229
Holly Twp.	1,196
Oxford Twp.	1,009
White Lake Twp.	954
Rochester Hills	811
Groveland Twp.	793
Addison Twp.	745
Oakland Twp.	738
Farmington Hills	697
Milford Twp.	550
Troy	488
West Bloomfield Twp.	342
Waterford Twp.	316
Bloomfield Twp.	289
Independence Twp.	246
Commerce Twp.	180
Orion Twp.	140
Farmington	117
South Lyon	73
Auburn Hills	69
Northville	37
Village of Leonard	26
Rochester	7
Lake Angelus	4
TOTAL	20,860 Acres (8445 hectares) (32.6 sq.mi.=82.8 sq.km)

FARMLAND LOSS 1966-1981



(IN ACRES)

N

CITY
Village
TOWNSHIP

0

1-499

500-999

> 1000

OAKLAND COUNTY
MICHIGAN

SCALE IN MILES

0 (0 km)

5 (8 km)

Appendix E

EROSION STATISTICS

In a soon to be published report, officials of the Soil Conservation Service (SCS) listed statistics related to soil erosion within Oakland County. In 1982 the SCS staff visited 263 statistically selected sites in Oakland County to collect erosion data for the Natural Resources Inventory. Each site consisted of 160 acres (64.8 ha) and three randomly selected points within each site were used for collecting field data.

Following analysis of the data, totals were determined for land area requiring conservation practices to reduce soil erosion and maintain vegetative production. The figures are as follows:

Land in Oakland County Needing Conservation Practices

Forest Land	62,200 acres (25,182 ha)
Crop Land	15,300 acres (6,194 ha)
Pasture and Idle Grassland	5,100 acres (2,065 ha)
	82,600 acres (33,441 ha)

Appendix F

FLOOD DAMAGE STATISTICS

In 1975 the Great Lakes Basin Commission Floodplain Work Group calculated expected average annual damages by floods, and forecasted damages for later years. Damages were computed on the basis of the expectancy in any one year of the amounts of damage that would result from events throughout the full range of potential magnitude. Damages are listed in 1970 dollars, and categorized according to urban or rural areas.

Estimated Average Annual Damages

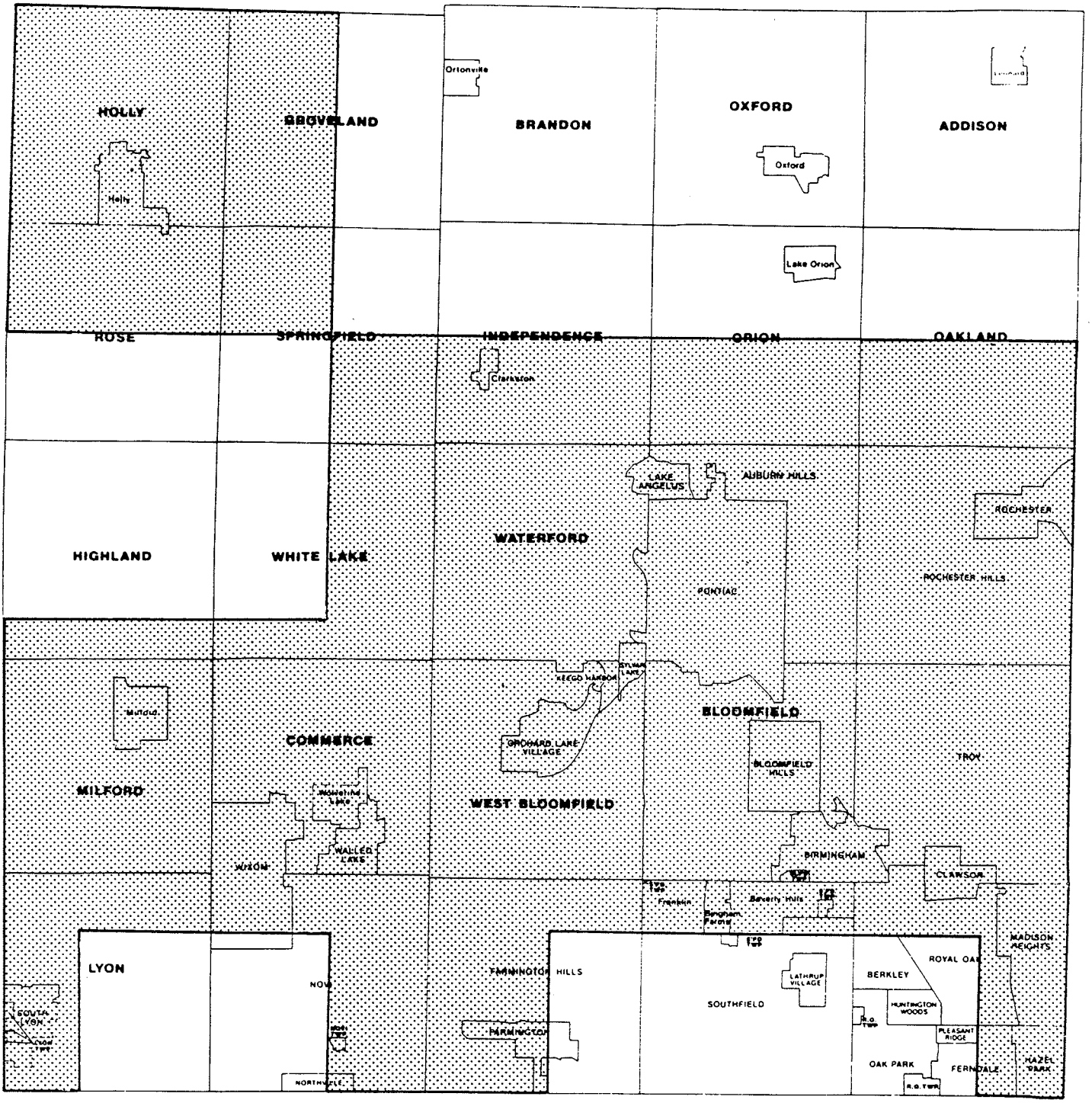
by Floods in Oakland County

	1970	1980	2000
Urban	146,400	234,900	542,700
Rural	1,800	3,000	5,600
TOTAL	$148,200	$237,900	$548,300

Appendix G

AREA SHOWN ON FLOODWAY INSURANCE RATE MAPS

FLOODWAY MAPS



AREA SHOWN ON "FIRM"

CITY
Village
TOWNSHIP

N

OAKLAND COUNTY
MICHIGAN

SCALE IN MILES

0 5
(0 km) (8 km)

Appendix H

CREATION OF THE UNSUITABLE SOILS PORTION OF THE LAND RELATED RESOURCES OVERLAY

The most recent Oakland County Soil Survey was completed in 1980, thus making soil information listed on the 1976 Soil Association Map outdated. After comparison of soil types listed in both sources it was found that four of the earlier soil types had been changed and grouped with new types based on more detailed characteristic studies of the soils. Therefore, if one was to use the old Soil Association Map in conjunction with the new soil survey, they would be combining two disparate information sources. It was suggested that the Soil Associations Map be updated in a manner that considered the revised and new soil types.

The most useful information contained on the Soil Associations Map is not the particular groupings, rather, it is the suitability index describing which soils are most to least suitable for development. Since the 1976 map is based on a survey that was prepared decades ago that has non-existent soil types, a new development suitability index was compiled. Also, the 1976 map was produced on a small scale, enlarged from an even smaller scale. Thus, the accuracy begins to become distorted. Township base maps are desired.

To remain consistent with the Conserve Oakland County's Natural Resources! booklet, the development index has three categories -- optimal, limited and least suitable for development. In doing this, a user may use the book in conjunction with the map. In other words, work within a guiding framework.

Determining which soils belonged in the different categories was accomplished by reviewing information contained in the soil survey. In addition to detailing the physical and chemical characteristics of each soil type, the survey analyzes each in terms of suitability for various uses. Tables ranking the soils for suitability as woodlands, for recreation, agriculture, engineering statistics, etc. are included in the survey. The table most appropriate for a general development index (development meaning construction of roads, dwellings, with or without basements and commercial buildings) is listed as Table 11 in the soil survey and titled "Building Site Development." Again, this is a general index. If a builder, developer, homeowner or community administrator desires more comprehensive information, it is con-

tained in the soil survey. The survey also has tables on suitability for septic fields and has engineering, chemical and physical properties of the soils. Also, the Oakland County Planning Division has mapped soils unsuitable for use as septic fields.

The Building Site Development table has three levels of suitability for each type of development being considered. They are: slight (minor limitations easily overcome), moderate (maintenance is needed to overcome limitations) and severe (unfavorable conditions needing special design and increased construction costs to overcome). Limitations range from wetness and slope to frost action and low strength and others. The table considers the limitations for all 72 County soil types for the categories: dwellings without basements, dwellings with basements, small commercial buildings, and local streets and roads. Also considered are the categories of lawns and landscaping and shallow excavations. For purposes of this map and study, however, the first four were used.

The process of determining which soils are best and least suited for development involved reviewing Table 11 of the soil survey. Any soil with a "slight" rating for all four development categories was considered optimal for development. Any soil with all four categories "severe" was termed least suitable for development. Any soil with a combination of ratings (e.g. 2 moderates, 1 severe, 1 slight) was termed limited suitability for development. This system is conservative since it would rank a soil as "limited development" if it has 3 "slights" and one "moderate". However, for specific purposes of builders, this maps flags the user to the existence of a limitation. After further study of the soil survey, a builder may find the limitation(s) do not affect their activities. This map and the soil survey are meant to be used complementarily. Before basing development plans on this map, it is highly recommended that data on this map be confirmed with soil tests.

For purposes of this study, all soils that were termed least suitable for development based on analysis of Table 11, were located on soil type maps of Waterford Township and outlined. Splicing together nine soil type maps with outlines produced a township base sized map. This information was then transcribed onto clear plastic, to become a portion of the Land Related Resources overlay.