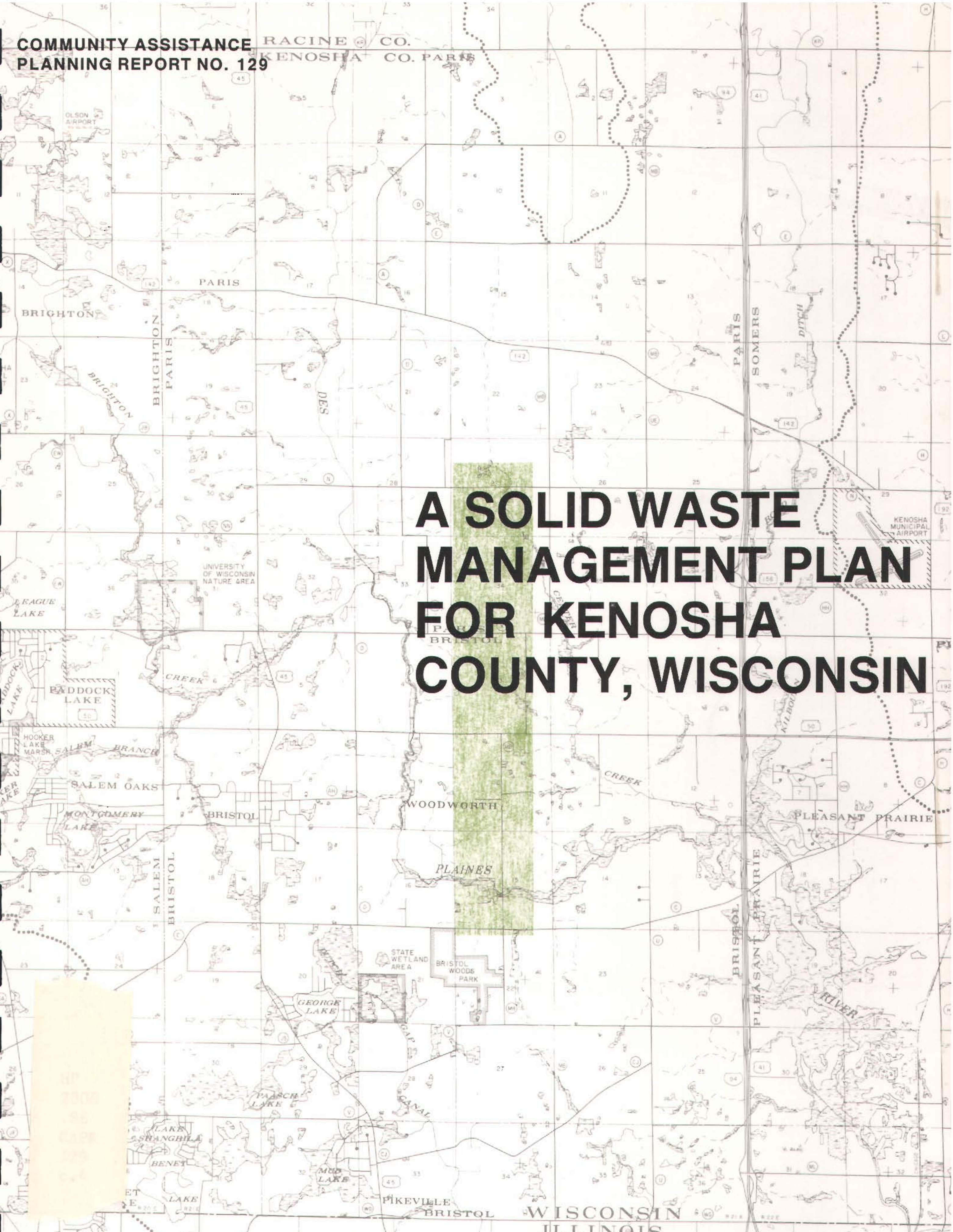
COMMUNITY ASSISTANCE
PLANNING REPORT NO. 129

# A SOLID WASTE MANAGEMENT PLAN FOR KENOSHA COUNTY, WISCONSIN

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COMMUNITY ASSISTANCE PLANNING REPORT
NUMBER 129

# A SOLID WASTE MANAGEMENT PLAN FOR KENOSHA COUNTY, WISCONSIN

Prepared by the
Southeastern Wisconsin Regional Planning Commission
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In Cooperation with the
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May 1989

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May 1, 1989

TO: Mr. George E. Melcher, Director
Kenosha County Department of Planning and Development

In May 1984, the Kenosha County Board requested that the Southeastern Wisconsin Regional Planning Commission assist the County in the preparation of a solid waste management plan for the County. The plan was to be based upon an assessment of the existing and probable future solid waste management needs, and was to recommend a strategy for meeting those needs while providing for the protection of the public health and of the overall quality of the environment from the potential adverse effects of improper solid waste disposal. Following the preparation of a study design and receipt of a grant from the Wisconsin Department of Natural Resources in partial support of the planning effort, work was initiated on the plan in March 1985.

To provide for the active participation in the work of all of the interests concerned, the plan was prepared under the guidance of a Technical Advisory and Intergovernmental Coordinating Committee. The 10-member committee was composed of elected and appointed county and local officials. In addition, input was received from interested and concerned citizens who attended the Committee meetings.

The County and Commission staffs working with the Advisory Committee have now completed, and are pleased to transmit herewith, this report setting forth a recommended plan for solid waste management in Kenosha County. The plan is based upon a careful evaluation of the existing solid waste management systems within the County, an analysis of the present and probable future needs for solid waste management, and an examination of the costs and other considerations attendant to alternative means of meeting those needs.

The selection of the recommended plan and the means to implement it followed an extensive review by the Advisory Committee of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered. Two public hearings on a preliminary version of the plan were held—one at the County Courthouse on October 25, 1988, and one at the Town of Wheatland Town Hall on October 26, 1988. A summary of the public hearing comment and the revisions made to the plan in response to that comment is included in Chapter X of the plan. The recommended plan addresses the seven basic solid waste management functions—storage, source separation, collection, transportation, transfer, processing, and disposal. Although the plan makes recommendations concerning all of these functions, the primary focus is on the source separation and disposal functions.

The solid waste management plan presented in this report provides a sound guide which can assist county and local government officials in providing for solid waste management in the County, while protecting the public health of the County's residents and the environment. The plan is hereby submitted for county consideration, adoption, and implementation. The Regional Planning Commission staff stands ready to assist the County in any way possible in implementation of the plan over time.

Sincerely,

Kurt W. Bauer
Executive Director

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# Chapter I

## INTRODUCTION AND BACKGROUND

Solid waste management has become an increasingly important issue of concern to elected officials at the state, county, and local levels of government. This concern stems from the growing per capita generation of solid wastes, and the heightened public awareness of the need to process and dispose of those wastes in an environmentally sound and cost-effective manner. In 1960, the total amount of residential and commercial solid wastes generated in the United States was about 2.7 pounds per person per day.[1] By 1970 this figure had risen to about 3.5 pounds per person per day; and by 1980, to 3.9 pounds per person per day.[2] It is estimated that 2.3 pounds per person per day of residential solid wastes was generated in Kenosha County in 1984, or about 52,000 tons per year. It is further estimated that 82,000 tons per year, or about 3.7 pounds per person per day, of additional solid wastes are generated from commercial, institutional, and industrial sources. In 1984, transportation and disposal--excluding collection--of these wastes in Kenosha County cost about $15 per ton, or about $2.0 million per year. Costs for the collection of solid wastes in the County are estimated to add $25 per ton, or about $3.3 million per year, to these transportation and disposal costs. Also of concern is the disposal of the sludge, grit, and grease generated by the City of Kenosha wastewater treatment plant and by the publicly owned sewage treatment facilities operated by the Villages of Paddock Lake, Silver Lake, and Twin Lakes; the Town of Bristol Utility District No. 1; the Town of Pleasant Prairie Sewer Utility District D and the Town of Pleasant Prairie Sanitary District No. 73-1; the Town of Salem Utility District No. 1 and the Town of Salem Sanitary District No. 2; and the Town of Somers Sanitary District. The Kenosha Water Utility estimated that in 1984, 15,000 tons of sludge and 1,800 cubic yards of grit and grease were generated at the regional plant operated by the Utility. The other publicly owned sewage treatment facilities generate an estimated 8,000 tons of solids to be disposed of annually. The total cost for the disposal of these materials was approximately $180,000 in 1984.

Proper long-range planning can minimize the costs of managing these solid wastes, as well as assure protection of the overall quality of the environment. This is especially important in Kenosha County because of the relatively large quantities of wastes generated within the County; the valuable cropland and recreational resources present in the County; the reliance upon groundwater as a source of water supply in the western portions of the County; the growing concern about the availability, cost, and environmental problems entailed in the use of landfills for the long-term disposal of solid wastes; and the potential to make productive use of this resource.

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[1] American Public Works Association, Solid Waste Collection Practices, 1975.

[2] The Tenth Annual Report of the Council on Environmental Quality, December 1979.

Planning for solid waste management is presently carried out at the state level by the Wisconsin Department of Natural Resources. Such planning has, to date, been limited to a broad needs assessment, and has included surveys of solid waste management practices and existing disposal sites, identification of general areas for the management of hazardous wastes, and assessment of the feasibility of establishing waste exchange between selected areas of the State. More comprehensive planning for solid waste management has been delegated to the county level. State funding is available for conducting countywide solid waste management studies. Other, single-purpose solid waste management studies have been conducted throughout the State by private agencies to evaluate specific project proposals. Recent landfill siting legislation adopted in 1983, and set forth in Chapter 144.44(2)(NM) of the Wisconsin Statutes, apparently does not permit the Wisconsin Department of Natural Resources to consider the recommendations of adopted county plans when evaluating landfill siting feasibility proposals unless the recommendations in those plans have been implemented through at least the feasibility report stage. There are efforts underway by the public officials concerned in southeastern Wisconsin to have this aspect of the landfill siting legislation revised to permit the Department to recognize the recommendations contained in adopted county plans.

Another consideration is recently enacted State legislation directed toward reducing the dependence on landfilling in the State. This legislation declares recycling and resource recovery systems to be preferable to land disposal. Specifically, state policy lists priorities for action in this order: 1-reductions in the amount of waste generated, 2-reuse of solid waste, 3-recycling, 4-composting, 5-energy recovery, and 6-land disposal.

The conduct of a countywide solid waste management study presents an opportunity to develop a practical, long-range plan for solid waste management, and to consider solid waste as a potential resource, rather than just a disposal problem. The solid waste management alternatives available offer choices which can minimize the long-term solid waste problems of the County, while maximizing long-range resource recovery benefits. The current solid waste management practices in the County should be capable of improvement through a positive, comprehensive, countywide approach.

The development of a county solid waste management plan, as outlined in a project description prepared by the Regional Planning Commission at the request of the Kenosha County Office of Planning and Zoning Administration in May 1984, was approved by the Kenosha County Board in June 1984. A Wisconsin Fund grant application was submitted on June 29, 1984, pursuant to Chapters NR 185 and 186 of the Wisconsin Administrative Code. A state grant was received on August 29, 1984, and work was initiated on the study in March 1985. In order to provide for the more active participation of all of the interests concerned, the study was conducted under the guidance of an Advisory Committee created by the County Board. The membership of the Committee is set forth in Appendix A.

## HISTORY OF SOLID WASTE MANAGEMENT IN KENOSHA COUNTY

The majority of solid waste originating in Kenosha County has historically been generated by residential, commercial, and industrial land uses located in the City of Kenosha. The increased amounts of solid waste being generated in the City of Kenosha probably first became a concern to municipal officials as the city resident population and commercial industrial base grew following World War I. As the City expanded and land became more valuable for intensive urban uses, convenient "dump" sites for the disposal of solid wastes in and near the City began to become more difficult to find. Growing concerns of public health officials about the adverse health effects of disposing of large amounts of "garbage" near residential areas further restricted the availability of land disposal sites. During the late 1930's, the federal Works Progress Administration (WPA) constructed a solid waste incinerator in the City of Kenosha southeast of the intersection of 50th Street and 13th Avenue, the site of the present City Waste Division garage. This facility was used to dispose of most of the combustible residential solid wastes generated in the City between about 1938 and 1968. Incinerator ash and the noncombustible portion of the residential solid waste collected by the City was disposed of at small landfills located within the City. The incinerator was periodically improved during the years of operation. However, the increasing amounts of solid waste being generated in the City had, by the late 1960's, exceeded the optimum operating capacity of the facility, and would have necessitated major renovation and expansion of the facility to meet growing disposal needs. In addition, expensive air pollution control equipment would have needed to be installed to meet increasingly stringent state and federal air pollution emission standards. Consequently, the City of Kenosha closed the incineration facility in 1968. Between 1968 and 1976, the City used three separate landfill sites located within the County to dispose of residential solid wastes. The last of these sites was ordered closed by the Wisconsin Department of Natural Resources (DNR) by October 1976. Since 1976, the City has been disposing of residential wastes and miscellaneous wastes associated with public works activities such as street sweeping, construction and demolition, and tree and brush removal at the Browning and Ferris landfill, located about nine miles from the City in the Town of Benton, Lake County, Illinois.[3]

The City of Kenosha has historically provided collection and disposal service for residential and some commercial sources of solid waste. Collection and disposal of most commercial waste and all industrial waste is by private contractors.

Solid wastes generated in the three villages and eight townships in Kenosha County have historically been disposed of by landfilling. Local landfills used for the disposal of residential wastes have been operated by the Villages of Silver Lake and Twin Lakes and by all of the eight townships. State regulations governing the operation of landfills have resulted in the closing of all of these small disposal sites with the exception of those operated by the Village of Twin Lakes and the Towns of Bristol and Randall. Private contractors have been used throughout most of the County outside the City of Kenosha to collect and dispose of residential, commercial, and industrial wastes.

More recent developments concerning solid waste management in Kenosha County included the completion of a solid waste management study for the Kenosha

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[3]In 1986, the City of Kenosha began transporting its solid waste to the Waste Management of Wisconsin Pheasant Run landfill in the Town of Paris, Kenosha County.

Urban Planning District.[4] That District consists of all that portion of Kenosha County located east of IH 94. The study findings are documented in a report dated August 1975. The report recommended the construction of a sanitary landfill west of the City of Kenosha, with a capacity of approximately 2.7 million tons, for the disposal of solid wastes generated in the City and in the Towns of Pleasant Prairie and Somers. The report recommended the use of a millfill operation to process waste material both to recover recyclable materials and to make more efficient use of the capacity of the recommended landfill.

In November 1977, the Kenosha County Board acted to create a county solid waste study committee. That committee set forth basic guidelines for the selection of a landfill site within the County and conducted studies of several potential sites. The sites investigated were screened by application of the site-specific criteria, and those having potential for use as a countywide landfill were identified. This committee action was documented in various committee memoranda.

In December 1978, a landfill feasibility report was completed by Residual Management Technology, Inc., consulting engineers, for the owner of a potential landfill site located in Section 32, Township 2 North, Range 21 East, Town of Paris. This report concluded that the site was potentially capable of supporting a large landfill operation. The report recommended that if the site studied were to be used as a landfill, an initial site report as specified in the state regulations covering landfills should be prepared and submitted to the Wisconsin Department of Natural Resources for review and approval. The report further recommended that rights for access and options to purchase sufficient area should be obtained to allow performance of the detailed subsurface investigations and to control land use development around the landfill.

On September 5, 1979, the Kenosha County Board Chairman wrote to the Southeastern Wisconsin Regional Planning Commission requesting that the Commission consider the possibility of conducting, in conjunction with the county solid waste study committee, a study to establish a basis for the selection and acquisition of a county solid waste landfill site. The Commission, in response to this request, prepared a proposal for the conduct of such a study under the guidance of the county committee. The proposal was not, however, acted on by the County Board. In 1980, Waste Management of Wisconsin, Inc., petitioned the Wisconsin Department of Natural Resources for approval of an 80-acre expansion of a landfill site which that firm purchased in 1979, located in the southeast one-quarter of Section 32, Township 2 North, Range 21 East, Town of Paris, Kenosha County. Final approvals for expansion of the site were granted by the State in July 1982, and the site was opened late in 1983. The site provides landfill capacity primarily for wastes generated in Kenosha and Racine Counties.

In 1982, the City of Kenosha contracted with the firm of Donohue & Associates, Inc., for a study to evaluate the feasibility of establishing a solid waste

[4] Havens and Emerson, Ltd., Report on Regional Waste Management for Kenosha Planning District, Wisconsin, August 1975.

transfer facility in the City. A transfer station is the location at which wastes that have been transported by packer trucks are consolidated prior to removal by large-capacity trucks to disposal locations. The results of that study indicated that the long-term costs for solid waste disposal could be significantly decreased should a transfer facility be used for the municipally collected solid wastes. The transfer station was constructed and became operational in 1984, and has a maximum capacity of 320 tons per day. The facility has the capacity to handle anticipated solid waste quantities to the year 2000.

As already noted, the disposal of sludge generated by the City of Kenosha wastewater treatment plant and the other publicly owned sewage treatment facilities in the County is an important concern within the County. Prior to 1984, sludge generated at the City of Kenosha treatment plant was disposed of primarily by spreading it on agricultural lands. The enactment of state regulations regarding groundwater protection in 1984 necessitated that alternative means of disposal be investigated. Since 1984, sludge from the treatment plant has been disposed of primarily by landfilling at the Waste Management of Wisconsin, Inc., Pheasant Run landfill, and at the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois. The recently constructed City of Kenosha transfer station was designed with sufficient capacity to handle not only all residential and some commercial refuse generated in the City, but also sewage sludge produced at the city sewage treatment plant. The other public sewage treatment facilities in the County continue to dispose of sludge by land spreading it. Because of the relatively small amounts of material generated, it is not difficult to find suitable sites for such land spreading.

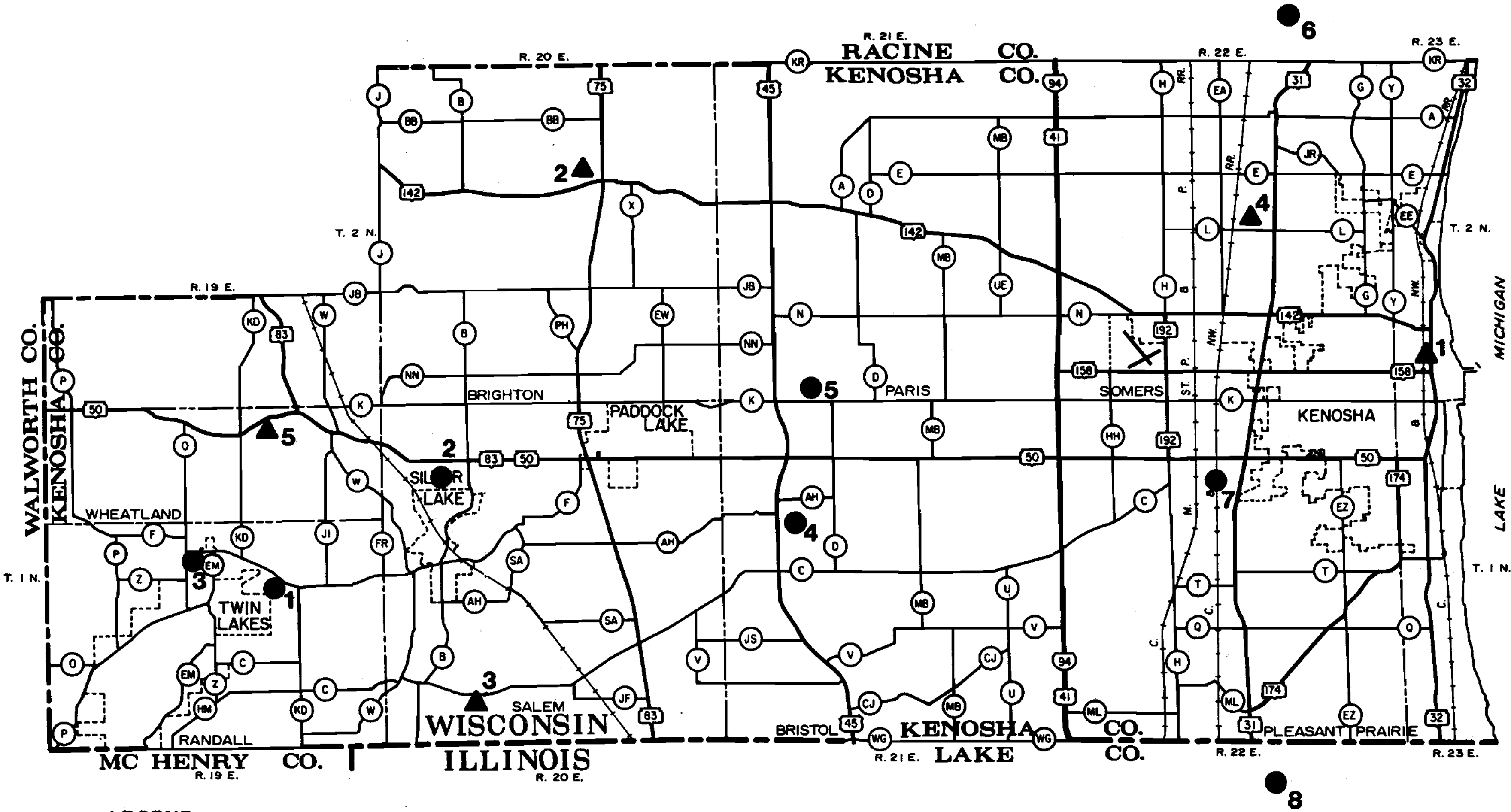
## EXISTING SOLID WASTE MANAGEMENT FACILITIES

Solid waste generated in Kenosha County is presently disposed of primarily at two licensed sanitary landfills located in Racine and Kenosha Counties, and at one additional landfill located in Lake County, Illinois. In addition, there are two public general-use landfills, one public special-use landfill, and two private special-use landfills located within Kenosha County that are used for the disposal of solid wastes such as demolition debris, fly ash, and similar materials, as well as a limited amount of residential wastes. The location of these facilities is shown on Map 1, and pertinent characteristics of the facilities are presented in Table 1. Residential refuse from the City of Kenosha is presently transported to a transfer station located at the Waste Division garage at the intersection of 50th Street and 13th Avenue prior to transport to the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois.[5] In addition, transfer stations located in the Towns of Brighton, Salem, Somers, and Wheatland serve the residential refuse disposal needs of these towns. Limited amounts of residential solid waste are recycled. These efforts include the separation of white goods and other recyclable material such as motor oil. Considerable recycling of commercial and industrial solid waste also occurs. There are no publicly owned and operated incinerators in Kenosha County.

[5] In 1986, the City of Kenosha began transporting its solid waste to the Waste Management of Wisconsin Pheasant Run landfill in the Town of Paris.

## Map 1

### LANDFILLS AND TRANSFER STATIONS RECEIVING WASTES GENERATED IN KENOSHA COUNTY: 1984




**LEGEND**

- ● LANDFILL SITE
- ▲ TRANSFER STATION

TRANSFER STATION IDENTIFICATION

1. CITY OF KENOSHA
2. TOWN OF BRIGHTON
3. TOWN OF SALEM
4. TOWN OF SOMERS
5. TOWN OF WHEATLAND

LANDFILL SITE IDENTIFICATION

1. TOWN OF RANDALL
2. KENOSHA COUNTY HIGHWAY DEPARTMENT
3. VILLAGE OF TWIN LAKES
4. TOWN OF BRISTOL
5. WASTE MANAGEMENT INC.-PHEASANT RUN
6. LAND RECLAMATION, LTD.
7. WISCONSIN ELECTRIC POWER COMPANY-PLEASANT PRAIRIE
8. BROWNING AND FERRIS, INC.

Source: Wisconsin Department of Natural Resources and SEWRPC.

## Table 1

## LANDFILL SITES RECEIVING WASTES GENERATED IN KENOSHA COUNTY: 1984

| Owner/Operator | Location | Landfill Type | Estimated Site Life (years) | Remaining Capacity (cubic yards) | Available Contiguous Property for Expansion |
|---|---|---|---|---|---|
| Waste Management of Wisconsin, Inc. Pheasant Run Landfill | Section 32, T2N, R21E Town of Paris | Commercial General Use | 4[a] | 1,100,000 | Yes |
| Land Reclamation, Ltd., Landfill | Section 23, T3N, R22E Town of Mt. Pleasant | Commercial General Use | 12 to 33 | 4,000,000 | Yes |
| Browning and Ferris Industries, Inc., Landfill | Section 7, T46N, R12E Town of Benton Lake County, Illinois | Commercial General Use | 25 | 10,700,000 | Yes |
| Wisconsin Electric Power Company-Pleasant Prairie Landfill | Section 9, T1N, R22E Town of Pleasant Prairie | Private Special Use | 30 | 1,400,000 | No |
| Village of Twin Lakes Landfill | Section 16, T1N, R19E Village of Twin Lakes | Public Special Use | --[b] | 5,000 | No |
| Town of Randall Landfill | Section 23, T1N, R19E Town of Randall | Public General Use | --[c] | 25,000 | No |
| Town of Bristol Landfill | Section 17, T1N, R21E Town of Bristol | Public General Use | 5 | 22,500 | No |
| Kenosha County Highway Department Landfill[d] | Section 8, T1N, R20E Town of Salem | Private Special Use | 1 | 5,000 | No |

[a]In August 1987, the Department of Natural Resources had under review a feasibility study for an 8-acre expansion of the Pheasant Run landfill which would, upon approval, extend the life of the landfill to about 15 years.

[b]The Village of Twin Lakes has signed an agreement with the Wisconsin Department of Natural Resources to abandon this landfill by 1999. Presently, only limited amounts of solid wastes are disposed of at this site.

[c]The Town of Randall has signed an agreement with the Wisconsin Department of Natural Resources to abandon this landfill by 1999. Presently, nearly all of the residential solid wastes generated in the Town of Randall are disposed of at this site.

[d]This landfill was closed in 1984, with only limited amounts of refuse being disposed of at this site prior to closure.

Source: Wisconsin Department of Natural Resources and SEWRPC.

As already noted, sludge and grit and grease generated by the City of Kenosha wastewater treatment plant are presently disposed of at the Waste Management of Wisconsin, Inc., Pheasant Run landfill and at the Browning and Ferris landfill. The other publicly owned sewage treatment facilities in the County use land application for the disposal of sludge.

Present state solid waste policy generally prohibits the disposal of materials in landfills unless the solids content is 40 percent or more by weight. While the sludge generated at the City of Kenosha sewage treatment plant meets this criterion, the sludges generated by the other public sewage treatment plants in Kenosha County generally do not. Thus, there may be a limitation on the disposal of these other sludges in landfills. The adopted regional wastewater sludge management plan for southeastern Wisconsin recommended the use of sanitary landfills as a backup to land application for sludge disposal in Kenosha County. The new state solids content policy accentuates the importance of developing feasible methods for sludge disposal for the publicly owned sewage treatment plants in Kenosha County.

## LEGAL FRAMEWORK FOR AND CONCEPTS INVOLVED IN SOLID WASTE MANAGEMENT

### Legal Framework

Chapter NR 185 of the Wisconsin Administrative Code governs the development of comprehensive county solid waste management plans and establishes criteria for such plans. The definitions of three basic terms as defined in Chapter NR 185 are as follows:

- "Solid waste" means any garbage; refuse; sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility; and other discarded or salvageable material, including solid, liquid, semi-solid, or contained gaseous material resulting from industrial, commercial, mining, and agricultural operations, and from community activities. Solid waste, as described herein, does not include solid or dissolved material in domestic sewage, solid or dissolved materials in irrigation return flows or industrial discharges, which are point sources subject to permits under Chapter 147 of the Wisconsin Statutes, or source, special nuclear, or by-product material as defined under Section 140.52 of the Wisconsin Statutes. While this study will discuss the management requirements of septic tank wastes and holding tank wastes from onsite sewage disposal systems, the main focus of the report will not be directed toward these wastes.

  It should be noted that the above definition of solid waste is somewhat unclear with regard to sewage sludges, grease, and grit materials. The definition of solid waste is meant to include sewage sludge, grit and grease generated as a result of the treatment of sewage. However, solid materials contained within sewage prior to or during treatment at a wastewater treatment facility are not considered to be solid waste, but a constituent of the sewage, which is regulated under Chapter 147 of the Wisconsin Statutes.

- "Solid waste management" means the systematic administration of activities which provide for source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal of solid waste.

- "Solid waste management functions" means source reduction, source separation, storage, collection, transportation, transfer, processing, treatment, resource recovery, and disposal of solid waste.

### Concepts Involved in Solid Waste Management

Solid waste management includes all potential management steps, from generation to ultimate disposal. Solid waste management functions presently utilized in Kenosha County generally consist of storage at the point of generation; recycling principally by industrial generators but also on a limited basis by some municipalities and community organizations; collection, transfer, and transportation; and disposal at conventional landfills located within the County or in northern Illinois. Because of changing economic conditions and the relative value of materials commonly found in solid wastes, and owing to the increasing costs of disposal of such wastes and limited landfill capacities, processing to recover certain elements of the waste stream and reduce the bulk and overall volume of the solid waste materials may be expected to become more viable. Additional management steps which can be considered are source reduction, source separation, processing, treatment, and resource recovery.

Source Reduction: Source reduction involves policies that are designed to reduce the consumption of materials in order to reduce the generation of solid wastes. An example of this solid waste management function is the enactment of special legislation to restrict the production of nonreturnable containers for soft drinks and beer. Source reduction for commercial or industrial operations may include the modification of an operation or process to more effectively control the amount of waste.

Source Separation: Source separation is the pre-collection form of resource recovery which may include the removal of certain materials such as newspaper, glass, waste oil, and metal beverage containers. The success of a source separation program is heavily dependent on public participation. For commercial and industrial users, source separation may be employed to remove certain materials that are not suited for the general waste stream, such as bulky materials or toxic and hazardous wastes that require special handling and disposal. Source separation may also be considered a form of source reduction if the material can be separated and removed from the waste stream for reuse.

Storage, Collection, and Transportation: Storage of solid waste occurs prior to collection, but can also be practiced following collection at a transfer station prior to transport to the disposal site. The collection operation can be subdivided into two operations--collection and transportation. The collection operation consists of removing solid waste from the storage point at the place of generation. This operation begins when the collection vehicle leaves the garage, and includes all time spent on the route. The transportation operation starts when the collection vehicle departs for the disposal site from the point where the last container of solid waste is loaded, and includes the time spent at the disposal site. It also includes the time it takes after leaving the site to return to the first container on the next collection route. Therefore, the transportation unit operation includes the total round-trip travel time from the collection route to the disposal site.

Transfer: A transfer station is a facility where solid waste is received from relatively small collection vehicles, and stored and/or placed into larger, long-haul vehicles before being transported to the disposal site.

Processing and Treatment: Processing is a physical operation that is designed to reduce the amount of material, to improve its handling characteristics, or to improve its usefulness. Processing methods include classification of wastes, separation, baling, and shredding. Incineration is also sometimes classified as a processing operation. Treatment functions are generally considered to be biological or chemical processes, including such unit processes as composting and bioconversion.

Resource Recovery: Resource recovery can include low-technology recovery such as source separation, or post-collection recovery, which may consist of the recovery of newspapers, metals, or other materials prior to land disposal. Post-collection resource recovery most commonly refers to high-technology processes that are designed to extract marketable materials and combustible materials from the waste stream. One common by-product of a solid waste processing operation is refuse-derived fuel. Refuse-derived fuel is the combustible fraction of solid waste and is commonly co-fired with coal in conventional or modified boiler systems. Other by-products include ferrous and nonferrous metals and glass. Another less intensive post-collection resource recovery system is simply solid waste incineration with heat recovery. Less emphasis is placed on materials recovery; however, this system does significantly reduce the volume of solid waste to be disposed of in landfills, with significant heat recovery from combustible materials.

Disposal: Even under the most intense recovery process, there are still significant amounts of residual materials that must be disposed of in a solid waste landfill. Under a high-technology resource recovery system, it may be possible to extract up to 70 percent by weight of resource materials for heat recovery or materials recycling. The remaining solid waste material is typically well-suited for land disposal. Landfills, therefore, are an essential part of all solid waste disposal systems. When landfills are used in conjunction with the most economically feasible resource recovery program, the maximum use of suitable landfill sites can be achieved.

### Solid Waste Management Planning Steps

The solid waste management planning process applied in the Kenosha County study consisted of the following seven steps: development of a public participation program; formulation of objectives and standards; inventory and analyses of pertinent basic data; preparation of forecasts of solid waste management needs and available resources; development of alternative solid waste management plans; selection of the best management plans from among the alternatives; and preparation of plan implementation strategies. The format of the report, as set forth in the Table of Contents, is organized to conform with the order of presentation required in Chapter 185 of the Wisconsin Administrative Code.

## PURPOSE AND SCOPE

The development of a comprehensive solid waste management plan for Kenosha County is intended to provide an assessment of countywide solid waste management needs, and to develop a general strategy for meeting those needs, while providing for the protection of public health and the environment from the potential adverse effects of improper solid waste disposal. The plan is intended to identify the existing solid waste management facilities and practices within the County; to evaluate the capability of the existing facilities and practices to meet the existing and future needs; to evaluate alternative means for meeting the unmet needs; and to recommend the most cost-effective means for adoption and implementation. Particular attention is to be given in the planning effort to the disposal of sludge generated by the Kenosha wastewater treatment plant and the other publicly owned sewage treatment facilities within the County. The plan is also intended to identify the existing and potential roles of the various units and agencies of government operating within the County in the development of the most cost-effective and environmentally sound solid waste management system.

The planning area is defined by the boundaries of Kenosha County. The study, however, recognizes and considers the existing and potential transfer of solid wastes into and out of the County.

The solid wastes generated in Kenosha County can be classified by source as residential, commercial, and industrial. The planning effort requires determination of the relative contribution from each of these sources in order to assess the overall amounts and characteristics of the solid wastes to be processed and disposed of. Toxic and hazardous wastes were addressed in the study only to the extent necessary to ascertain the need for disposal.

The scope of the plan includes an inventory of existing solid waste generation rates, and of existing management facilities and operations. The inventory was conducted by mailing survey forms to all local units of government in the County, as well as to selected industrial, commercial, and institutional generators of solid waste. A telephone contact was made, where appropriate, to verify data and ensure a maximum return rate of survey information. Additional information was obtained by individual communication with the Wisconsin Department of Natural Resources, local units of government, and private landfill operators and solid waste collection services. Special areas of concern that were identified for study include the effects of seasonal population levels on the solid waste management requirements and the impact of solid waste loads from outside the County.

Implementation of a long-term, comprehensive, solid waste management plan for Kenosha County will require substantial public and private efforts and expenditures, as well as a commitment to the plan over a long period of time. A planning period covering up to the year 2010 has been chosen for the alternatives presented, recognizing that the service life or operational utility of certain elements of the management program may be considerably more or less than the planning period. A planning period of about 25 years is considered to be necessary so that local, county, and private concerns can effectively organize existing operations to meet future solid waste disposal needs. The study is further intended to provide an appropriate technical basis for and the suitable roles agents--both public and private--for implementing a technically sound, cost-effective, and environmentally responsible system for solid waste management.

In view of the 1980 census data, the land use inventory and analysis and the economic and population inventory and analysis will be based upon an approach termed "alternative futures." This approach attempts to deal with the uncertainty that currently exists about future conditions influencing public utility systems. Under this approach, the design, test, and evaluation of alternative systems is based upon a number of alternative futures which together define a range of possible future conditions, and which identify those facilities which will perform well under a wide range of conditions.

## SOLID WASTE MANAGEMENT OBJECTIVES

Planning is defined as a rational process for formulating and meeting objectives. The formulation of objectives is, therefore, an essential task which must be undertaken before plans can be prepared. To be useful in a comprehensive planning process, objectives not only must be logically sound, but must be related in a demonstrable and measurable way to alternative development proposals. Upon selection of sound objectives and subsequent development of appropriate alternative plans, a plan can be selected which best meets the agreed-upon objectives. The development of objectives for the countywide solid waste disposal plan was based upon the knowledge and experience of the members of the technical advisory committee directing the study, the membership of which is set forth on the inside front cover of this report.

The following objectives have been developed to provide the basic framework within which alternative solid waste management plans can be formulated:

1. The development of a solid waste management system which will effectively protect the public health and welfare and the quality of life within Kenosha County.

2. The development of a solid waste management system which will effectively protect the quality of the groundwater and surface water resources and minimize the possibility of pollution and depletion.

3. The development of a solid waste management system which will be properly related to the natural resources and which will enhance the overall quality of the environment in the County.

4. The development of a solid waste management system which will effectively serve existing and future land uses and promote implementation of sound land use planning concepts and zoning practices.

5. The development of a solid waste management system which will accommodate existing and future industrial and commercial development.

6. The development of a solid waste management system which will maximize the recovery and utilization of both material and energy resources contained in the solid waste stream.

7. The development of a solid waste management system which will be consistent with the waste management plans of adjoining counties and which will be adaptable to development of a regional solid waste management plan.

8. The development of a solid waste management system which will meet pertinent local, state, and federal regulations.

9. The development of a solid waste management system which will efficiently and effectively meet all of the other stated objectives at the lowest cost possible.

10. The development of a solid waste management system which will be flexible and readily adaptable to changing needs.

# Chapter II

# INVENTORY AND ANALYSIS

## INTRODUCTION

The man-made and natural features which together form the environment of Kenosha County are important considerations in solid waste management planning. The principal features of the County which are relevant to solid waste management planning are the population and employment levels, the land use patterns, the topography, the public utility and transportation systems, the geology and soils, the surface water and groundwater resources, the climate, and the location and extent of environmentally significant areas. An understanding of these features, in addition to a knowledge of the existing solid waste sources, the quantity and character of the solid wastes generated, the existing solid waste management systems, and related legal constraints, is essential to sound solid waste management planning.

This chapter describes the man-made and natural features of Kenosha County pertinent to solid waste management planning. The first section describes the County and its internal governmental boundaries. The second section describes the demographic and economic base of the County in terms of historic trends as well as existing conditions, providing pertinent data on the population size, distribution, and composition, and on employment levels and distribution. The third section describes the existing pattern of land use in the County. The fourth section describes the public utility and transportation systems of the County. The fifth section describes the spatial distribution, characteristics, and extent of those elements of the natural resource base which must be considered in the preparation and implementation of a solid waste management plan for the County. The sixth section describes the existing solid waste sources and the quantity and character of the solid wastes, while the seventh section describes the existing solid waste management systems operating within the County and the legal regulations governing the location and operation of those systems and their component parts.

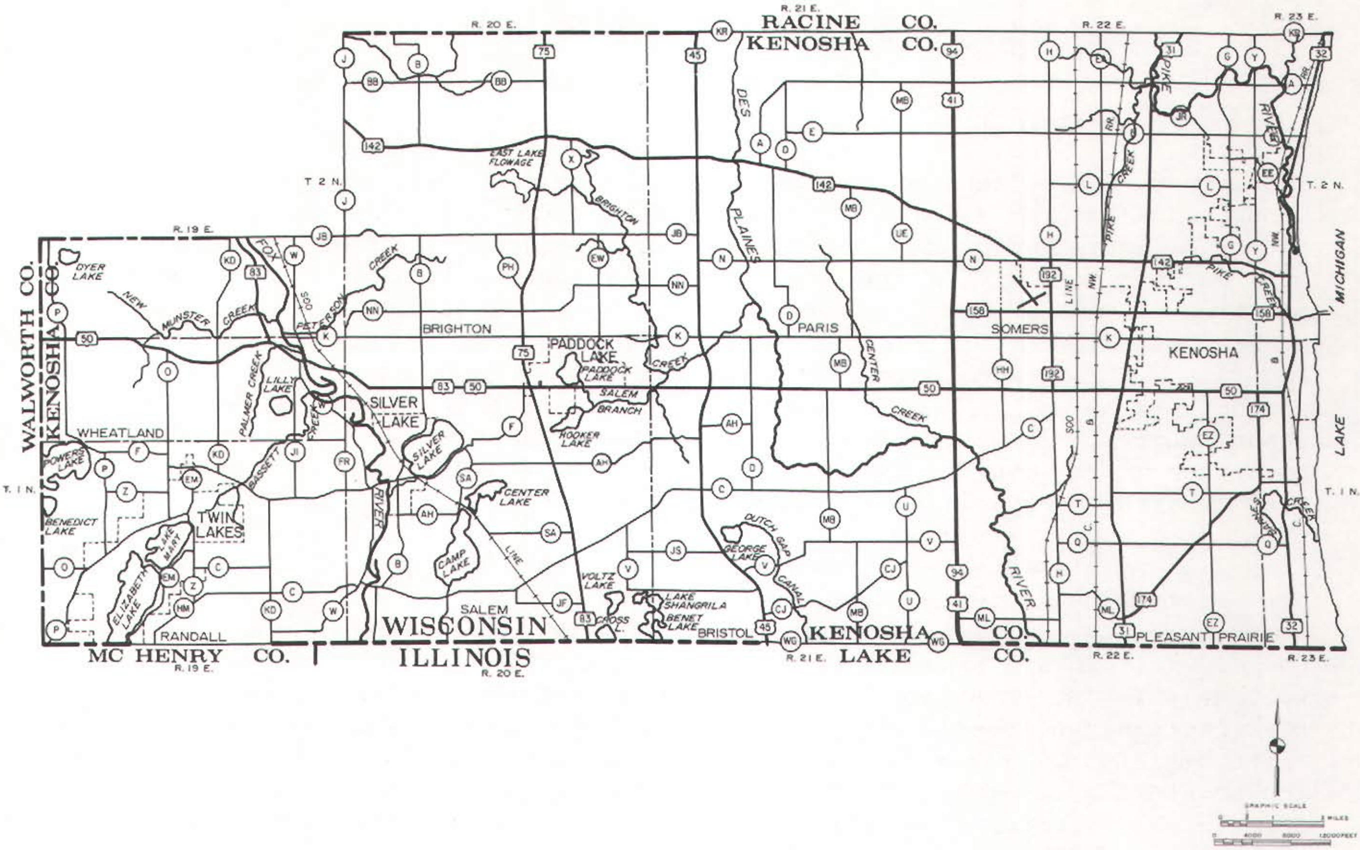
The principal sources of the basic data required for the study were the Southeastern Wisconsin Regional Planning Commission; the Kenosha County Office of Planning and Zoning Administration; the City of Kenosha Public Works Department; the public works departments of the other municipalities in Kenosha County; and selected industrial, commercial, and institutional generators of solid waste. Other sources of basic data were the Wisconsin Department of Natural Resources, the Wisconsin Department of Transportation, and the University of Wisconsin-Extension.

## GEOGRAPHIC SETTING AND POLITICAL BOUNDARIES

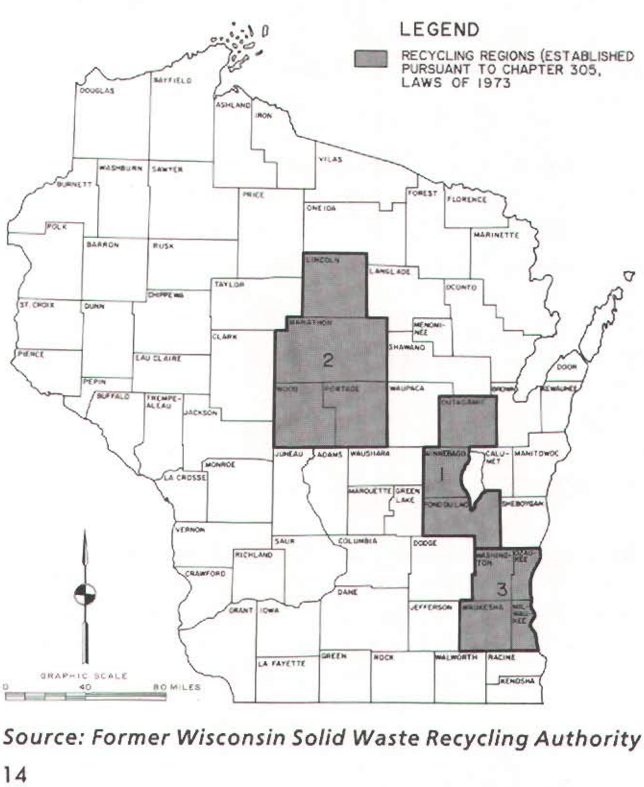
The geographic area considered in the Kenosha County solid waste management study was defined as all of Kenosha County. The study area thus encompassed 278.4 square miles, as shown on Map 2. Map 2 also shows the boundaries of other regional planning areas in the vicinity of Kenosha County and to the recycling authority regions established by the former Wisconsin Solid Waste Recycling Authority.

## Map 2

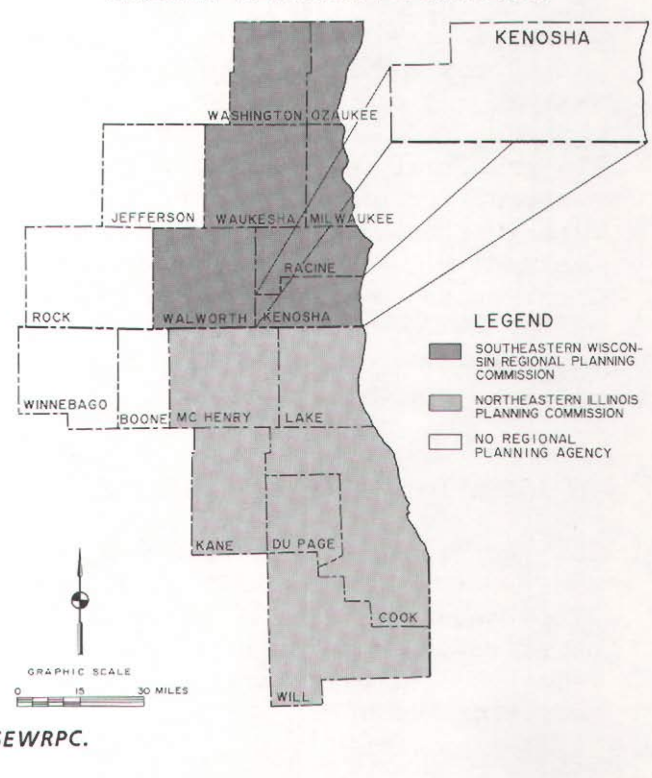
### KENOSHA COUNTY SOLID WASTE MANAGEMENT PLANNING AREA




### FORMER RECYCLING REGION LOCATIONS IN RELATIONSHIP TO KENOSHA COUNTY




### THE SOUTHEASTERN WISCONSIN REGION AND OTHER REGIONAL PLANNING AREAS ADJACENT TO KENOSHA COUNTY: 1988




*Source: Former Wisconsin Solid Waste Recycling Authority and SEWRPC.*

Kenosha County is located in southeastern Wisconsin and is part of the highly urbanized seven-county Southeastern Wisconsin Planning Region. The County is bounded on the east by Lake Michigan, which provides an ample supply of fresh water for both domestic and industrial use, and is also an integral part of a major international transportation network. The County is bounded on the south by the rapidly expanding northeastern Illinois metropolitan region and on the west by the fertile agricultural lands and desirable recreational areas of Walworth County. Racine County, an integral part of the greater Milwaukee area, forms the northern boundary of Kenosha County.

There are a total of 12 general-purpose local units of government within Kenosha County. These 12 units of government include one city, three villages, and eight towns. Presently, these 12 units of government are the primary public agencies responsible for solid waste management functions in the County. As shown in Table 2, the City of Kenosha occupies about 15.4 square miles, or 5.5 percent of the total area of the County, and the three villages together an additional 7.0 square miles, or 2.5 percent of the County. Thus, about 256 square miles of Kenosha County, or 92.0 percent of the total area of the County, is unincorporated.

Superimposed upon these local units and agencies of government are the state and federal governments. Certain agencies of these governments also have important responsibilities for solid waste management and these are described in a later section of this chapter, along with their legal authority and responsibilities. These include the Wisconsin Department of Natural Resources and the U. S. Environmental Protection Agency.

## DEMOGRAPHIC AND ECONOMIC BASE

Since the ultimate purpose of any solid waste management planning effort is to develop an environmentally sound solid waste management system to serve the residents of the planning area, an understanding of the size, characteristics, and spatial distribution of the resident population is basic to the planning effort. Resident population levels and associated commercial and industrial activity bear a direct relationship to the demand for solid waste collection, transportation, handling, and disposal services. The size and characteristics of the resident population of an area, as well as the types and quantities of solid waste generated, are greatly influenced by growth and change in economic activity. Population and economic activity must therefore be considered together.

As shown in Figure 1 and Table 3, from 1900 to 1980, the resident population of the County increased at a greater rate than that of the Southeastern Wisconsin Region as a whole, or of the State of Wisconsin as a whole. The distributions of resident population within the County by civil division for 1970 and 1980 are shown in Table 4. During that time period, the population of the County increased by about 5,220 persons, or 4.4 percent. The largest percentage increases in resident population between 1970 and 1980 occurred in the Villages of Twin Lakes and Paddock Lake, with increases of 52.6 percent and 50.1 percent, respectively. Decreases in resident population between 1970 and 1980 occurred in the Towns of Paris and Brighton, with decreases of 7.6 percent and 1.6 percent, respectively, and in the City of Kenosha, with a decrease of 1.4 percent.

## Table 2

### AREAL EXTENT OF MUNICIPALITIES IN KENOSHA COUNTY: 1980

| Civil Division | Land Area (square miles) | Percent of County Area |
|---|---|---|
| City of Kenosha............. | 15.4 | 5.5 |
| Village of Paddock Lake..... | 1.5 | 0.5 |
| Village of Silver Lake...... | 1.1 | 0.4 |
| Village of Twin Lakes....... | 4.4 | 1.6 |
| All Townships............... | 256.0 | 92.0 |
| Total | 278.4 | 100.0 |

Source: SEWRPC.

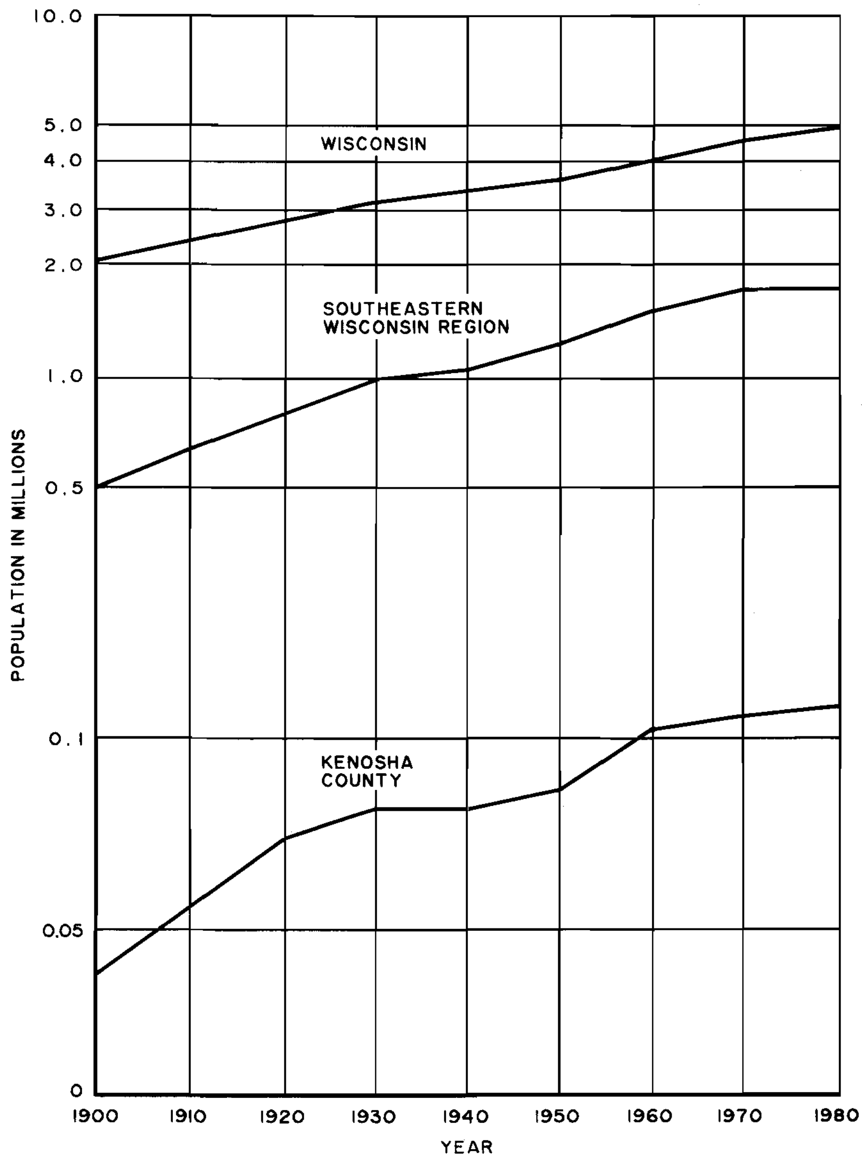
Seasonal population is another factor to be considered in any solid waste management planning effort for the County. Recreational opportunities, particularly in the southwestern portion of the County, result in a seasonal and weekend influx of people. In 1980, there were approximately 1,600 seasonal and migratory housing units in the County, with about 1,490, or 93 percent, located in the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and the Towns of Randall, Salem, and Wheatland. Solid waste quantities discussed later in this chapter take into consideration the waste generated by seasonal residents of the County.

In 1980, a total of 49,500 jobs were available in the County, as shown in Table 5. This was about 9,500 more jobs than were available in the County in 1970. This job increase of approximately 24 percent compares with a population increase of about 4 percent over the same period. Economic activity within the County consists of a complex combination of various employment categories, as shown in Table 5. As of 1980, those industries employing the largest percentage of county workers included manufacturing, employing 37 percent of the total work force in the County; services, about 17 percent; retail trade, about 16 percent; and government, about 9 percent of the total county work force. The proportion of workers in most of these categories is about the same as for the Region and the State as a whole. However, the percentage of workers employed in manufacturing--36.9 percent--is considerably higher than the comparable percentage for the Region--29.6 percent--or the State--24.8 percent.

Per capita income in the County increased from $3,070 in 1970 to $7,760 in 1980, an increase of 153 percent, as measured in real dollars. In terms of constant dollars, this increase is about 26 percent. This per capita income for Kenosha County compares with a 1980 per capita income of $8,154 and $7,243 for the Southeastern Wisconsin Region and the State of Wisconsin, respectively. It should be noted that this increase in average per capita income reflects not only an increase in the earnings of the heads of each household, but also the tendency for additional household members to work to supplement the family income. The 153 percent increase in per capita income in the County may be compared to an increase of about 121 percent in the cost of living over this same time span, as measured by the consumer price index prepared by the U. S. Bureau of Labor Statistics.

Figure 1

POPULATION LEVELS IN KENOSHA COUNTY, SOUTHEASTERN WISCONSIN, AND THE STATE OF WISCONSIN: 1900-1980




Source: SEWRPC.

## LAND USE AND ZONING

The type, intensity, and spatial distribution of the various land uses comprising the planning area are important determinants of the solid waste management needs of that area. The amounts of land devoted to each of the various land uses in Kenosha County in 1975 and 1980 are set forth in Table 6. Map 3 shows the land use pattern of Kenosha County in 1980, including the principal residential, commercial, industrial, transportation, governmental, institutional, and recreational land use concentrations and the remaining rural land uses in the County. In 1980, urban land uses comprised about 49 square miles in Kenosha County, or about 17 percent of the total area of the County. This represents an increase of about three square miles, or 6.5 percent, from 1975 to 1980.

## Table 3

### RESIDENT POPULATION TRENDS IN KENOSHA COUNTY, SOUTHEASTERN WISCONSIN, AND THE STATE OF WISCONSIN: 1900-1980

| Year | Population | | | County Population as a Percent of | |
|---|---|---|---|---|---|
| | Kenosha County | Southeastern Wisconsin | Wisconsin | Southeastern Wisconsin | Wisconsin |
| 1900 | 21,707 | 501,808 | 2,069,042 | 4.3 | 1.0 |
| 1930 | 63,277 | 1,006,118 | 2,939,006 | 6.3 | 2.1 |
| 1960 | 100,615 | 1,573,620 | 3,952,771 | 6.4 | 2.5 |
| 1970 | 117,917 | 1,756,086 | 4,417,933 | 6.7 | 2.7 |
| 1980 | 123,137 | 1,764,919 | 4,705,335 | 7.0 | 2.6 |

Source: U. S. Bureau of the Census, Wisconsin Department of Administration, and SEWRPC.

## Table 4

### POPULATION IN KENOSHA COUNTY BY CIVIL DIVISION: 1970 AND 1980

| Civil Division | Population | | Change 1970-1980 | |
|---|---|---|---|---|
| | 1970 | 1980 | Number | Percent |
| City | | | | |
| Kenosha........... | 78,805 | 77,685 | -1,120 | -1.4 |
| Villages | | | | |
| Paddock Lake...... | 1,470 | 2,207 | 737 | 50.1 |
| Silver Lake....... | 1,210 | 1,598 | 388 | 32.1 |
| Twin Lakes........ | 2,276 | 3,474 | 1,198 | 52.6 |
| Towns | | | | |
| Brighton ......... | 1,199 | 1,180 | -19 | -1.6 |
| Bristol........... | 2,740 | 3,599 | 859 | 31.3 |
| Paris............. | 1,744 | 1,612 | -132 | -7.6 |
| Pleasant Prairie.. | 12,019 | 12,703 | 684 | 5.7 |
| Randall........... | 1,582 | 2,155 | 573 | 36.2 |
| Salem............. | 5,555 | 6,292 | 737 | 13.3 |
| Somers............ | 7,270 | 7,724 | 454 | 6.2 |
| Wheatland......... | 2,047 | 2,908 | 861 | 42.1 |
| County | | | | |
| Kenosha........... | 117,917 | 123,137 | 5,220 | 4.4 |

Source: U.S. Bureau of the Census and SEWRPC.

Residential land use was the predominant urban land use in 1980, constituting about 24 square miles, or 49 percent of the urban land uses and about 9 percent of all land uses in the County. Transportation land use was the next most predominant urban land use, constituting about 15 square miles, or 31 percent of the urban land uses and about 5 percent of all land uses in the County. The remaining urban land uses--commercial, industrial, governmental and institutional, recreational, and unused urban--together made up about 10 square miles, or 20 percent of urban land uses and about 3 percent of the total land uses in the County. Rural land uses predominated, occupying about 230 square miles, or

Table 5

INDUSTRY EMPLOYMENT BY PLACE OF WORK IN KENOSHA COUNTY, SOUTHEASTERN WISCONSIN, AND WISCONSIN: 1970 AND 1980

| Major Employment Category | 1980 Employment by Place of Work | | | | | |
|---|---|---|---|---|---|---|
| | Kenosha County | | Region | | Wisconsin | |
| | Number | Percent | Number | Percent | Number | Percent |
| Agriculture | 1,410 | 2.8 | 12,818 | 1.5 | 156,648 | 7.0 |
| Construction | 2,578 | 5.2 | 25,816 | 2.9 | 70,062 | 3.1 |
| Manufacturing | 18,250 | 36.9 | 261,754 | 29.6 | 560,200 | 24.8 |
| Transportation, Communication, and Utilities | 1,530 | 3.1 | 39,610 | 4.5 | 92,625 | 4.1 |
| Wholesale Trade | 907 | 1.8 | 43,454 | 4.9 | 95,946 | 4.3 |
| Retail Trade | 7,769 | 15.7 | 131,866 | 14.9 | 341,240 | 15.1 |
| Finance, Insurance, and Real Estate | 1,002 | 2.0 | 46,403 | 5.3 | 96,578 | 4.3 |
| Services | 8,245 | 16.7 | 177,971 | 20.1 | 384,043 | 17.0 |
| Government[a] | 4,675 | 9.4 | 95,736 | 10.8 | 297,972 | 13.2 |
| Nonfarm Proprietors | 2,852 | 5.8 | 46,191 | 5.2 | 150,995 | 6.7 |
| Miscellaneous[b] | 282 | 0.6 | 2,526 | 0.3 | 9,984 | 0.4 |
| Total Jobs | 49,500 | 100.0 | 884,145 | 100.0 | 2,256,293 | 100.0 |

| Major Employment Category | 1970 Employment by Place of Work | | | | | |
|---|---|---|---|---|---|---|
| | Kenosha County | | Region | | Wisconsin | |
| | Number | Percent | Number | Percent | Number | Percent |
| Agriculture | 1,331 | 3.3 | 11,939 | 1.6 | 150,844 | 8.2 |
| Construction | 1,251 | 3.1 | 27,172 | 3.6 | 65,480 | 3.6 |
| Manufacturing | 16,440 | 41.1 | 252,318 | 33.5 | 504,184 | 27.5 |
| Transportation, Communication, and Utilities | 1,263 | 3.2 | 36,739 | 4.9 | 81,227 | 4.4 |
| Wholesale Trade | 609 | 1.5 | 35,226 | 4.7 | 67,180 | 3.7 |
| Retail Trade | 6,144 | 15.3 | 115,741 | 15.4 | 270,748 | 14.7 |
| Finance, Insurance, and Real Estate | 659 | 1.6 | 32,759 | 4.3 | 61,636 | 3.4 |
| Services | 5,752 | 14.4 | 119,547 | 15.9 | 256,248 | 13.9 |
| Government[a] | 4,290 | 10.7 | 83,329 | 11.0 | 250,688 | 13.6 |
| Nonfarm Proprietors | 2,269 | 5.7 | 37,193 | 4.9 | 123,324 | 6.7 |
| Miscellaneous[b] | 22 | 0.1 | 1,740 | 0.2 | 6,087 | 0.3 |
| Total Jobs | 40,030 | 100.0 | 753,743 | 100.0 | 1,837,696 | 100.0 |

[a]Excludes armed forces.

[b]Includes agricultural services, forestry, commercial fishery, mining, and jobs held by residents of the County working for international organizations.

Source: SEWRPC.

about 83 percent of the total area of the County in 1980. The predominant rural land use was agricultural, encompassing about 168 square miles, or about 73 percent of the rural land uses and about 60 percent of all the land uses in the County. The remaining rural land uses--surface waters, wetlands, woodlands, and other open land--made up about 62 square miles, or 27 percent of the rural land uses and about 23 percent of all land uses in the County.

## Table 6

## LAND USE IN KENOSHA COUNTY: 1975 AND 1980

| Land Use Category | 1975 Acres | 1975 Percent of Subtotal | 1975 Percent of County | 1980 Acres | 1980 Percent of Subtotal | 1980 Percent of County |
|---|---|---|---|---|---|---|
| Urban | | | | | | |
| Residential[a] ........ | 13,936 | 47.8 | 7.8 | 15,128 | 48.6 | 8.5 |
| Commercial........... | 526 | 1.8 | 0.3 | 593 | 1.9 | 0.3 |
| Industrial[b].......... | 836 | 2.9 | 0.5 | 888 | 2.9 | 0.5 |
| Transportation[c] ..... | 9,046 | 31.0 | 5.1 | 9,639 | 31.0 | 5.4 |
| Governmental and Institutional... | 1,265 | 4.3 | 0.7 | 1,295 | 4.2 | 0.7 |
| Recreational[d]........ | 2,376 | 8.1 | 1.3 | 2,456 | 7.9 | 1.4 |
| Unused Urban......... | 1,200 | 4.1 | 0.7 | 1,103 | 3.5 | 0.6 |
| Urban Subtotal | 29,185 | 100.0 | 16.4 | 31,102 | 100.0 | 17.4 |
| Rural | | | | | | |
| Agricultural......... | 108,792 | 73.1 | 61.1 | 107,301 | 73.0 | 60.2 |
| Surface Water........ | 4,777 | 3.2 | 2.7 | 4,826 | 3.3 | 2.7 |
| Wetlands............. | 15,823 | 10.6 | 8.9 | 15,612 | 10.6 | 8.8 |
| Woodlands............ | 9,705 | 6.5 | 5.4 | 9,572 | 6.5 | 5.4 |
| Other Open Lands[e] ... | 9,862 | 6.6 | 5.5 | 9,761 | 6.6 | 5.5 |
| Rural Subtotal | 148,959 | 100.0 | 83.6 | 147,072 | 100.0 | 82.6 |
| Total[f] | 178,144 | -- | 100.0 | 178,174 | -- | 100.0 |

[a]Includes residential areas under development.

[b]Includes wholesaling and storage.

[c]Includes off-street parking, airports, terminals, communication facilities, and utilities.

[d]Consists of intensively used outdoor recreation lands.

[e]Includes extractive uses, landfills, and unused lands.

[f]The difference between the 1975 and 1980 totals is due to the addition of a 30-acre landfill south of the Kenosha harbor area.

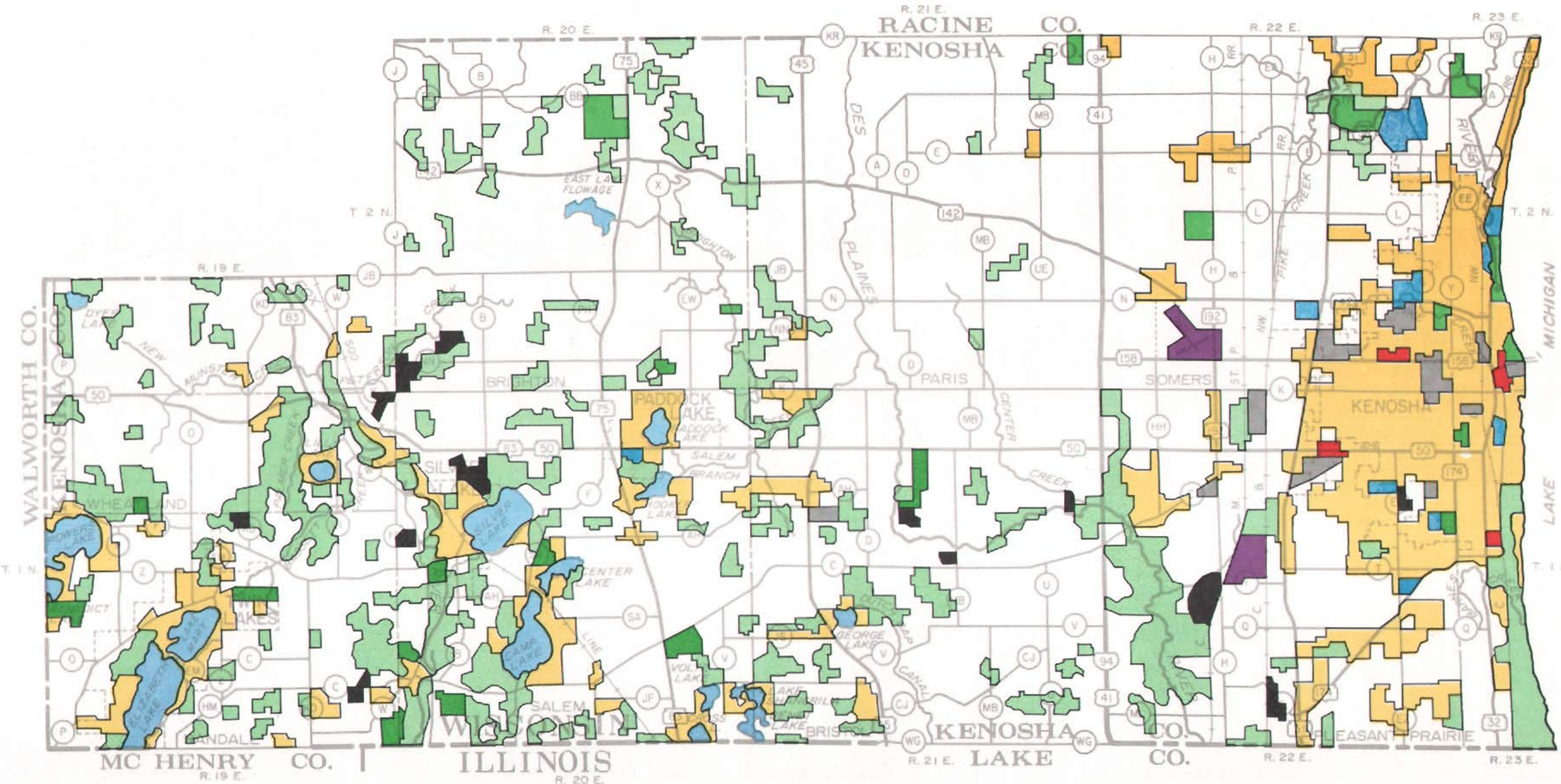
Source: SEWRPC.

The County follows sound land use zoning practices to preserve prime agricultural lands, protect significant environmental features, and direct urban growth to the areas of the County most suitable for such growth. The County zoning ordinance is a particularly important consideration in the detailed siting of solid waste management facilities.

Two county zoning ordinances were adopted by the Kenosha County Board of Supervisors in May 1983, a shoreland zoning ordinance and a comprehensive zoning ordinance. Both ordinances apply only in the unincorporated areas of the County. The special-purpose shoreland zoning ordinance applies to lands within 1,000 feet of a lakeshore, and to all lands lying within 300 feet of all navigable streams, or within the limits of the floodlands along the streams, whichever is greater. It contains special regulations to protect the shoreland areas. This ordinance became effective upon adoption by the County Board, since State law does not provide for Town Board ratification of shoreland zoning ordinances. The comprehensive zoning ordinance of the County applies to

## Map 3

### EXISTING LAND USE IN KENOSHA COUNTY: 1980




LEGEND

PREDOMINANT LAND USE

- RESIDENTIAL
- COMMERCIAL
- INDUSTRIAL
- EXTRACTIVE AND LANDFILL
- TRANSPORTATION, COMMUNICATION AND UTILITIES
- GOVERNMENTAL AND INSTITUTIONAL
- WOODLAND AND WETLAND
- PARK
- MAJOR LAKE
- AGRICULTURAL AND OPEN LAND

Source: SEWRPC.

the unincorporated areas of the County lying outside the shoreland area. This ordinance requires Town Board ratification in addition to County Board adoption to be effective in any given area of the County. To date, four of the eight towns in Kenosha County--Pleasant Prairie, Randall, Somers, and Wheatland--have ratified this ordinance. The Towns of Paris and Salem have adopted their own zoning ordinances, and the Towns of Brighton and Bristol have no zoning ordinance in effect. Land use development and redevelopment in the City of Kenosha and in the three incorporated villages is regulated by local zoning ordinances.

The two county zoning ordinances seek to regulate land use development and redevelopment, particularly the conversion of land from rural to urban uses, in the public interest. The ordinances seek to protect the rich natural resource base of the County, particularly the prime agricultural lands and primary environmental corridors. To accomplish these goals, several districts and associated requirements are provided. A listing of those zoning districts, together with a summary of the regulations applicable in each district, is provided in Appendix B. Detailed maps, at a scale of 1 inch equals 1,000 feet, delineating the boundaries of the zoning districts are on file at the County Office of Planning and Zoning Administration. The zoning ordinance includes an M-3 Mineral Extraction and Landfill District designed to accommodate sanitary landfill sites and other waste disposal facilities such as incinerators.

Land application of sewage treatment plant sludge is regulated by Kenosha County under the Kenosha County Sanitary Code and Private Sewage System Ordinance. The ordinance establishes criteria for the disposal of treated or partially treated sludge from public or private wastewater treatment plants or from private sewage disposal systems. As noted in Chapter IV, these criteria were used in the conduct of the sludge disposal siting analysis under this study.

Chapter NR 117 of the Wisconsin Administrative Code requires the zoning of shoreland-wetlands within incorporated areas following receipt of final wetland maps by the respective communities from the Wisconsin Department of Natural Resources. Such zoning has not as yet been exercized in any of the municipalities within the County, but will have to be in the near future. The establishment of zoning in the applicable wetland areas will preclude the location of solid waste management facilities in such areas.

## PUBLIC UTILITY AND TRANSPORTATION SYSTEMS

### Public Utility Base

Urban development is highly dependent upon public utility systems which serve land uses with power, light, communications, heat, water, and sewerage. Of particular importance to solid waste management planning is the sanitary sewerage system, because treatment facilities generate solid waste in the form of sludge, and because solid waste landfill siting requires consideration of leachate treatment and disposal which may involve conveyance to a municipal sewage treatment plant. The location and source of water supply systems is also a consideration in evaluating landfill sites in the County because of the potential for landfills to pollute the groundwater, thus precluding the use of that source for a good supply.

Sanitary Sewerage Facilities: There were 11 public sewage treatment plants in Kenosha County in 1985.[1] In addition, there were eight private sewage treatment plants serving isolated enclaves of urban development, commercial and industrial wastewater generators, and recreational facilities within the County. The public sanitary sewerage systems in Kenosha County together served an area of about 30.2 square miles, or about 10.8 percent of the total area of the County. The existing public sanitary sewerage service areas, together with the locations of the existing public and private sewage treatment facilities within the County, are shown on Map 4.

Water Utilities: There were five public water utilities in Kenosha County in 1985, serving a combined area of about 22.3 square miles, or about 8.0 percent of the county area, and a resident population of about 88,200 persons, or 72.6 percent of the county population. The names and locations of these public water utilities are shown on Map 5. In addition to publicly owned water utilities, there were 22 special-purpose water systems in operation in Kenosha County providing water supply service on a limited basis to isolated enclaves of urban development. The names and locations of these special-purpose water systems are also shown on Map 5. These special-purpose water systems serve about one square mile, or less than 1 percent of the county area, and a resident population of about 5,100 persons, or about 4 percent of the county population.

Three of the five public utilities--Kenosha Water Utility, Somers Sanitary District No. 1, and a portion of the area served by the Town of Pleasant Prairie Water Utility--used Lake Michigan as their source of supply. The remaining two public water utilities--Paddock Lake Municipal Water Utility and Town of Bristol Water Utility--and a portion of the area served by the Town of Pleasant Prairie Water Utility used groundwater as their source of supply.

Gas and Electric Utilities: Natural gas service is provided to Kenosha County by the Wisconsin Natural Gas Company, whose service area includes that portion of the County east of IH 94, and by the Wisconsin Southern Gas Company, whose service area includes that portion of the County west of IH 94. The Wisconsin Electric Power Company provides electric power service throughout Kenosha County with the exception of the Town of Randall, the Village of Twin Lakes, and the southwesternmost portion of the Town of Wheatland, where electric power is supplied by the Wisconsin Power and Light Company. Generally, natural gas and electric power service is available on demand to serve residential, commercial, and industrial uses throughout the County. The availability of these services is not a major constraint on the location and intensity of urban development, and does not affect the analysis of alternative solid waste management facilities.

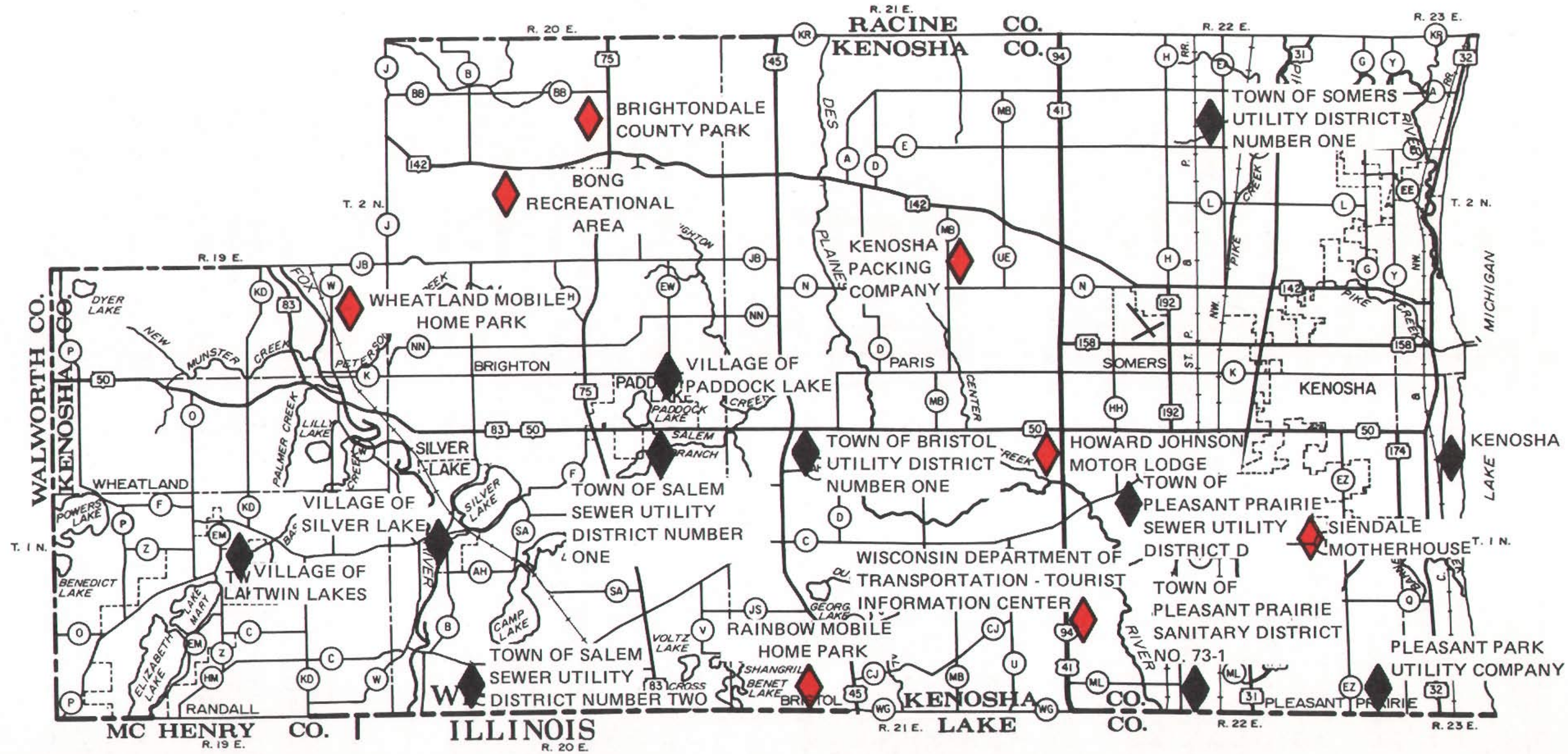
## Transportation Base

The transportation systems of the County have a direct impact on the cost-effectiveness and efficiency of alternative solid waste management plans. Although Kenosha County is served by intercity passenger bus and passenger and freight railway service, the highway system is the transportation network that is of the most direct concern in solid waste management planning. Kenosha

[1]Sewage from the area being served by the Town of Somers Utility District No. 1 sewage treatment plant is, as of July 1986, being conveyed to the Kenosha Water Utility sewage treatment plant. The Town of Somers sewage treatment plant was abandoned in 1986 and is no longer operational.

## Map 4

### PUBLIC AND SPECIAL-PURPOSE SEWAGE TREATMENT PLANTS IN KENOSHA COUNTY: 1985



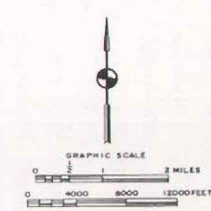

**LEGEND**

EXISTING PUBLIC SEWAGE TREATMENT PLANT

EXISTING SPECIAL-PURPOSE SEWAGE TREATMENT PLANT

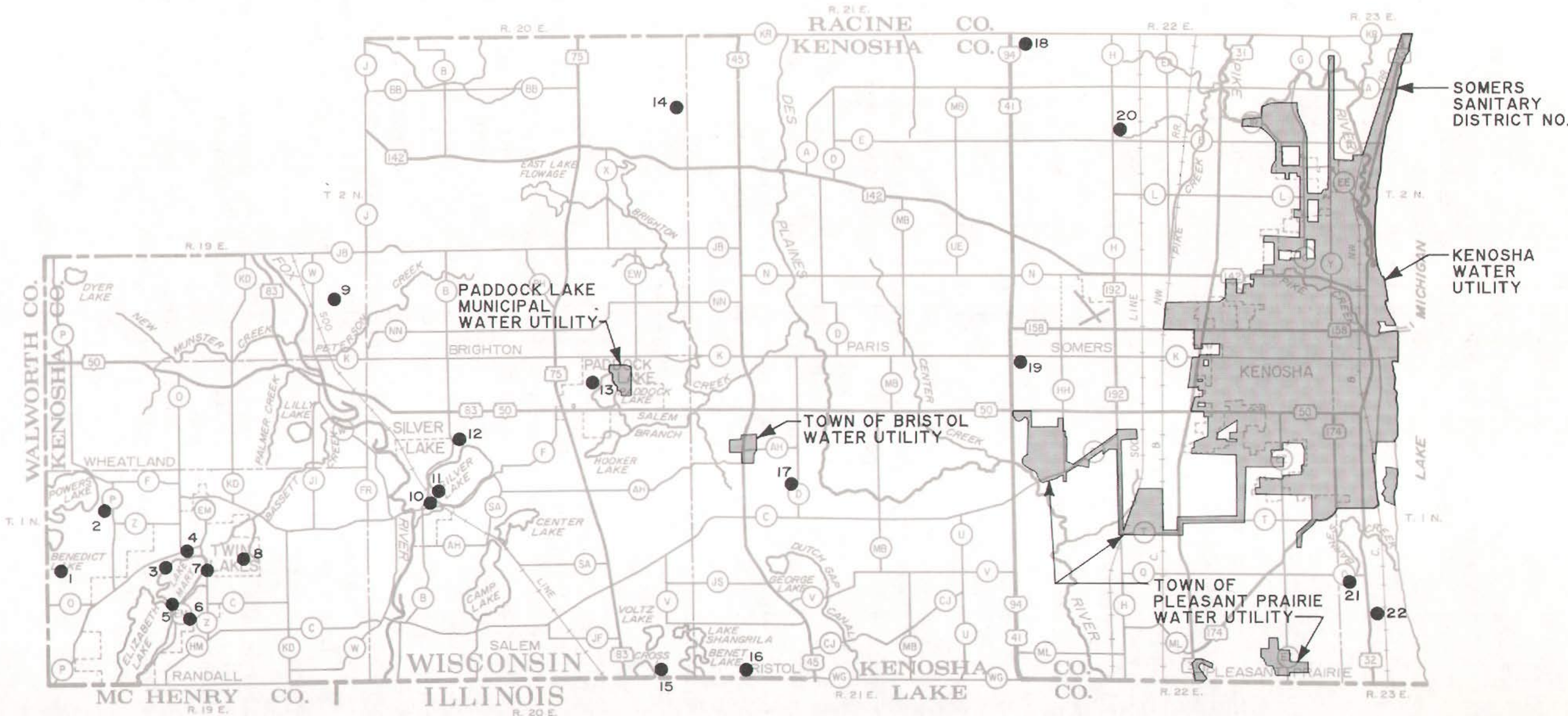
NOTE: As of July 1986, the Town of Somers Utility District No. 1 sewage treatment plant, was abandoned and sewage from that District is being conveyed to the City of Kenosha Sewerage system.

Source: Wisconsin Department of Natural Resources and SEWRPC.



## Map 5

## AREAS SERVED BY PUBLIC AND PRIVATE WATER UTILITIES IN KENOSHA COUNTY: 1985




LEGEND

AREA SERVED BY PUBLIC WATER UTILITY

LOCATION OF SPECIAL PURPOSE WATER SUPPLY SYSTEM

1 NIPPERSINK WATER TRUST
2 LAKE KNOLLS SUBSDIVISION
3 REGIS LANDING
4 CHATEAU DU LAC
5 TWIN LAKES WATER COOPERATIVE
6 VAN WOODS ESTATES
7 WYWOOD COOPERATIVE
8 COUNTRY CLUB TRAILS
9 WHEATLAND MOBILE HOME PARK
10 SILVER CREST APARTMENTS
11 LAKE CREST MOBILE HOME PARK
12 LAKEWOOD ESTATES MOBILE HOME PARK
13 GLEN WATER SYSTEM
14 SHADY NOOK TRAILER PARK
15 OAKWOOD KNOLLS SUBDIVISION
16 RAINBOW LAKE MANOR MOBILE HOME PARK
17 BRISTOL MOBILE HOME COURT
18 OAKDALE ESTATES MOBILE HOME PARK
19 PLEASANT PRAIRIE MOBILE HOME PARK
20 EAGLE CHATEAU APARTMENTS
21 KENOSHA MOBILE HOME COURT
22 CAROL BEACH WATER COMPANY

Source: SEWRPC.

County is served by a well-developed and well-maintained, all-weather arterial street and highway system. There were a total of 934 miles of streets and highways open to traffic in the County in 1984, with 329 miles, or 35 percent, functioning as arterial streets and highways. The jurisdictional classification of the arterial street and highway system in Kenosha County is shown on Map 6.

Two important variables in the configuration of any solid waste management system are the transportation distances and transportation times involved. These variables are dependent upon the allowable roadway loadings, vertical clearances, and roadway conditions, as well as upon pavement width and alignment. Careful evaluation of these conditions is necessary to minimize solid waste transportation costs.

The State of Wisconsin requires that vehicles not exceed an overall height of 13 feet 6 inches except for agricultural vehicles, or vehicles that have been granted a special permit. The design practices of the Wisconsin Department of Transportation provide for a minimum vertical clearance under structures carrying highway and railway facilities over state trunk highways and over highways directly interchanging with state trunk highways of 16 feet 3 inches, and a minimum vertical clearance for all other highways of 14 feet 9 inches.

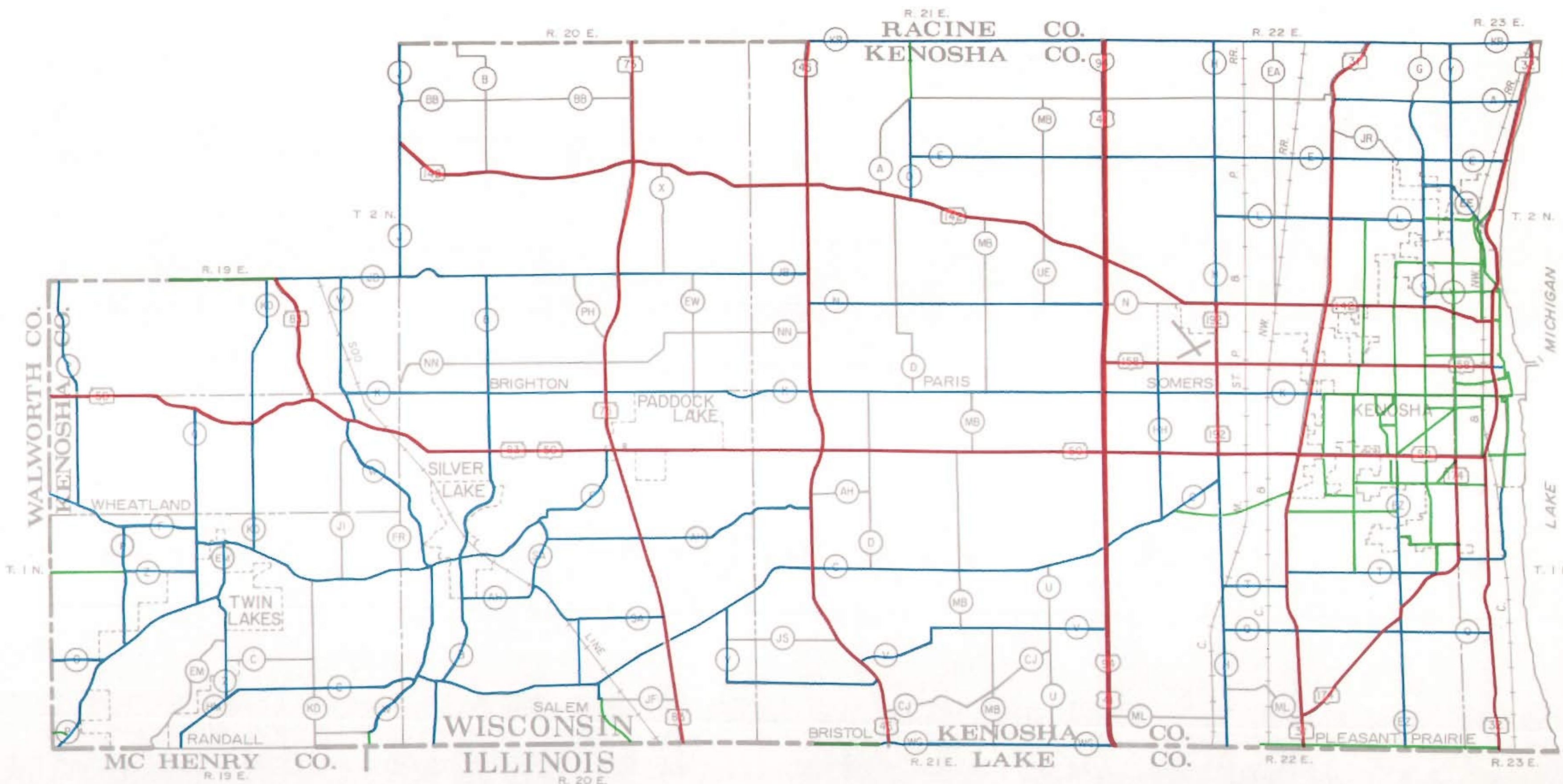
The vehicles used in the transportation of solid waste typically require a vertical clearance of about 13 feet 6 inches, with some special vehicles being somewhat higher and requiring a special permit. For the purpose of maintaining safe vertical clearance for the movement of solid waste transportation vehicles, a minimum height of 15 feet was selected as the height below which bridge clearances should be identified and reviewed further in selection of a solid waste disposal site. All bridges overpassing state trunk or county trunk highways with a vertical clearance of less than 15 feet are shown on Map 7. In addition, some bridges within the County have weight limitations for use. Such bridges on the state and county trunk systems are shown on Map 7. The actual vertical clearances and posted weight limitations, where applicable, are listed in Table 7.

Chapter 348.15 of the Wisconsin Statutes requires that vehicles operating on Class A state trunk or county trunk highways not exceed a gross weight of 10,000 pounds imposed on the highway by any one wheel or wheels supporting one end of an axle; 20,000 pounds by any one axle; and 80,000 pounds by all the axles of one vehicle. For Class B highways, it is required that the gross weight not exceed 60 percent of the limitations for Class A highways. Any motor vehicle whose operation is pick up or delivery may operate on a Class B highway if the gross weight imposed on the highway by the wheels of any one axle does not exceed 16,500 pounds, subject to the approval of the county highway commissioner or the county highway committee in the case of highways maintained by the county. The Class A and Class B state and county trunk highways in Kenosha County are shown on Map 7.

The State prohibits the operation of a vehicle in violation of special seasonal weight limitations imposed by state or local authorities. Special seasonal weight limitations during spring thaw are not routinely imposed on county trunk highways in Kenosha County. However, occasional imposition of such limits on county trunk highways could be a short-term, infrequent impediment to the transportation of solid wastes in large vehicles.

Map 6

JURISDICTIONAL CLASSIFICATION OF THE ARTERIAL STREET AND HIGHWAY SYSTEM IN KENOSHA COUNTY: 1984



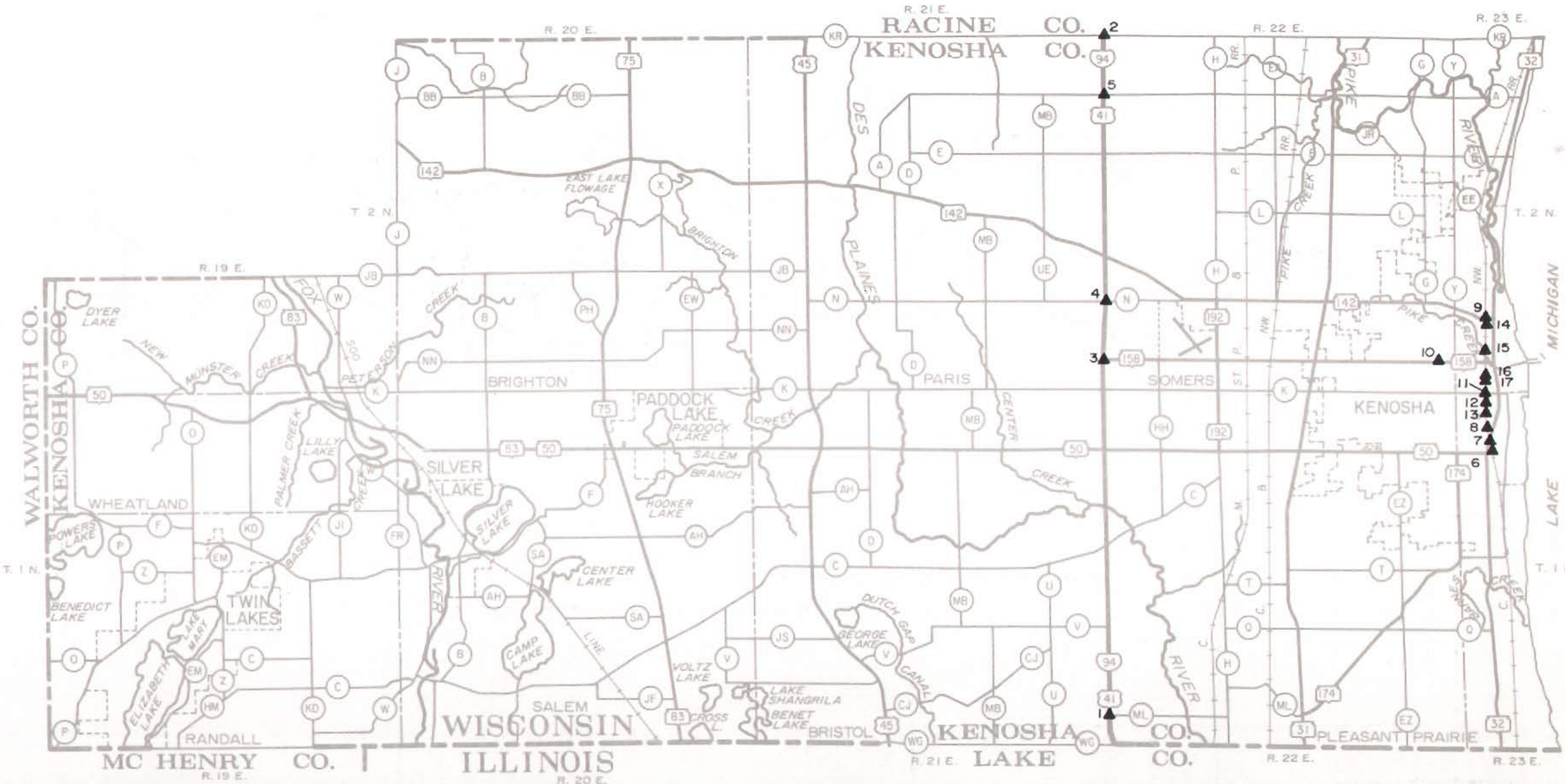

LEGEND

- STATE TRUNK ARTERIAL - FREEWAY
- STATE TRUNK ARTERIAL - NON FREEWAY
- COUNTY TRUNK ARTERIAL HIGHWAY
- LOCAL TRUNK ARTERIAL STREET OR HIGHWAY

Source: SEWRPC.

## Map 7

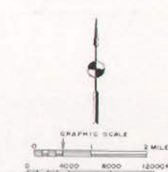
### BRIDGES OVERPASSING THE STATE OR COUNTY ARTERIAL SYSTEM IN KENOSHA COUNTY WITH A VERTICAL CLEARANCE OF LESS THAN 15 FEET: 1984




LEGEND

▲ LOCATION OF BRIDGES PROVIDING A VERTICAL CLEARANCE OF LESS THAN 15 FEET

5 IDENTIFICATION NUMBER (SEE TABLE 7)



Source: SEWRPC.

## Table 7

## STATE AND COUNTY ARTERIAL SYSTEM WITH OVERHEAD CLEARANCES OF 15 FEET OR LESS

| Number On Map 7 | Minimum Vertical Clearance | Direction | Minimum Vertical Clearance | Direction | Feature Under | Feature On |
|---|---|---|---|---|---|---|
| 1 | 14.50 | N | 15.17 | S | IH 94 - USH 41 | CTH ML |
| 2 | 14.17 | E | 14.17 | W | CTH KR | IH 94 - USH 41 |
| 3 | 14.50 | E | 14.50 | W | STH 158 | IH 94 - USH 41 |
| 4 | 14.50 | E | -- | -- | CTH N | IH 94 - USH 41 |
| 5 | 14.42 | E | 14.42 | W | CTH A | IH 94 - USH 41 |
| 6 | 13.67 | E | -- | -- | STH 50-75th Street | C&NW Railway |
| 7 | 14.00 | N | 14.00 | S | STH 32-Sheridan Road | C&NW Railway |
| 8 | 13.83 | E | -- | -- | 68th Street | C&NW Railway |
| 9 | 12.75 | E | 12.84 | W | STH 142-Washington Road | C&NW Railway |
| 10 | 14.00 | E | 14.92 | W | STH 158-52nd Street | AMC Walkway |
| 11 | 12.67 | E | 12.92 | W | 60th Street | C&NW Railway |
| 12 | 13.83 | E | -- | -- | 63rd Street | C&NW Railway |
| 13 | 13.83 | E | -- | -- | 65th Street | C&NW Railway |
| 14 | 13.00 | E | -- | -- | 43rd Street | C&NW Railway |
| 15 | 12.83 | E | 12.83 | W | 50th Street | C&NW Railway |
| 16 | 13.50 | E | 13.50 | W | 56th Street | C&NW Railway |
| 17 | 13.17 | E | -- | -- | 57th Street | C&NW Railway |

Source: Wisconsin Department of Transportation.

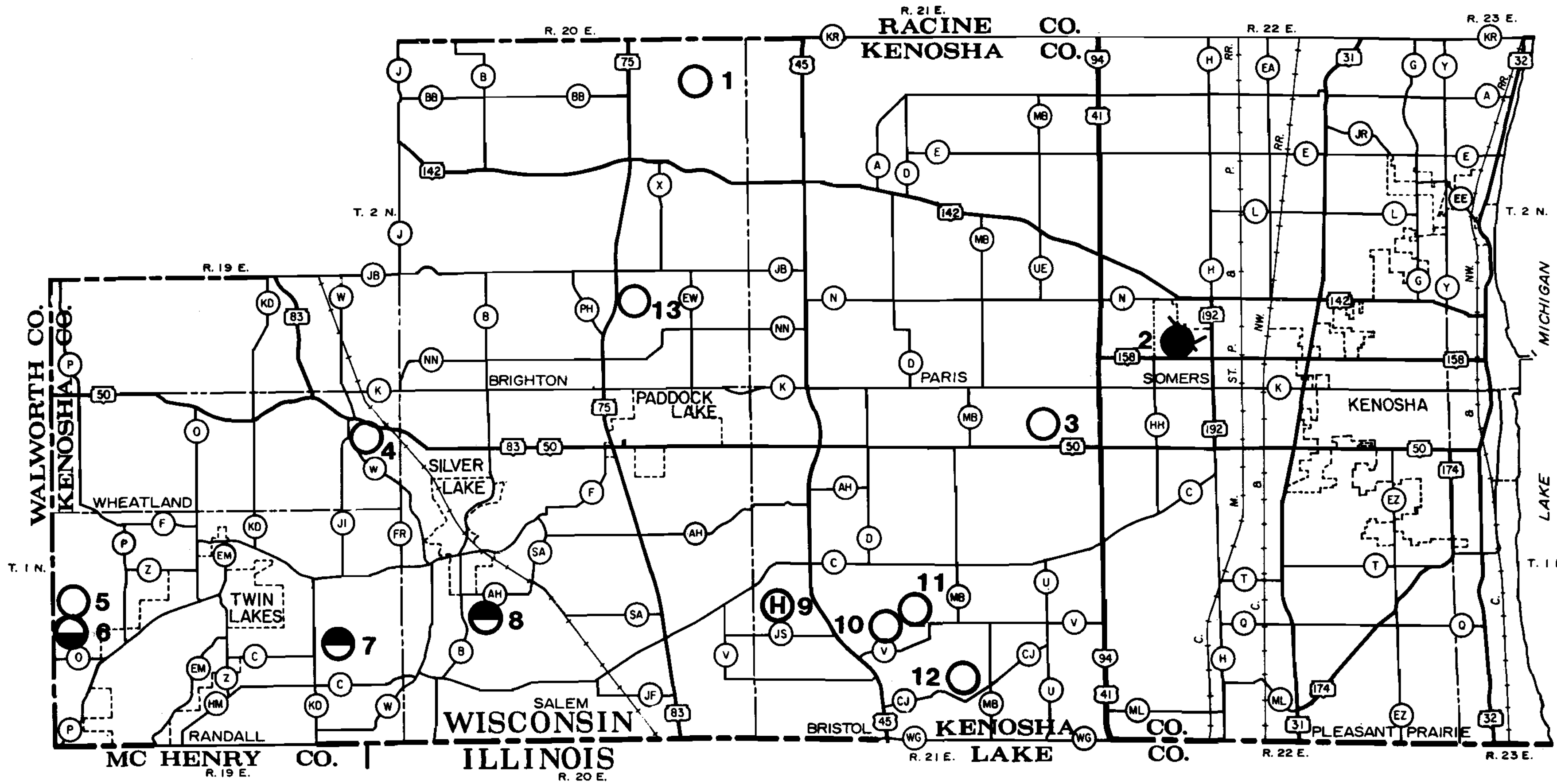
Solid waste vehicles generally haul 10,000- to 20,000-pound loads, with larger semi-trailer vehicles hauling up to 40,000-pound loads. Based on the weight restrictions noted above, there should be no constraint on the operation of the conventional two-axle packer truck with a gross weight of less than 40,000 pounds for Class A highways, and 24,000 pounds for Class B highways. Seasonal restrictions would reduce the maximum gross weight of a two-axle vehicle to 18,000 pounds. The gross weight of double tandem semi-trailers may not exceed 80,000 pounds or 48,000 pounds on Class A and Class B highways, respectively, and 28,000 pounds on roads under the Kenosha County special seasonal vehicle weight restrictions when seasonal weight limits are imposed.

### Airports

The present air transportation system in Kenosha County includes 13 airports, of which four are general aviation facilities open for use by the general public, with the remaining nine airports being restricted to private use. These airports are shown on Map 8. General aviation airports are intended to serve business, charter, and air taxi aircraft, as well as aircraft used for agricultural, recreational, sport, and training purposes. The largest general aviation airport in Kenosha County is the publicly owned Kenosha Municipal Airport. The regional airport plan, as documented in SEWRPC Planning Report No. 38,

## Map 8

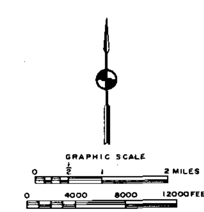
## EXISTING AIRPORTS IN KENOSHA COUNTY: 1984




### LEGEND

- PUBLIC USE AIRPORT-PUBLIC OWNERSHIP
- PUBLIC USE AIRPORT-PRIVATE OWNERSHIP
- PRIVATE USE AIRPORT-PRIVATE OWNERSHIP
- PRIVATE USE HELIPAD-PRIVATE OWNERSHIP

1. OLSON'S
2. KENOSHA MUNICIPAL
3. THOMPSON STRAWBERRY FARM
4. FOXEWOOD
5. VOLIDS
6. VINCENT
7. WESTOSHA
8. CAMP LAKE
9. WINDSONG INTERNATIONAL
10. WINFIELD
11. DUTCH GAP AIRSTRIP
12. ELFERING
13. TREFTC




Source: SEWRPC.

A Regional Airport System Plan for Southeastern Wisconsin: 2010, recommends that Kenosha Municipal Airport be operated as a General Utility-Stage II airport to accommodate turbojet-powered aircraft. This is the only airport in the County which presently serves such aircraft and which is proposed to accommodate such aircraft.

Chapter NR 180.13(3a) of the Wisconsin Administrative Code states that: "No person shall establish, construct, operate, maintain, or permit the use of property for a solid waste land disposal facility within 10,000 feet of any airport runway, used or planned to be used by turbojet aircraft, or within 5,000 feet of any airport runway used only by piston-type aircraft or within such other areas where a substantial bird hazard to aircraft would be created, unless a waiver is granted by the Federal Aviation Administration." This applies to all airports that are listed in the state and federal airport system plans.

This regulation was established to ensure that bird species that are typically attracted to, and gather at, landfill sites are kept away from airport traffic patterns and approaching and departing aircraft. Aircraft collision with birds has been shown to be a serious safety hazard. Turbo-powered aircraft are particularly susceptible to serious collision damage because of the sensitivity of the exposed engine turbine to foreign objects and the extreme dependence of such aircraft on engine thrust to maintain flight. Turbo-jet aircraft also generally require higher airport approach and departure speeds, increasing the potential severity of damage. The Wisconsin law is patterned after the Federal Aviation Administration regulation which recommends that similar buffer zones be maintained between landfills and airports for the safety of air traffic.

## Railways

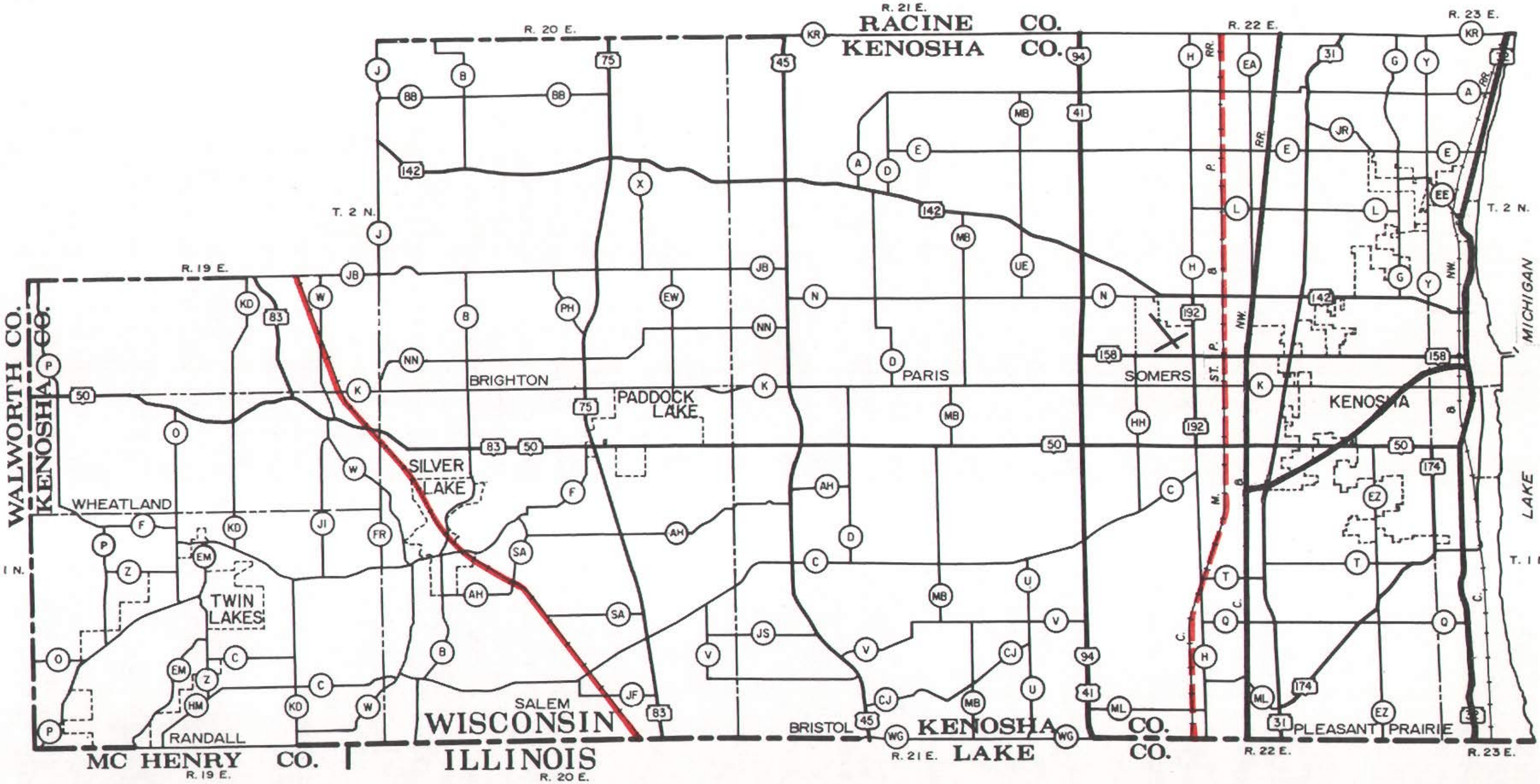
As of December 31, 1984, railway freight service in Kenosha County was provided by three railway companies operating over 60 miles of common carrier railway lines in the County. The Chicago & North Western Transportation Company (C&NW) operated in the eastern portion of the County over two north-south main lines in the Chicago-Milwaukee corridor, the first passing through the City of Kenosha and the second located just west of the City of Kenosha in the Towns of Somers and Pleasant Prairie. The C&NW also provided extensive switching service in and around the City and Port of Kenosha. The Chicago, Milwaukee, St. Paul & Pacific Railroad Company (Milwaukee Road)--recently acquired by the Soo Line--also operated over a north-south main line in the Chicago-Milwaukee corridor, located in the Towns of Somers and Pleasant Prairie. The Soo Line Railroad Company Chicago-Twin Cities main line passes through the western portion of the County, including the Town of Wheatland and the Village of Silver Lake. This railway freight system, as shown on Map 9, and attendant services facilitate the movement of commodities between Kenosha County and state, national, and international markets. Passenger service is provided over the Milwaukee Road by the National Railroad Passenger Corporation (Amtrak).

## Water Transportation Facilities

Bounded on the east by Lake Michigan, Kenosha County has ready access to a major international transportation system, the Great Lakes-St. Lawrence Seaway, which extends from the Great Lakes to the Gulf of St. Lawrence on the

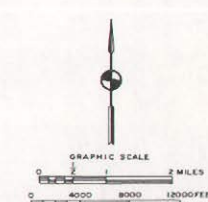
## Map 9

### COMMON CARRIER RAILWAY FREIGHT LINES IN KENOSHA COUNTY: 1984




**LEGEND**

- CHICAGO & NORTH WESTERN TRANSPORTATION COMPANY (C&NW)
- CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC RAILROAD COMPANY (MILW)
- SOO LINE RAILROAD COMPANY (SOO)




Source: SEWRPC.

Atlantic Ocean. Major harbor facilities, dockage, and heavy cargo-handling equipment are concentrated in the Port of Kenosha to handle both bulk and containerized shipments. These facilities may be an important consideration in the evaluation of solid waste management alternatives because of the potential reduced transportation costs associated with the transport or receipt of recyclable materials, refuse-derived fuel, or other materials associated with solid waste management.

## NATURAL RESOURCE BASE

The natural resource base is a primary determinant of the continued development potential of the County, as well as of its ability to provide a pleasant and habitable environment for all forms of life. The principal elements of the natural resource base which are related to solid waste management planning are climate, topography, geology, soils, vegetation, fish and wildlife, and water resources. Without a proper understanding and recognition of these elements and of their interrelationships, human use and alteration of the natural environment proceeds at the risk of excessive costs in terms of both monetary expenditures and destruction of nonrenewable or slowly renewable resources.

### Climate

Climate, especially the extreme variations in the three principal elements of climate--temperature, precipitation, and snow cover--directly affects the selection, construction, operation, and cost of solid waste management facilities. However, the range of conditions which occur in Kenosha County is sufficiently small that the siting of facilities would not be affected.

Climate does have an impact on the operation of landfills. Snow removal requirements for access, low temperatures which affect heavy equipment operation, and potential frost penetration of soils make winter the most difficult season for operations. During warm weather, dry periods require dust control for access roads and landfill surfaces. A knowledge of the prevailing wind conditions is necessary for good sanitary landfill design and operation, since wind will affect dust distribution and may also require measures for the control of blowing paper and other debris. Precipitation can affect access roads and landfill site operation. Additionally, precipitation which infiltrates the soil at the landfill can cause the formation of leachate.

Kenosha County has a continental climate which spans four seasons, one season succeeding the other through varying time periods of unsteady transition. Summer generally spans the months of June, July, and August. The summers are relatively warm with occasional periods of hot, humid weather and sporadic periods of cool weather. Winter generally spans the months of December, January, and February, but it may, in some years, include parts of the months of November and March. Autumn and spring in the County are transitional times of the year between the dominant seasons and are usually periods of unsettled weather conditions. Temperatures are extremely varied, and long periods of precipitation are common in autumn and spring.

Air temperatures within the County are subject to great seasonal change and yearly variation, as well as diurnal variations. Table 8 presents temperature data for the County as recorded at the Kenosha weather station located at the City of Kenosha sewage treatment plant on the Lake Michigan shoreline, and at the Union Grove weather station located at the Village of Union Grove sewage treatment plant in Racine County. Data for the Kenosha weather station are considered representative of meteorological and climatic conditions in eastern Kenosha County, while data for the Union Grove weather station are considered representative of such conditions in the central and western portions of the County. These data, which encompass periods of record ranging from 1948 through 1976, and 1964 through 1976, respectively, indicate the temporal and spatial variations in temperature which may be anticipated within the County. As indicated in Table 8, monthly mean temperatures range from 21.6°F in January to 70.5°F in July at the Kenosha weather station, and from 21.2°F in January to 71.7°F in July at the Union Grove weather station.

The daily precipitation data recorded at those two weather stations are shown in Table 9. These data encompass periods of record ranging from 1945 through 1978 and 1960 through 1977 for the Kenosha weather station, and from 1945 through 1977 for the Union Grove weather station. Based on the data recorded at these observation stations, the total average annual precipitation in the County is over 31 inches expressed as water equivalent. Monthly averages at the Kenosha weather station range from a February low of 1.02 inches to a June high of 3.90 inches. Monthly averages for the Union Grove weather station range from a February low of 1.17 inches to a June high of 4.10 inches. Snowfall averages 42.80 inches annually at the Kenosha weather station, and 41.07 inches annually at the Union Grove weather station.

Prevailing winds in southeastern Wisconsin are northwesterly in the late fall and winter, northeasterly in the spring, and southwesterly in the summer and early fall. Wind velocities are less than 5 miles per hour about 15 percent of the year, between 5 and 15 miles per hour about 60 percent of the year, and greater than 15 miles per hour about 25 percent of the year.

## Ambient Air Quality

Air quality is not only an important determinant of the overall quality of life in an area, but has important direct and indirect effects on the economic development of an area. Air generally contains substances in the form of smoke, soot, dust, fly ash, fumes, mists, odors, and pollens. Although some of this particulate matter is contributed by natural sources, much is contributed by man-made sources such as land cultivation, heat and power generation, industrial processes, transportation movements, and waste burning. Urbanization tends to intensify the contribution of air pollutants from human activities because it concentrates the distribution of pollutant sources. When the level of pollutants in the air becomes so severe as to seriously and adversely affect health and property, an air pollution problem exists. Solid waste management facilities need to be planned and designed to maintain and protect existing air quality.

The adopted regional air quality management plan for southeastern Wisconsin[2] recommends actions that should be taken by federal, state, and local units of

[2]SEWRPC Planning Report No. 28, A Regional Air Quality Attainment and Maintenance Plan for Southeastern Wisconsin: 2000, June 1980.

## Table 8

### AIR TEMPERATURE CHARACTERISTICS AT SELECTED LOCATIONS IN OR NEAR KENOSHA COUNTY IN DEGREES FAHRENHEIT

| Month | Kenosha (1948-1976) | | | Union Grove (1964-1976) | | |
|---|---|---|---|---|---|---|
| | Average Daily Maximum[a] | Average Daily Minimum[a] | Mean[b] | Average Daily Maximum[a] | Average Daily Minimum[a] | Mean[b] |
| January..... | 29.8 | 13.4 | 21.6 | 29.9 | 12.5 | 21.2 |
| February.... | 33.4 | 17.6 | 25.5 | 33.5 | 15.8 | 24.7 |
| March....... | 41.0 | 25.7 | 33.4 | 42.9 | 24.9 | 33.9 |
| April....... | 53.7 | 35.9 | 44.8 | 56.8 | 35.3 | 46.0 |
| May......... | 64.3 | 44.7 | 54.5 | 67.5 | 43.8 | 55.7 |
| June........ | 75.0 | 54.7 | 64.8 | 78.2 | 54.6 | 66.4 |
| July........ | 79.9 | 61.0 | 70.5 | 83.0 | 60.4 | 71.7 |
| August...... | 79.3 | 60.9 | 70.1 | 82.0 | 59.5 | 70.7 |
| September... | 72.1 | 53.1 | 62.6 | 74.6 | 51.7 | 63.1 |
| October..... | 62.0 | 43.1 | 52.6 | 64.0 | 42.1 | 53.0 |
| November.... | 46.8 | 30.5 | 38.6 | 47.0 | 29.3 | 38.1 |
| December.... | 34.4 | 18.9 | 26.7 | 34.2 | 17.9 | 26.1 |
| Year | 56.0 | 38.3 | 47.1 | 57.8 | 37.3 | 47.6 |

[a]The monthly average daily maximum and minimum temperatures are obtained by using daily measurements to compile an average for each month in the indicated period of record; the results are then averaged for all months in the period of record.

[b]The mean monthly temperature is the average of the average daily maximum temperature and daily minimum temperature for each month.

Source: National Weather Service and SEWRPC.

## Table 9

### PRECIPITATION CHARACTERISTICS AT SELECTED LOCATIONS IN OR NEAR KENOSHA COUNTY IN INCHES

| Month | Kenosha | | Union Grove | |
|---|---|---|---|---|
| | Average Total Precipitation (1945-1978) | Average Snow and Sleet (1960-1977) | Average Total Precipitation (1945-1977) | Average Snow and Sleet[a] |
| January..... | 1.53 | 11.10 | 1.39 | 8.44 |
| February.... | 1.02 | 10.00 | 1.17 | 8.17 |
| March....... | 2.22 | 8.20 | 2.39 | 9.55 |
| April....... | 3.38 | 1.80 | 3.22 | 1.59 |
| May......... | 3.19 | -- | 3.19 | -- |
| June........ | 3.90 | -- | 4.10 | -- |
| July........ | 3.58 | -- | 3.56 | -- |
| August...... | 3.12 | -- | 3.22 | -- |
| September... | 3.24 | -- | 3.07 | -- |
| October..... | 2.26 | 0.10 | 2.27 | 0.01 |
| November.... | 2.09 | 2.00 | 2.00 | 2.64 |
| December.... | 1.78 | 9.60 | 1.80 | 10.67 |
| Year | 31.31 | 42.80 | 31.38 | 41.07 |

[a]Snow and sleet data are not available at Union Grove. Therefore, approximations were made by taking proportional values of the average total precipitation, using the same proportion of snow and sleet to total precipitation, computed from data recorded at the Waukesha station, which is located approximately the same distance from Lake Michigan.

Source: National Weather Service and SEWRPC.

government, businesses and industries, and individuals to attain and maintain the air quality standards established by the federal and state governments for ambient air quality. The federal government has established ambient air quality standards which are intended to protect human health and the public welfare by preventing damage to vegetation and real and personal property, and improving visibility. These standards have been set for the following pollutants: particulate matter, sulfer oxides as measured by sulfer dioxide, carbon monoxide, nitrogen dioxide, ozone, and lead. Based upon these standards, nonattainment areas--that is, areas having ambient air quality conditions which do not meet the prescribed standards--have been identified. In 1980, upon adoption of the regional air quality management plan, all of Kenosha County was designated as an ozone nonattainment area. In addition, a small portion of Kenosha County--that portion of the City of Kenosha bounded by 67th Street, 39th Avenue, 52nd Street, and Lake Michigan--was designated as a secondary nonattainment area for particulate matter.[3] There was no change in these air quality nonattainment designations for Kenosha County as of 1985.

## Physiographic and Topographic Features

As already noted, Kenosha County encompasses an area of approximately 278.4 square miles, or about 178,174 acres. The County extends for approximately 12 miles north to south and, at its maximum width, about 25 miles east to west. Kenosha County is bounded on the north by Racine County, on the west by Walworth County, and on the south by Lake and McHenry Counties, Illinois. The irregularly shaped eastern boundary of the County is the result of erosion by wind and rainfall, groundwater discharge, and Lake Michigan wave action.

Physiographic features, or surficial land forms, have been determined largely by the underlying bedrock and the overlying glacial deposits of the watershed. The Niagara cuesta on which the County lies is a gently eastward-sloping bedrock surface, with the eastern border of the County being about 200 to 250 feet lower in elevation than the western border. Glacial deposits overlying the bedrock formations form the irregular surface topography of the watershed, characterized by rounded hills or groups of hills, ridges, particularly in the western one-third of the County, broad undulating plains, and poorly drained wetlands.

As shown on Map 10, surface elevations within the County range from a high of approximately 990 feet above National Geodetic Vertical Datum (NGVD) in the Town of Randall to approximately 580 feet above NGVD at the Lake Michigan shoreline. Most of the County is covered by gently sloping ground moraine--heterogeneous material deposited beneath the ice--end moraines consisting of material deposited at the forward margins of the ice sheet, and outwash plains formed by the action of flowing glacial meltwater. Glacial land forms are of economic significance because some are prime sources of sand and gravel needed for highway and other construction purposes. Topography is also an important consideration in the evaluation of areas which may be considered for the construction of landfills.

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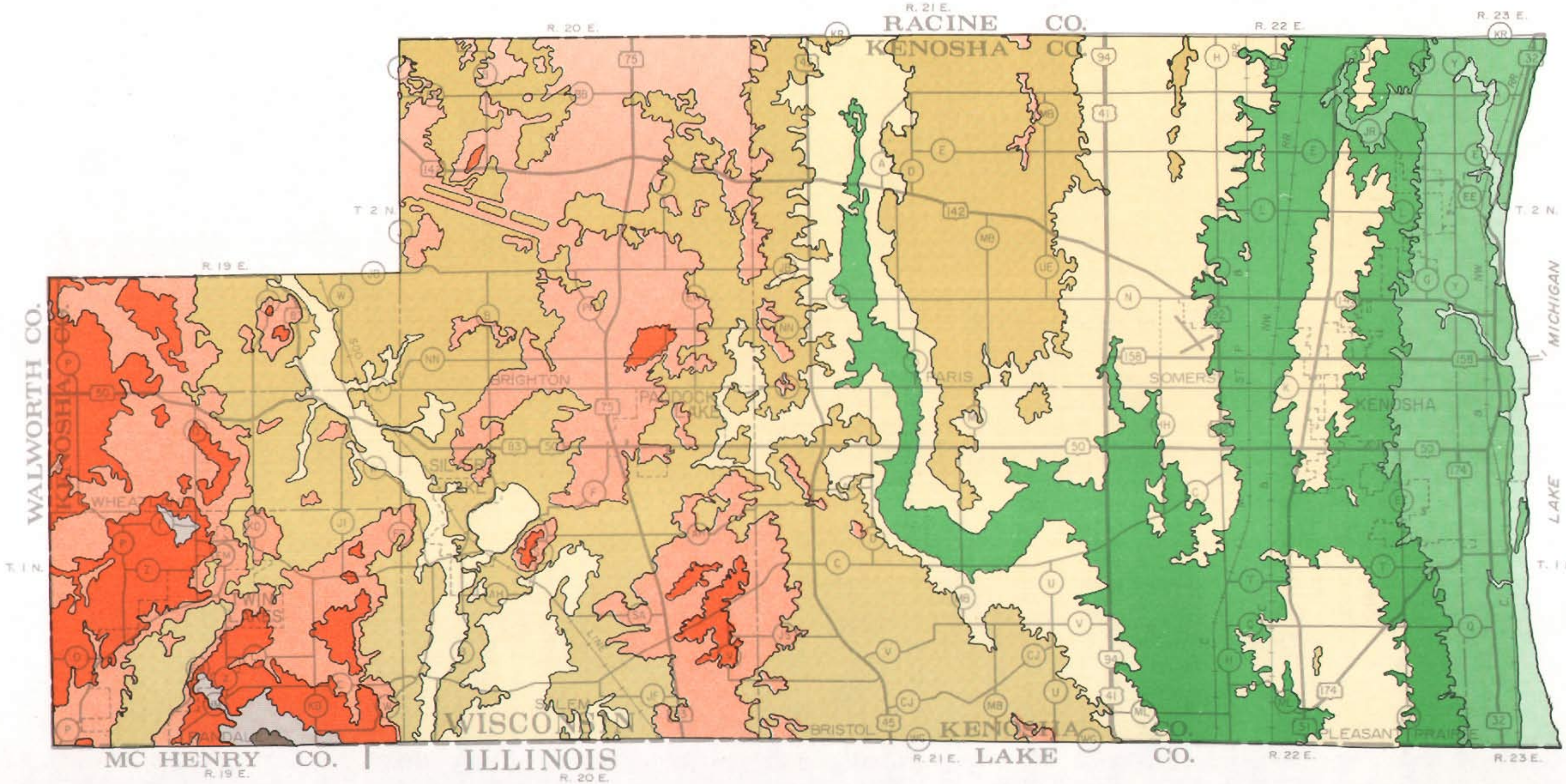
[3] Ibid.

Map 10

TOPOGRAPHY OF KENOSHA COUNTY




LEGEND

ELEVATION IN FEET ABOVE NATIONAL GEODETIC VERTICAL DATUM

- 580 - 600
- 600 - 650
- 650 - 700
- 700 - 750
- 750 - 800
- 800 - 850
- 850 - 900
- 900 - 950
- 950 - 990

Source: U. S. Geological Survey and SEWRPC.

## Geology

The bedrock formations underlying the unconsolidated surficial deposits of Kenosha County consist of Precambrian crystalline rocks; Cambrian sandstone; Ordovician dolomite, sandstone, and shale; and Silurian dolomite. Many of these rocks underlie only parts of the County. All of these rock units slope toward the east. The bedrock geology of the County is shown on Map 11, a map of the surface of the bedrock. The uppermost bedrock unit throughout most of the County is Silurian dolomite, primarily Niagara dolomite, underlain by a relatively impervious layer of Maquoketa shale. In some of the pre-Pleistocene valleys in the southwestern and central portions of the County, however, the Niagara dolomite has been removed by erosion, and the uppermost bedrock unit is Maquoketa shale.

Bedrock topography was shaped by preglacial and glacial erosion of the exposed bedrock. The consolidated bedrock underlying Kenosha County generally dips eastward at a rate of 10 feet per mile. The bedrock surface ranges in elevation from 750 feet NGVD in the western portion of the County to less than 450 feet NGVD in the eastern portion of the County.

The glacial deposits above the bedrock include end moraine, ground moraine, outwash, and lake-basin deposits. Morainal areas are the most likely to have the relatively impermeable soils most suitable for landfill construction, while glacial outwash areas generally have soils with too high a permeability for use in landfill construction.

The combined thickness of unconsolidated glacial deposits, alluvium, and marsh deposits exceeds 100 feet throughout most of the County. Thicknesses are greatest where glacial materials fill the bedrock valleys and in areas of topographic highs formed by end moraines. Map 12 indicates the spatial variation of the thickness of the unconsolidated deposits overlying the bedrock in Kenosha County.

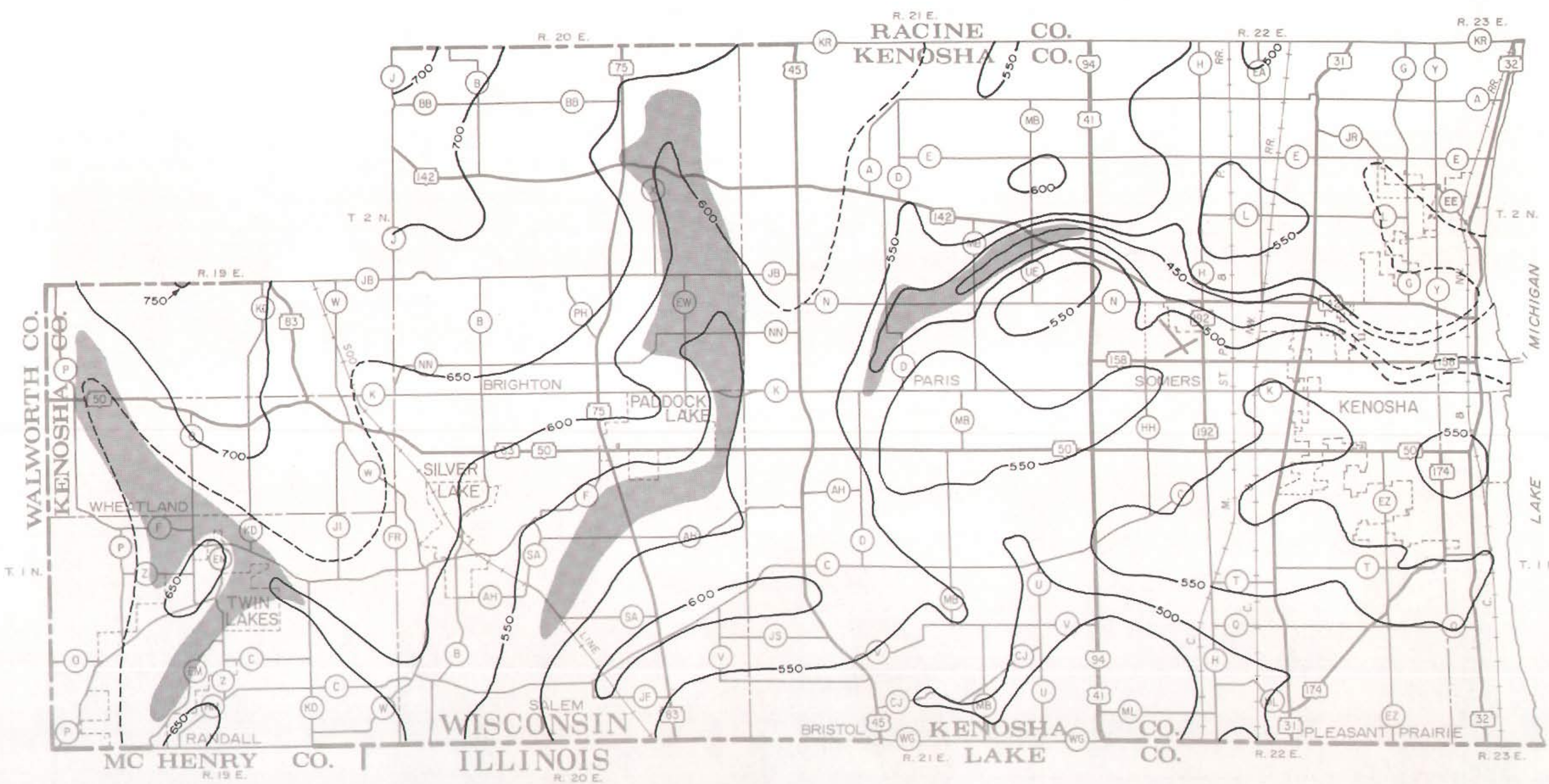
## Soils

The nature of soils within Kenosha County has been determined primarily by the interaction of the parent glacial deposits covering the County and by topography, climate, plants, animals, and time. In selecting areas for landfill sites, soils are an important consideration.

To assess the significance of the diverse soils found in southeastern Wisconsin, the Southeastern Wisconsin Regional Planning Commission in 1963 entered into a cooperative agreement with the U. S. Soil Conservation Service under which detailed operational soil surveys were completed for the entire Region. The results of the soil surveys are published in SEWRPC Planning Report No. 8, Soils of Southeastern Wisconsin. The regional soil surveys have resulted in the mapping of the soils within the Region in great detail. At the same time, the surveys have provided data on the physical, chemical, and biological properties of the soils and, more importantly, have provided interpretations of the soil properties for planning, engineering, agricultural, and resource conservation purposes. Interpretations of the soil properties for landfill construction are available. Both generalized and detailed soils maps are available for use in the evaluation of potential landfill sites.

# Map 11

## BEDROCK GEOLOGY OF KENOSHA COUNTY




LEGEND

SILURIAN DOLOMITE UNDIFFERENTIATED

MAQUOKETA SHALE

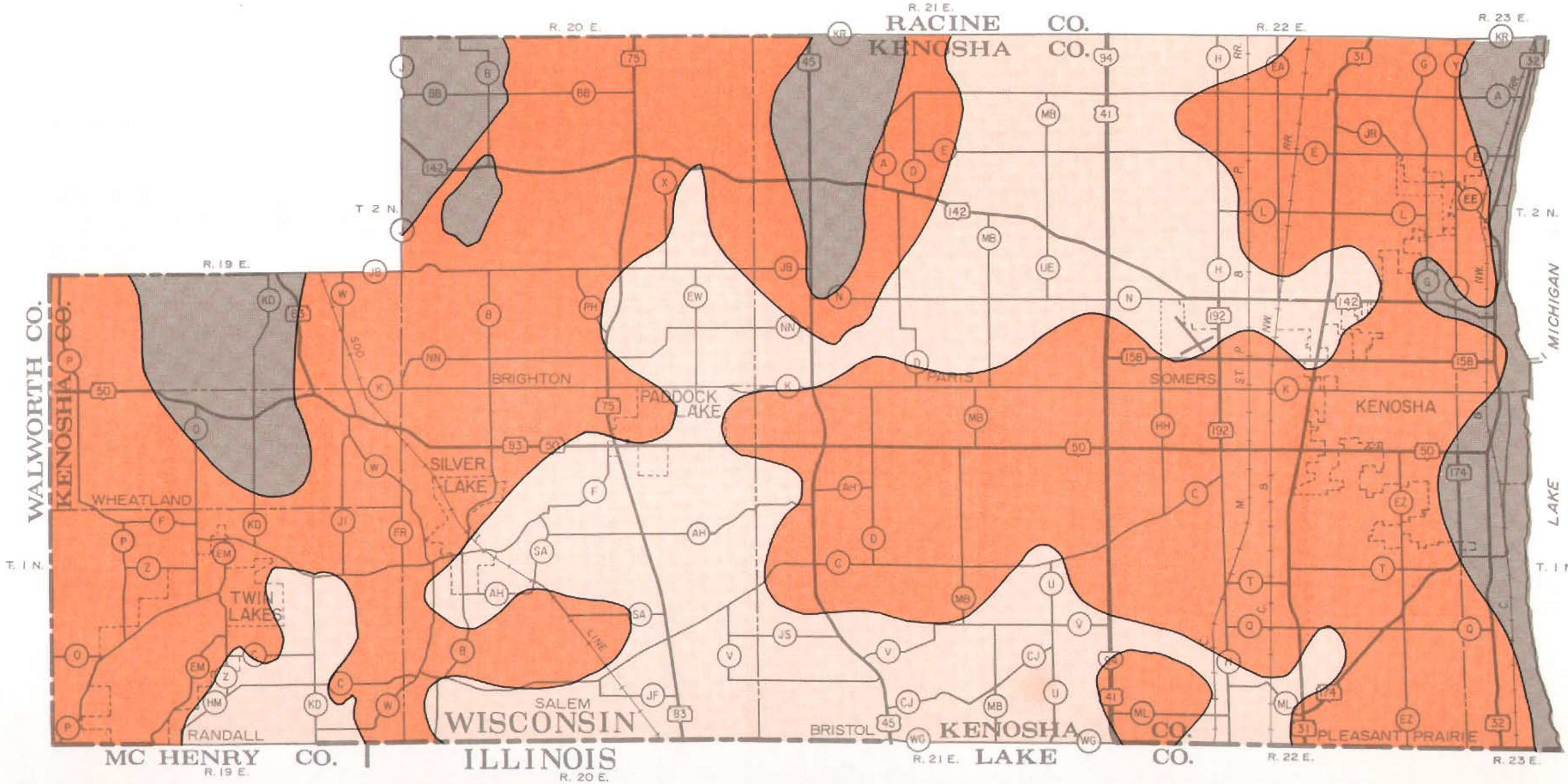
BEDROCK CONTOUR (NATIONAL GEODETIC VERTICAL DATUM) DASHED WHERE LOCATION IS APPROXIMATE

GRAPHIC SCALE

Source: U. S. Geological Survey, University of Wisconsin-Extension, and SEWRPC.

## Map 12

## THICKNESS OF GLACIAL DEPOSITS IN KENOSHA COUNTY




LEGEND

- 20 – 100 FEET
- 100 – 200 FEET
- 200 – 300 FEET

Source: U. S. Department of Agriculture, Soil Conservation Service.

The soils in the County range from organic, poorly drained soils to loamy, well-drained soils. There are nine major soil association groups in the County as identified by the U. S. Department of Agriculture, Soil Conservation Service. A soil association is a group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region. The distribution of these soils in the County is indicated on Map 13. The nine soil associations are described briefly below:

1. Varna-Elliot-Ashkum Association
   Well-drained to poorly drained soils that have a silty clay loam to clay subsoil which are formed in thin loess and the underlying clay loam or silty clay loam glacial till. The soils in this association are typically found on ridges and knobs. This association covers about 30 percent of the area of the County. The soils in this association are rated as having from slight to severe limitations for landfill construction.

2. Morley-Beecher-Ashkum Association
   Well-drained to poorly drained soils that have a silty clay or silty clay loam subsoil which are formed in thin loess and the underlying clay loam or silty clay loam glacial till. The soils in this association are typically found on ridges and knobs. This association covers about 26 percent of the area of the County. The soils in this association are rated as having from slight to severe limitations for landfill construction.

3. Hebron-Montgomery-Aztalan Association
   Well-drained to poorly drained soils that have a loam to silty clay subsoil which are underlain by clayey to loamy lacustrine and outwash material. The soils in this association are typically found on hills, knobs, and lake plains. This association covers about 25 percent of the area of the County. The soils in this association are rated as having from slight to moderate limitations for landfill construction.

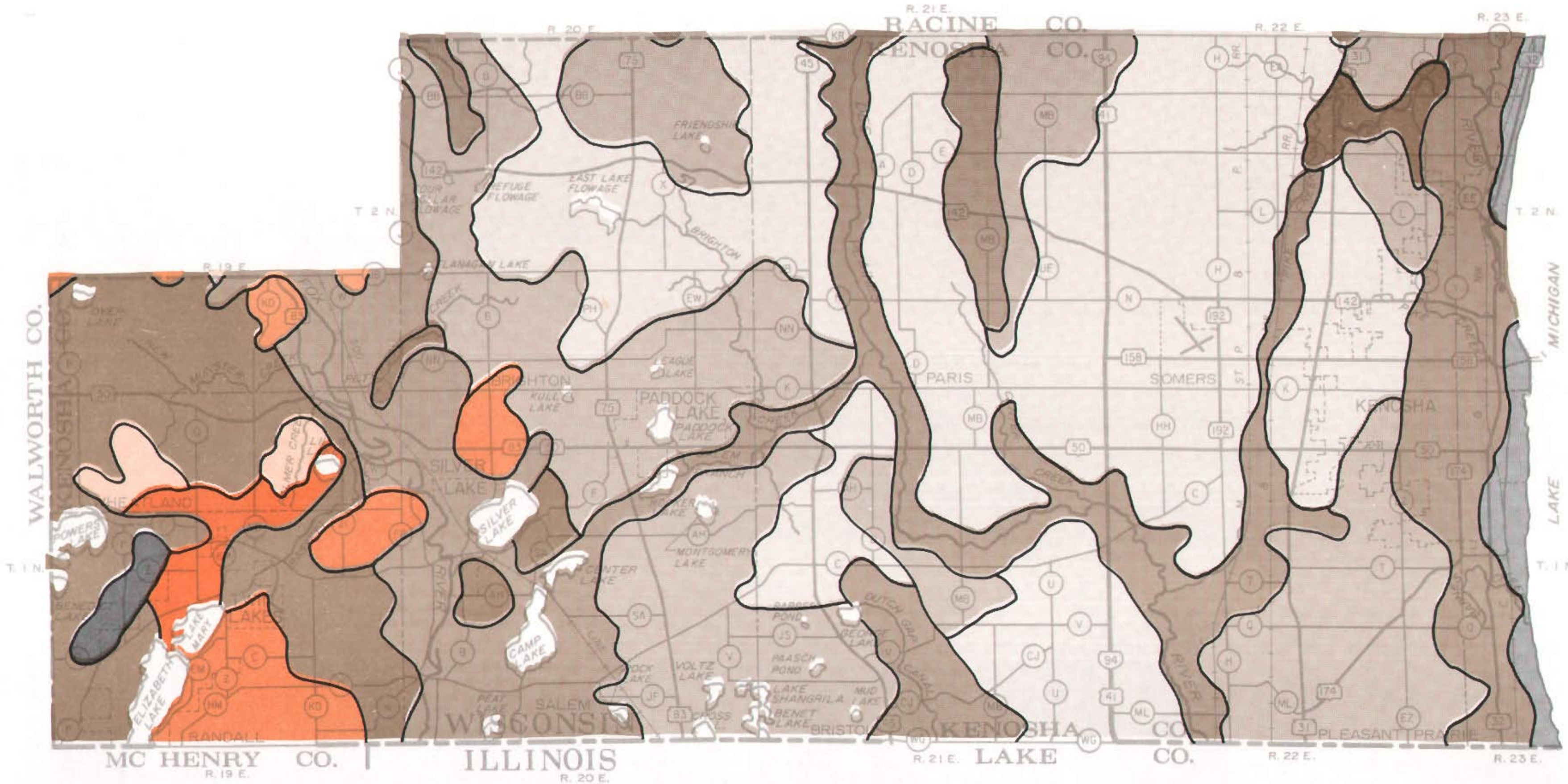
4. Fox-Casco Association
   Well-drained soils that have a silty clay loam subsoil, which are moderately deep to shallow over sand and gravel. The soils in this association are typically found on outwash plains and stream terraces. This association covers about 11 percent of the area of the County. The soils in this association are rated as having from moderate to severe limitations for landfill construction.

5. Houghton-Palms Association
   Very poorly drained organic soils found in depressions and bottom lands. This association covers about 1 percent of the area of the County. The soils in this association are rated as having severe limitations for landfill construction.

6. Miami Association
   Well-drained soils that have a silty clay loam and clay loam subsoil which are formed in thin loess and the underlying loamy glacial till. The soils in this association are typically found on ridges and knobs. This association covers about 4 percent of the area of the County. The soils in this association are rated as having slight to moderate limitations for landfill construction.

## Map 13

## SOIL ASSOCIATIONS IN KENOSHA COUNTY




LEGEND

VARNA-ELLIOTT-ASHKUM ASSOCIATION: WELL-DRAINED TO POORLY DRAINED SOILS THAT HAVE A SILTY CLAY LOAM TO CLAY SUBSOIL; FORMED IN THIN LOESS AND THE UNDERLYING CLAY LOAM OR SILTY CLAY LOAM GLACIAL TILL ON RIDGES AND KNOBS

MORLEY-BEECHER-ASHKUM ASSOCIATION: WELL-DRAINED TO POORLY DRAINED SOILS THAT HAVE A SILTY CLAY OR SILTY CLAY LOAM SUBSOIL; FORMED IN THIN LOESS AND THE UNDERLYING CLAY LOAM OR SILTY CLAY LOAM GLACIAL TILL ON RIDGES AND KNOBS

HEBRON-MONTGOMERY-AZTALAN ASSOCIATION: WELL-DRAINED TO POORLY DRAINED SOILS THAT HAVE A LOAM TO SILTY CLAY SUBSOIL; UNDERLAIN BY CLAYEY TO LOAMY LACUSTRINE AND OUTWASH MATERIAL ON HILLS, KNOBS, AND LAKE PLAINS

FOX-CASCO ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A CLAY LOAM AND SILTY CLAY LOAM SUBSOIL; MODERATELY DEEP TO SHALLOW OVER SAND AND GRAVEL, ON STREAM TERRACES

HOUGHTON-PALMS ASSOCIATION: VERY POORLY DRAINED ORGANIC SOILS; IN BASINS AND DEPRESSIONS

MIAMI ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A SILTY CLAY LOAM AND CLAY LOAM SUBSOIL; FORMED IN THIN LOESS AND THE UNDERLYING LOAMY GLACIAL TILL ON RIDGES AND KNOBS

CASCO-RODMAN ASSOCIATION: WELL-DRAINED AND EXCESSIVELY DRAINED SOILS THAT HAVE A CLAY LOAM OR GRAVELLY LOAM SUBSOIL; SHALLOW OVER SAND AND GRAVEL, ON STREAM TERRACES AND MORAINIC RIDGES

BOYER-GRANBY ASSOCIATION: WELL-DRAINED TO VERY POORLY DRAINED SOILS THAT HAVE A LOAM TO SAND SUBSOIL; UNDERLAIN BY SANDY GLACIAL OUTWASH ON RIDGES AND KNOBS AND IN DRAINAGEWAYS AND DEPRESSIONS

WARSAW-PLANO ASSOCIATION: WELL-DRAINED SOILS THAT HAVE A LOAM TO SILTY CLAY LOAM SUBSOIL; MODERATELY DEEP TO DEEP OVER SAND AND GRAVEL, ON STREAM TERRACES

Source: U. S. Department of Agriculture, Soil Conservation Service.

7. Casco-Rodman Association
   Well-drained and excessively drained soils that have a clay loam or gravelly loam subsoil which are shallow over sand and gravel. The soils in this association are typically found on stream terraces and morainic ridges. This association covers about 1 percent of the area of the County. The soils in this association are rated as having severe limitations for landfill construction.

8. Boyer-Granby Association
   Well-drained to very poorly drained soils that have a loam to sand subsoil which are underlain by sandy glacial outwash. The soils in this association are typically found on ridges and knobs and in drainageways and depressions. This association covers about 1 percent of the area of the County. The soils in this association are rated as having severe limitations for landfill construction.

9. Warsaw-Plano Association
   Well-drained soils that have a loam to silty clay loam subsoil which are moderately deep to deep over sand and gravel. The soils in this association are typically found on stream terraces. This association covers about 1 percent of the area of the County. The soils in this association are rated as having slight to severe limitations for landfill construction.

## Groundwater Resources

Groundwater resources constitute an extremely valuable element of the natural resource base. The groundwater reservoir not only sustains lake levels and provides the base flow of the streams, but comprises a major source of water supply for domestic, municipal, and industrial water users.

The rock units within Kenosha County and the Southeastern Wisconsin Region differ widely in the yield of stored water. Rock units that supply water in usable amounts to pumping wells and in important amounts to lakes and streams are called aquifers. There are three major aquifers within Kenosha County and the Southeastern Wisconsin Region. From the land surface downward, they are: 1) the sand and gravel aquifer, 2) the Niagara dolomite aquifer, and 3) the sandstone aquifer. Because of their relative nearness to the land surface and their intimate hydraulic interconnection, the first two aquifers are often considered to be a single aquifer commonly called the "shallow aquifer." The latter, accordingly, is commonly known as the "deep aquifer."

The sand and gravel aquifer consists of unconsolidated sand and gravel deposits in glacial drift and alluvium. These deposits occur over much of the County, either at land surface or buried beneath less permeable drift.

The Niagara dolomite aquifer in Kenosha County consists of Silurian Age dolomite, which overlies the Maquoketa shale throughout all of the County. The sandstone aquifer includes all sedimentary bedrock below the Maquoketa shale. The Maquoketa shale separates the Niagara and sandstone aquifers. Because of its very low permeability, the shale restricts the vertical movement of water and confines water in the sandstone aquifer. The bottom of the sandstone aquifer is the surface of the impermeable Precambrian rocks. This aquifer is continuous throughout the County and is a part of a large regional aquifer which is used as a source of water supply for major concentrations of urban development throughout southeastern Wisconsin and northeastern Illinois.

The source of most groundwater which is contained in the shallow aquifer underlying the County is precipitation, which infiltrates and recharges this groundwater reservoir. The amount that infiltrates depends mainly on the type of soils covering the land surface. The deep sandstone aquifer is recharged primarily in areas west of Kenosha County, where the Maquoketa shale is absent.

Recharge to each aquifer is largely controlled by the permeability of the overlying units. Recharge to the shallowest bedrock aquifer is high where the aquifer is overlain by outwash and end moraine and low where water must pass through clay or silty till.

A limited amount of recharge to the sandstone aquifer occurs through the Maquoketa shale, but most occurs west of the limit of occurrence of the shale outside Kenosha County. Discharge from the sandstone aquifer in most of Kenosha County is through wells, with little or no natural discharge to surface water bodies. Water in the sandstone aquifer also moves regionally from the County to pumping centers in southeast Wisconsin and northeast Illinois.

Map 14 shows the elevation of the top of the saturation zone in the sand and gravel aquifer by 20-foot contour intervals. For the most part, the water table lies within the glacial drift. The elevation ranges from more than 840 feet above National Geodetic Vertical Datum along the extreme western border of the County to about 580 feet above NGVD along the Lake Michigan shoreline. The water table generally is a subdued replica of the land surface and is higher under topographic highs and lower under topographic lows. Areas where the depth to water is less than 10 feet for at least part of the year occur in the low-lying parts of the County along streams, lakes, and wetlands, and in other areas characterized as having heavy clay soils with slow permeability.

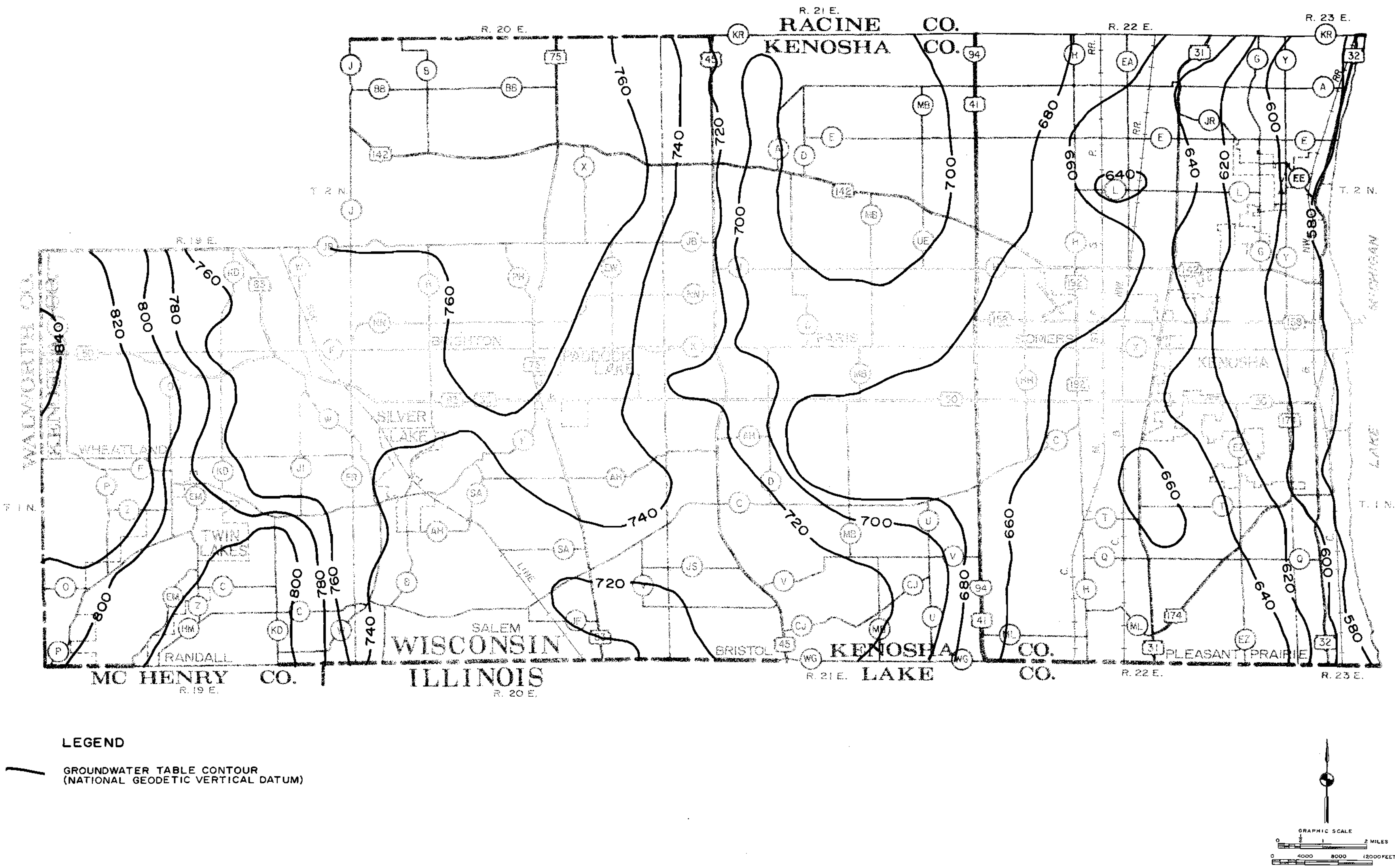
Map 15 shows the estimated depth to seasonal high groundwater for the County. Seasonal high groundwater is defined as the average of the highest annual groundwater levels over the period of record available. Soils mapping and soils moisture information were used by the U. S. Geological Survey to determine the seasonal high groundwater levels.

Map 16 shows the potentiometric surface of the sandstone aquifer, or the elevation to which water rose in wells in the sandstone aquifer as of 1974. These data were obtained by the Regional Planning Commission and the U. S. Geological Survey in 1973 and 1974. In Kenosha County, the potentiometric surface was found to range from an elevation of about 600 feet above NGVD along the western border of the County to less than 450 feet above NGVD in the extreme southeast corner of the County. The general slope of the surface was downward toward the center of the County.

Water levels of the sandstone aquifer of Racine and Kenosha Counties began to decline after the first wells tapping that aquifer were drilled--probably shortly after the Civil War. The early wells were free flowing. The artesian heads in wells in Racine and Kenosha were as much as 125 feet above the land surface. Much of this artesian flow was wasted, as the flow from many of the wells was unrestrained, causing water levels to decline rapidly through 1910.

## Map 14

## ELEVATION OF GROUNDWATER TABLE IN KENOSHA COUNTY: 1978




Source: U. S. Geological Survey and SEWRPC.

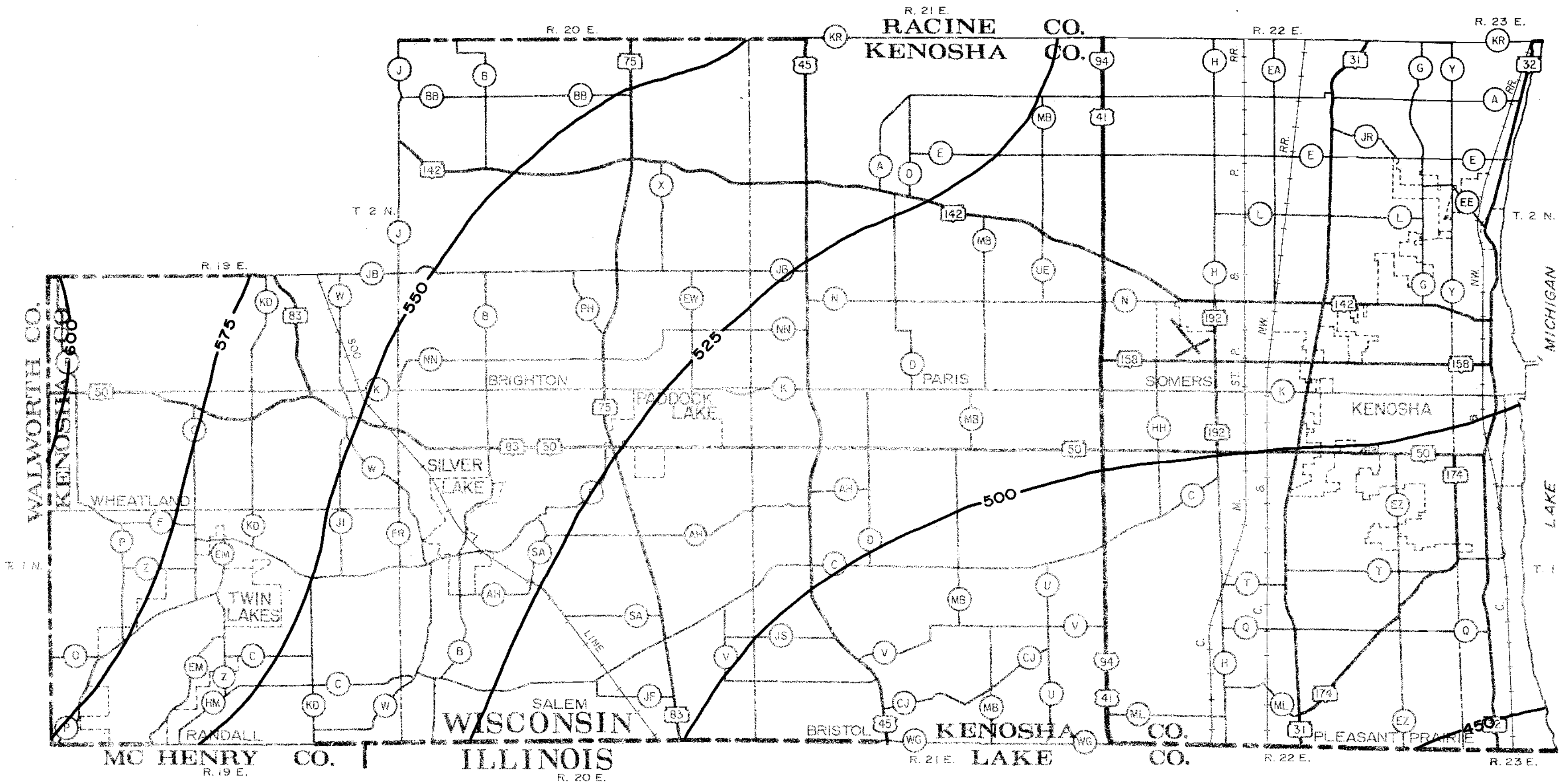
# Map 15

## DEPTH TO SEASONAL HIGH GROUNDWATER IN KENOSHA COUNTY


Source: SEWRPC.

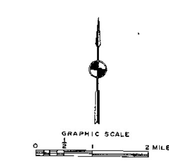
## Map 16

### POTENTIOMETRIC SURFACE OF THE SANDSTONE AQUIFER IN KENOSHA COUNTY: 1973-1974




LEGEND

POTENTIOMETRIC CONTOUR (NATIONAL GEODETIC VERTICAL DATUM)




Source: SEWRPC.

After 1910, the rate of water level decline slowed as a result of diminished artesian flow. Further decline occurred, however, as a result of local pumpage and withdrawals in the Milwaukee and Chicago areas. Presently, water level declines in the sandstone aquifer of Kenosha County result primarily from continuing pumpage in the Chicago and Milwaukee metropolitan areas rather than from local pumpage. Withdrawal from the sandstone aquifer in the Chicago area increased from about 30 million gallons per day (mgd) in the mid-1920's to about 80 mgd in the early 1970's. Withdrawal from the sandstone aquifer in the Milwaukee-Waukesha area increased from under 5 mgd in the mid-1920's to more than 20 mgd in the early 1970's.

Most of the area of Kenosha County, although by no means most of the resident population, depends on groundwater as a source of potable water. In 1984, there were three public water utilities and 22 special-purpose water supply systems using groundwater for their source of water. These utilities together served about 8,200 persons, or about 6.8 percent of the county resident population, and an area of about 3.1 square miles, or about 1.1 percent of the total area of the County. The Kenosha Water Utility uses Lake Michigan as its source of supply, and in 1984 served about 85,000 persons, or about 70.1 percent of the county resident population, and about 19.8 square miles, or about 7.1 percent, of the total area of the County. Urban development and farm dwellings in the rest of the County--accounting for about 28,000 persons, or about 23.1 percent of the resident population--also utilized groundwater for their source of supply, primarily from the shallow limestone and sand and gravel aquifers. Well water pumped from the shallow aquifer in Kenosha County averaged about 2.2 million gallons per day (mgd) in 1984. Well water pumped from the deep sandstone aquifer averaged 0.8 mgd. Water pumped from Lake Michigan by the Kenosha Water Utility averaged 14.9 mgd.

Under current State law (Section 30.21 of the Wisconsin Statutes), public utilities may provide water from Lake Michigan to municipalities located within 50 miles of the lake, provided that the municipal sewage is collected, properly treated, and returned to the Lake Michigan basin. Substantial diversion of water from Lake Michigan across the subcontinental divide, which traverses the eastern portion of Kenosha County in a generally north-south direction, is further constrained by interstate compact and international agreement, as well as by past U. S. Supreme Court rulings. As a result, the western areas of the County must rely primarily on groundwater from the shallow aquifer or from the deep sandstone aquifer as a source of water supply. Of the two aquifers, the deep sandstone aquifer is a higher quality source of water. However, use of that aquifer is more costly because of the depth of the wells required, particularly as water levels continue to decline as a result of pumping in southeastern Wisconsin and northeastern Illinois. In contrast, the shallow aquifer, while less costly to tap, provides a less dependable source of water supply--being locally recharged--and is more subject to contamination.

Based upon a review of available water quality data, it may be concluded that the quality of groundwater in Kenosha County generally is good; however, some water has chemical characteristics that make it objectionable or unsuitable for certain domestic and industrial uses. Most of the groundwater is very hard. However, hardness does not cause water consumption-related health problems. It can cause scale deposits on piping and heating equipment. Iron and manganese concentrations are higher than desirable in the shallow aquifers throughout most of the County. Elevated levels of these two metals can result in staining during domestic or industrial washing operations. Since most of the potable water used in Kenosha County comes from Lake Michigan, such concerns are generally not a problem in the County. Nitrates and dissolved solids levels are generally below recommended upper limits.

## Environmentally Significant Areas

The siting of solid waste management facilities requires consideration of environmentally significant areas. Any new landfill site or expansion of an existing site should be accomplished in strict conformance with state criteria regarding environmentally significant areas. Environmentally significant areas include surface waters, floodlands, woodlands, wetlands, wildlife habitat, existing outdoor recreation areas, potential park sites, historic sites, natural and scientific areas, and environmental corridors.

Surface Water Resources: Surface water resources, consisting of lakes and streams and their associated floodlands, form a particularly important element of the natural resource base of Kenosha County. Their contribution to the economic development, recreational activity, and aesthetic quality of the County is immeasurable. Surface waters are also an important consideration in the siting of solid waste landfills. State regulations preclude the siting of a landfill within 300 feet of a navigable stream, river, or floodplain, or within 1,000 feet of a lake.

Lakes--Major lakes are defined as those having 50 acres or more of surface water area, a size capable of supporting reasonable recreational use with relatively little degradation of the resource. As indicated in Table 10, there are 16 major lakes in Kenosha County, ranging in size from 52 acres (Voltz Lake) to 638 acres (Elizabeth Lake). The location and relative sizes of the lakes are shown on Map 17. The 16 major lakes in Kenosha County have a combined surface area of 3,361 acres, or about 2 percent of the County.

In addition, there are 12 lakes and ponds in Kenosha County of less than 50 acres of surface water, which are considered to be minor lakes in this report. As indicated in Table 10, these minor lakes have a combined surface water area of about 227 acres, or less than 1 percent of the County.

Streams--As shown on Map 17, the surface drainage system of Kenosha County may be viewed as existing within five individual watersheds. Two of the five watersheds contained partly in Kenosha County--the Fox and Des Plaines River watersheds--lie west of the subcontinental divide and are part of the Mississippi River drainage system. These two watersheds have a combined area of 219 square miles, or 79 percent of the area of the County. The three watersheds lying east of the subcontinental divide constitute the remainder of Kenosha County--the Root River watershed, the Pike River watershed, and the watershed of minor streams directly tributary to Lake Michigan--and have a combined area of 59 square miles, or 21 percent of the area of Kenosha County. These rivers and streams discharge into Lake Michigan and are a part of the Great Lakes-St. Lawrence River drainage system. Major streams in Kenosha County--including those watercourses which have a perennial flow and those intermittent streams that have been identified in SEWRPC Planning Guide No. 5, Floodland and Shoreland Development Guide--total 106 lineal miles.

## Table 10

## LAKES AND PONDS IN KENOSHA COUNTY

| Lakes and Ponds | U. S. Public Land Survey Sections, Town, and Range | Surface Area (acres) | Maximum Depth (feet) | Direct Tributary Drainage Area (acres) |
|---|---|---|---|---|
| Major Lakes | | | | |
| Benedict Lake............ | 24-1-18; 19-1-19 | 78 | 37 | 2,589[a] |
| Benet/Shangrila Lake..... | 36-1-20; 31-1-21 | 180 | 24 | 328 |
| Camp Lake............... | 21, 28, 29-1-20 | 461 | 19 | 2,566 |
| Center Lake.............. | 15, 16, 21-1-20 | 129 | 28 | 2,243 |
| Cross Lake............... | 35, 36-1-20 | 87 | 35 | 436 |
| Dyer Lake................ | 30-2-19 | 56 | 13 | 1,353 |
| East Lake Flowage........ | 15, 16, 21, 22-2-20 | 123 | 15 | 960 |
| Elizabeth Lake........... | 28, 29, 32-1-19 | 682 | 32 | 5,029 |
| George Lake.............. | 20, 29-1-21 | 59 | 16 | 1,911 |
| Hooker Lake.............. | 11-1-20 | 87 | 24 | 1,133 |
| Lilly Lake............... | 11-1-19 | 88 | 6 | 307 |
| Lake Mary................ | 21, 28-1-19 | 315 | 33 | 1,143 |
| Paddock Lake............. | 2-1-20 | 112 | 32 | 362 |
| Powers Lake.............. | 13-1-18; 18-1-19 | 459 | 33 | 2,426 |
| Silver Lake.............. | 8, 9, 16, 17-1-20 | 464 | 44 | 3,191 |
| Voltz Lake............... | 36-1-20 | 52 | 24 | 257 |
| Subtotal | -- | 3,432 | -- | -- |
| Other Named Lakes and Ponds | | | | |
| Barber Pond.............. | 30-1-21 | 2 | 20 | N/A |
| Flanagan Lake............ | 19, 30-2-20 | 11 | 24 | N/A |
| Four Dollar Flowage...... | 18-2-20 | 18 | 6 | N/A |
| Friendship Lake.......... | 12-2-20 | 11 | 11 | N/A |
| Kull Lake................ | 4-1-20 | 13 | 14 | N/A |
| League Lake.............. | 35-2-20 | 14 | 21 | N/A |
| Montgomery Lake.......... | 12, 13, 14-1-20 | 46 | 23 | N/A |
| Mud Lake................. | 32-1-21 | 22 | 14 | N/A |
| Paasch Lake.............. | 29, 30-1-21 | 15 | 9 | N/A |
| Peat Lake................ | 32-1-20 | 6 | 5 | N/A |
| Refuge Flowage........... | 17-2-20 | 23 | 9 | N/A |
| Rock Lake................ | 34-1-20 | 46 | 33 | N/A |
| Subtotal | -- | 227 | -- | -- |
| Total | -- | 3,659 | -- | -- |

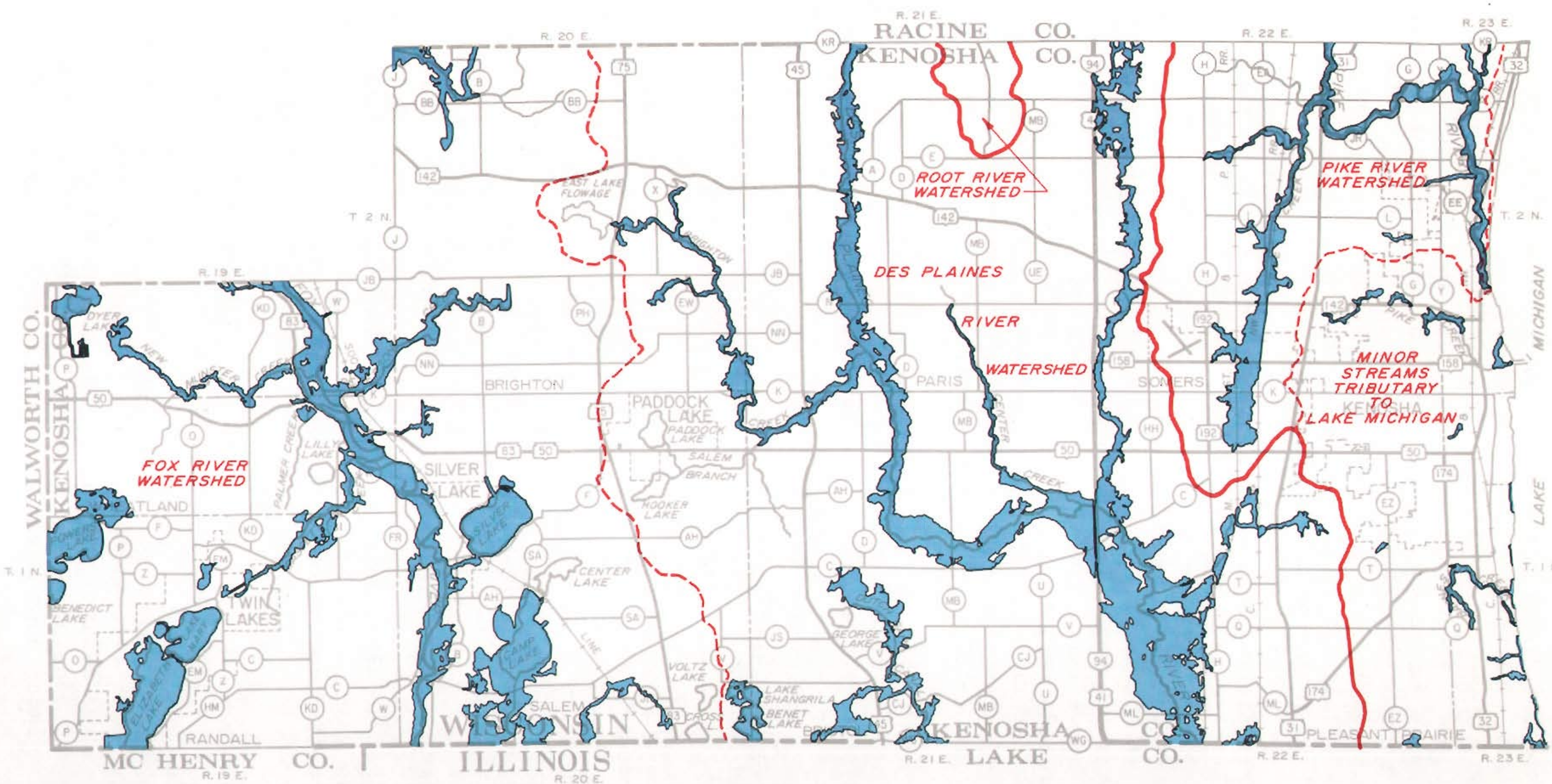
NOTE: N/A indicates data not available.

[a]Combined direct drainage area of Lake Benedict and Lake Tombeau.

Source: SEWRPC.

Map 17

## SURFACE WATER RESOURCES AND FLOODLANDS IN KENOSHA COUNTY: 1985




LEGEND

100-YEAR RECURRENCE INTERVAL FLOODLANDS

WATERSHED BOUNDARY

SUBCONTINENTAL DIVIDE

Source: Federal Emergency Management Agency and SEWRPC.

Floodlands: The floodlands of a river or stream are the wide, gently sloping areas contiguous with, and usually lying on both sides of, a river or stream channel. Rivers and streams occupy their channels most of the time. However, during even minor flood events, stream discharges increase markedly so that the channel is not able to convey all the flow. As a result, stages increase and the river or stream spreads laterally over the floodlands. The periodic flow of a river onto its floodlands is a normal phenomenon and, in the absence of major, costly structural flood control works, will occur regardless of whether urban development occurs on the floodlands.

For planning and regulatory purposes, floodlands are normally defined as those areas, excluding the channel, subject to inundation by the 100-year recurrence interval flood event. This is the event that would be reached or exceeded in severity once on the average of every 100 years. Stated another way, there is a 1 percent chance that this event will be reached or exceeded in severity in any given year. Studies conducted by the Southeastern Wisconsin Regional Planning Commission indicate that about 7 to 10 percent of the total land area of any given watershed will be within the 100-year floodplain area of the Region's rivers and streams. The 100-year recurrence interval floodplain contains within its boundaries those areas inundated by floods of less severe but more frequent occurrence such as the 50-, 25-, and 5-year recurrence interval events.

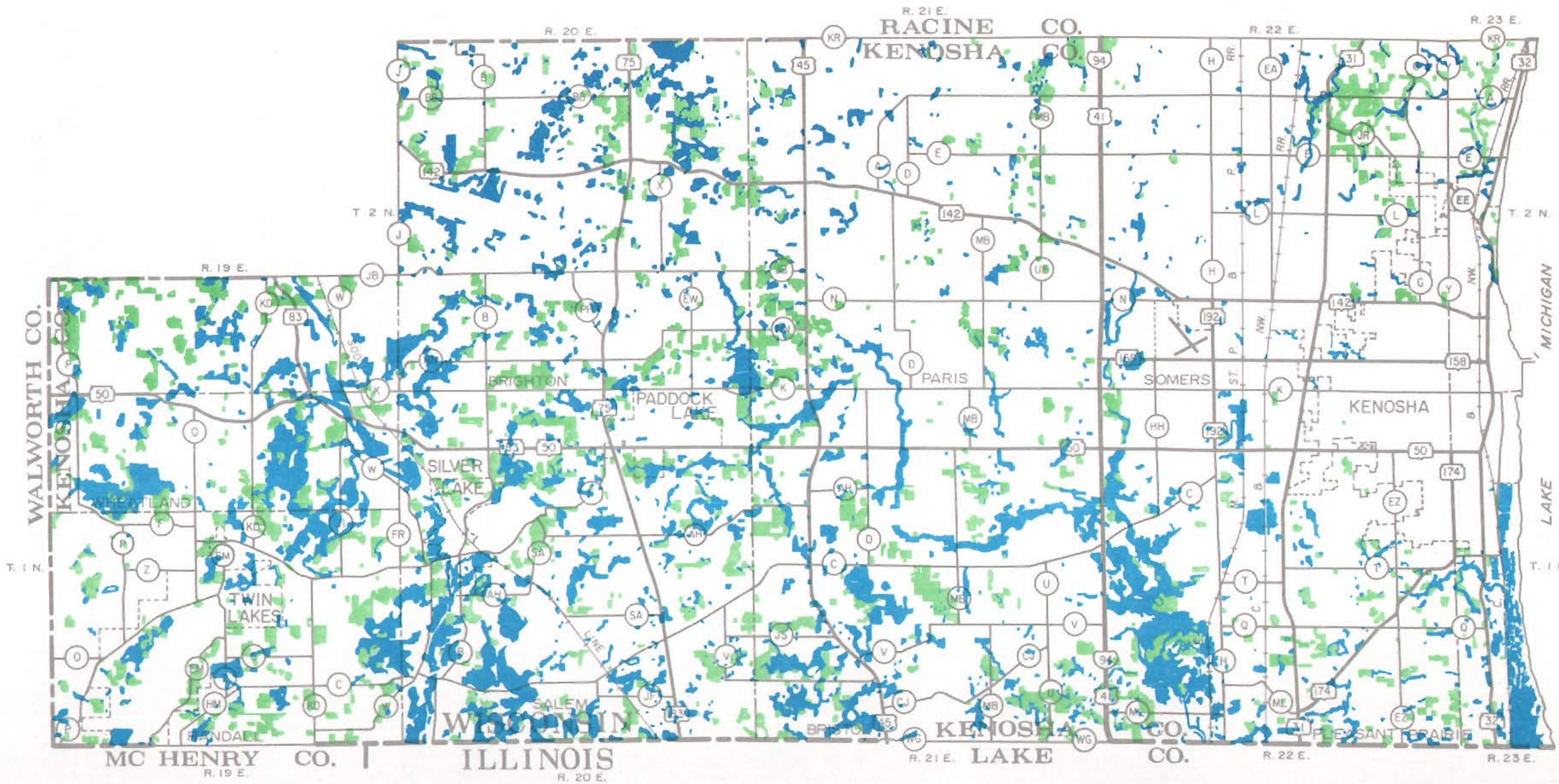
Floodland areas are generally not suited for the development of solid waste management facilities because of flood hazards, high water tables, and inadequate soils. Floodland areas are, however, generally prime locations for much needed park and open space areas, and therefore, within the context of regional land use planning, every effort should be made to discourage indiscriminate urban development in the floodplain while encouraging open space uses. Floodlands delineated in Kenosha County are shown on Map 17 and encompass approximately 12,300 acres, or about 7 percent of the total area of the County.

Woodlands: Woodlands in Kenosha County have both economic and ecologic values, and with proper management can serve a variety of uses which provide multiple benefits. As shown on Map 18, in 1980 woodlands in Kenosha County encompassed approximately 9,572 acres, or about 5 percent of the total area of the County. The quality of life within an area is greatly influenced by the overall condition of the environment as measured by clean air, clean water, scenic beauty, and ecological diversity. Primarily located on ridges and slopes, along lakes and streams, and in wetlands, woodlands provide an attractive natural resource of immeasurable value. Not only is the beauty of the lakes, streams, and glacial land forms of the County accentuated by woodlands, but woodlands are essential to maintaining the overall quality of the environment. Woodlands can and should be maintained for their total values--scenic, wildlife, educational, recreational, and watershed protection--as well as for their forest products. Under balanced use and sustained yield management, woodlands can provide many of these benefits simultaneously. Solid waste facilities should generally not be sited in woodlands. However, wooded areas should be considered for use as buffer zones for such facilities.

Wetlands: Water and wetland areas are an important landscape feature within the County, and can serve to enhance proximate uses. Wetlands represent a variety of stages in the natural filling of lake and pond basins and floodplain areas. Wetlands are considered herein as areas in which the water table is at or near the land surface. Such areas are generally unsuited or poorly suited

## Map 18

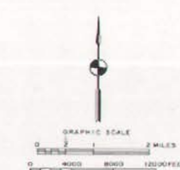
## WOODLANDS AND WETLANDS IN KENOSHA COUNTY: 1980




LEGEND

WOODLANDS

WETLANDS




Source: Wisconsin Department of Natural Resources and SEWRPC.

for most agricultural or urban development purposes. Wetlands, however, have important ecological value in a natural state. Wetlands contribute to flood control and stream purification, since such areas naturally serve to store excess runoff temporarily and thereby to reduce peak flood flows. It has been found that, except during periods of unusually high runoff or when wetland vegetation is not actively growing, concentrations of nutrients in waters leaving such areas can be considerably lower than in waters entering the wetlands.

Wetlands within Wisconsin have been classified by the Wisconsin Department of Natural Resources according to the national wetland classification system. Under this system, seven major classes of wetlands are recognized: potholes, fresh meadows, shallow marshes, deep marshes, shrub swamps, timber swamps, and bogs. Wetlands in southeastern Wisconsin, including Kenosha County, were mapped in 1981 by the Commission under an agreement with the Wisconsin Department of Natural Resources as part of the state wetlands mapping program. Detailed information concerning the type and extent of wetlands in the County is available from the Commission or the Wisconsin Department of Natural Resources. As shown on Map 18, wetlands in Kenosha County encompass about 15,612 acres, or about 9 percent of the total area of the County. Generally, wetlands are not well suited for the development of solid waste management facilities because of unsuitable soils and the potential for surface water and groundwater contamination.

Wildlife Habitat: Wildlife in Kenosha County include upland game and nongame species such as rabbits, squirrels, shrews, mice, and woodchucks; predators such as fox and mink; game birds including pheasant; and marsh furbearers such as muskrats. In addition, waterfowl are present and deer are found in some areas. The remaining habitat and wildlife residing therein provide opportunities for recreational, educational, and scientific activities, and constitute an aesthetic asset to the County.

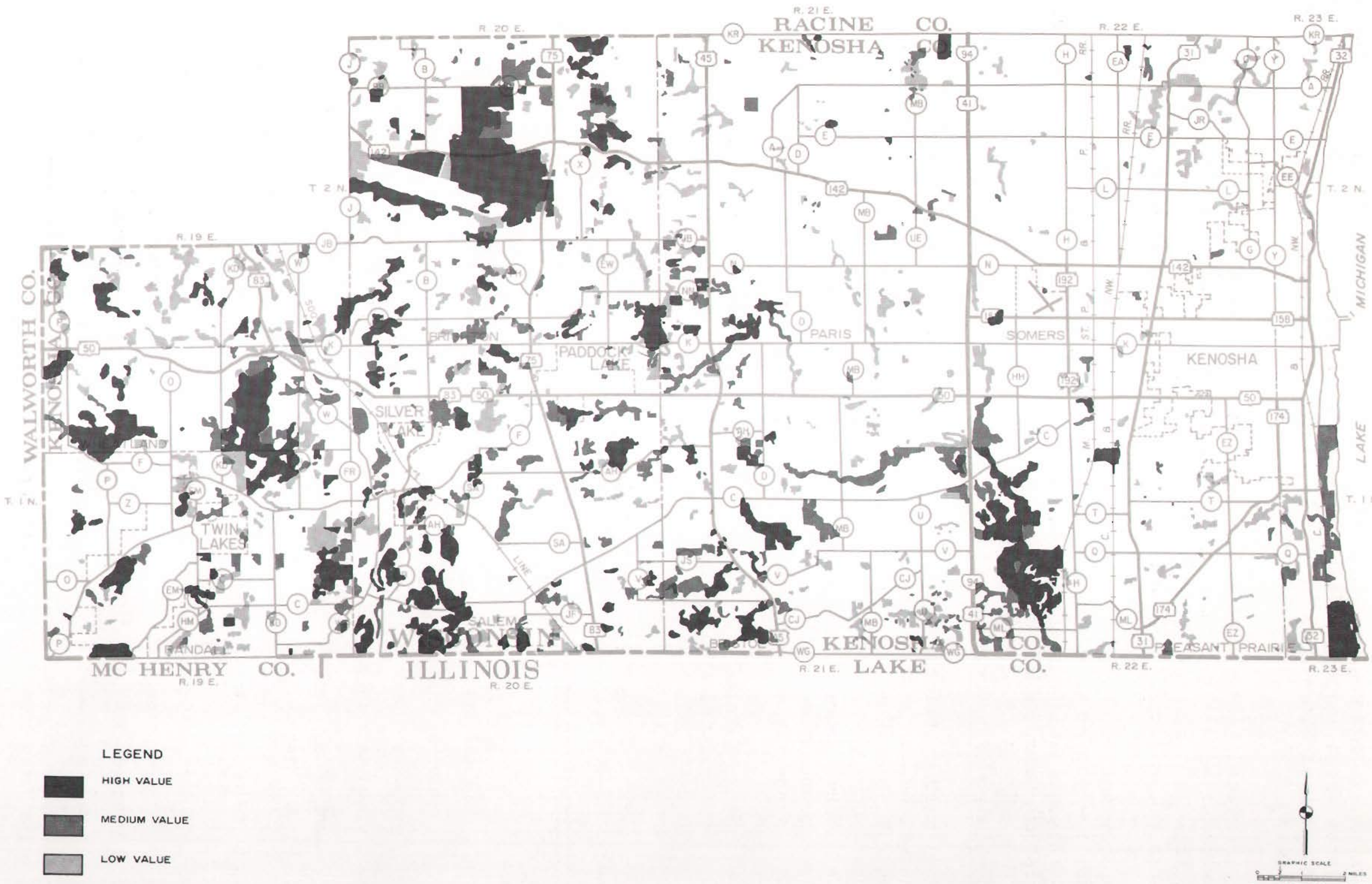
Wildlife habitat areas in Kenosha County are identified on Map 19 and in 1980 encompassed 22,065 acres, or about 12 percent of the total area of the County. High-value wildlife habitat comprised 10,307 acres, or 47 percent of the total wildlife habitat; medium-value wildlife habitat comprised 5,893 acres, or 27 percent of the total; and low-value wildlife habitat comprised 5,865 acres, or 26 percent of the total. High-value habitat areas contain a good diversity of wildlife, are adequate in size to meet all of the habitat requirements for the species concerned, and are generally located near other wildlife habitat areas. Medium-value wildlife habitat areas generally lack one of the three criteria for a high-value wildlife habitat. However, they do retain a good plant and animal diversity. Low-value wildlife habitat areas are remnant in nature in that they generally lack two or more of the three criteria for a high-value wildlife habitat, but may, nevertheless, be important if located near high- or medium-value wildlife habitat areas, if they provide corridors linking higher value wildlife habitat areas, or if they provide the only available habitat in the area.

## Historic Sites

The National Register of Historic Places is the official list of the Nation's and the State's historical, architectural, and archaeological sites and structures worthy of preservation. Under the National Historic Preservation Act of

## Map 19

## WILDLIFE HABITAT IN KENOSHA COUNTY: 1980




Source: SEWRPC.

1966, the Secretary of the U. S. Department of the Interior is authorized to maintain a national register of districts, sites, buildings, structures, and objects which are significant in American history, architecture, archaeology, and culture. Properties of local, state, and national importance are included in the register.

As indicated in Table 11 and shown on Map 20, a total of 10 sites in Kenosha County were listed on the National Register of Historic Places in 1985. Eight of these are historic structures located in the City of Kenosha. The other two sites are archaeological sites located in the Town of Pleasant Prairie.

An inventory of historic sites in Wisconsin is maintained by the State Historical Society of Wisconsin. State Historical Society files identify more than 300 historical sites--including structures, archaeological features, and other cultural features in Kenosha County.

## Scientific and Natural Areas

Areas with significant natural or geological features unique to Wisconsin are designated as state scientific areas by the Scientific Areas Preservation Council. Areas are classified into the following five categories.

- NA-1. Natural areas that contain nearly intact native plant and animal communities believed to be representative of the presettlement landscape. These areas are of statewide or greater significance.

- NA-2. Natural areas slightly modified by man's activities and of county or regional significance.

### Table 11

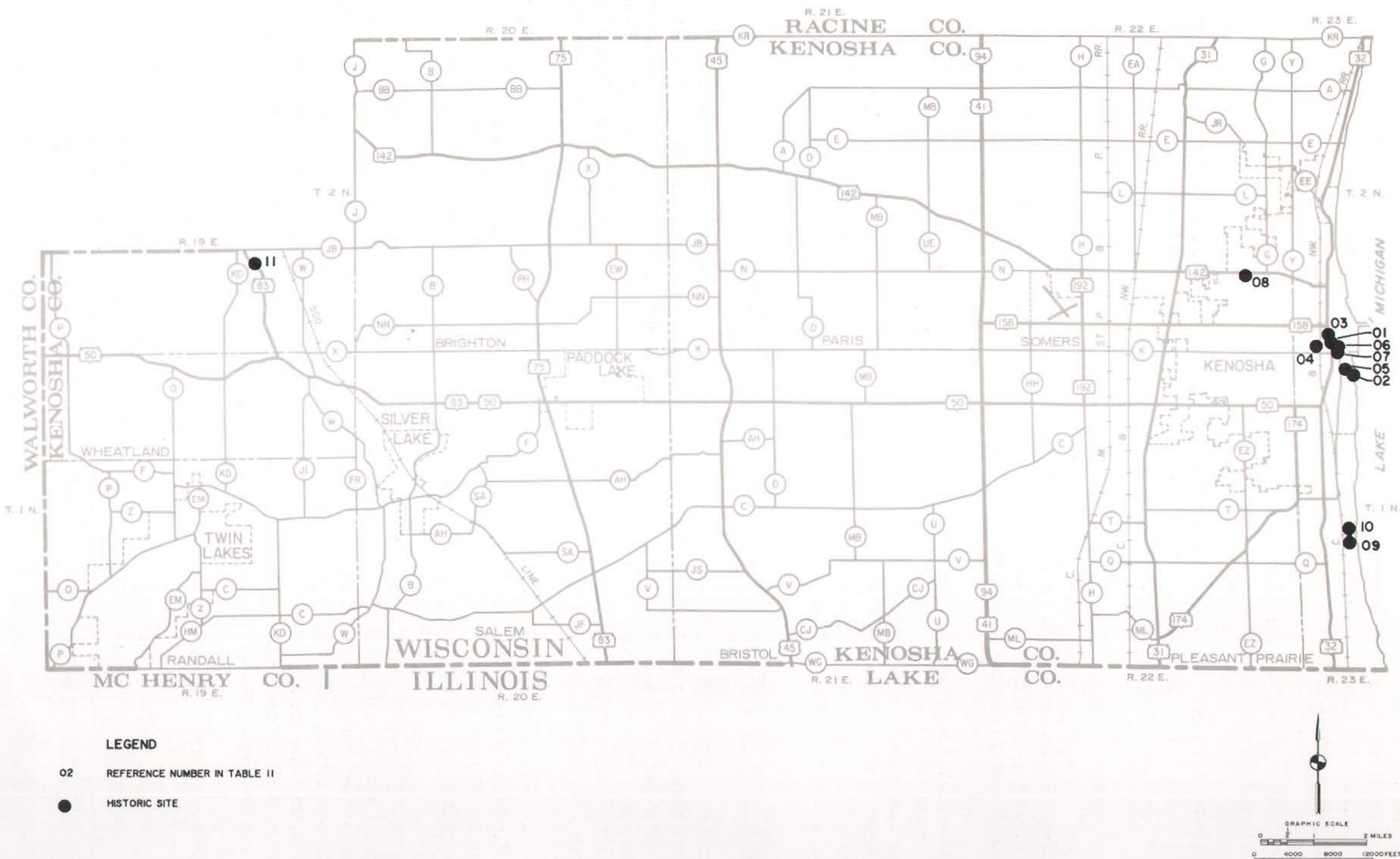
### SITES IN KENOSHA COUNTY LISTED ON THE NATIONAL REGISTER OF HISTORIC PLACES: 1986

| Map Reference Number | Site Name | Civil Division | U. S. Public Land Survey Town, Range, and Section | Year Listed |
|---|---|---|---|---|
| 1 | Boys and Girls Library....... | City of Kenosha | T2N, R23E Section 31 | 1980 |
| 2 | Kemper Hall.................. | City of Kenosha | T1N, R23E Section 5 | 1976 |
| 3 | Kenosha County Courthouse.... | City of Kenosha | T2N, R23E Section 31 | 1982 |
| 4 | John McCaffary House......... | City of Kenosha | T2N, R23E Section 31 | 1978 |
| 5 | The Manor House.............. | City of Kenosha | T1N, R23E Section 5 | 1980 |
| 6 | St. Matthew's Episcopal Church........... | City of Kenosha | T2N, R23E Section 31 | 1979 |
| 7 | Gilbert M. Simmons Memorial Library........... | City of Kenosha | T2N, R23E Section 31 | 1974 |
| 8 | Justin Weed House............ | City of Kenosha | T2N, R22E Section 25 | 1974 |
| 9 | Barnes Creek Site............ | Town of Pleasant Prairie | T1N, R23E Section 19 | 1977 |
| 10 | Chesrow Site................. | Town of Pleasant Prairie | T1N, R23E Section 19 | 1978 |
| 11 | Wehmhoff Mound............... | Town of Wheatland | T2N, R19E Section 26 | 1985 |

Source: State Historical Society of Wisconsin.

## Map 20

## HISTORIC SITES IN KENOSHA COUNTY: 1985




Source: SEWRPC.

- NA-3. Natural areas modified through man's disturbance, but which maintain a moderate degree of natural cover and are suitable for preservation. Many of these lower quality areas play an important role in watershed protection and as environmental corridors.

- Rare Species Habitat. Areas where one or more rare, threatened, or endangered species are known to exist.

- Geological Sites. Areas where outcrops and structural and glacial features of geological interest are located. These areas can be of state or county significance.

Those natural areas which represent the best remaining examples of plant and animal communities, geological sites, or archaeological sites may also be designated as state scientific areas. These areas have been determined to be of at least statewide significance and have been so designated by the Scientific Areas Preservation Council.

A total of 28 natural areas have been identified and ranked in Kenosha County, as shown on Map 21. Four of these sites--Chiwaukee Prairie in the Town of Pleasant Prairie, Silver Lake Bog and Peat Lake in the Town of Salem, and New Munster Bog Island in the Town of Wheatland--have been designated as state scientific areas by the Wisconsin Scientific Areas Preservation Council. A description of the natural areas in Kenosha County is presented in Table 12.

## Existing Outdoor Recreation and Open Space Sites

Kenosha County encompasses a broad spectrum of public and nonpublic outdoor recreation and related open space sites, ranging from tot lots and small, intensively developed neighborhood parks in urbanized areas to large wildlife preserves in outlying areas of the County. In 1985, there were 200 public outdoor recreation and related open space sites in the County, totaling 9,754 acres. In addition, there were 117 nonpublic sites, totaling 3,384 acres.

The largest contiguous outdoor recreation lands in the County are comprised of the Kenosha County Parks System and lands owned by the Wisconsin Department of Natural Resources. As shown in Table 13 and on Map 22, these lands encompass approximately 7,803 acres, or about 4 percent of the total area of the County.

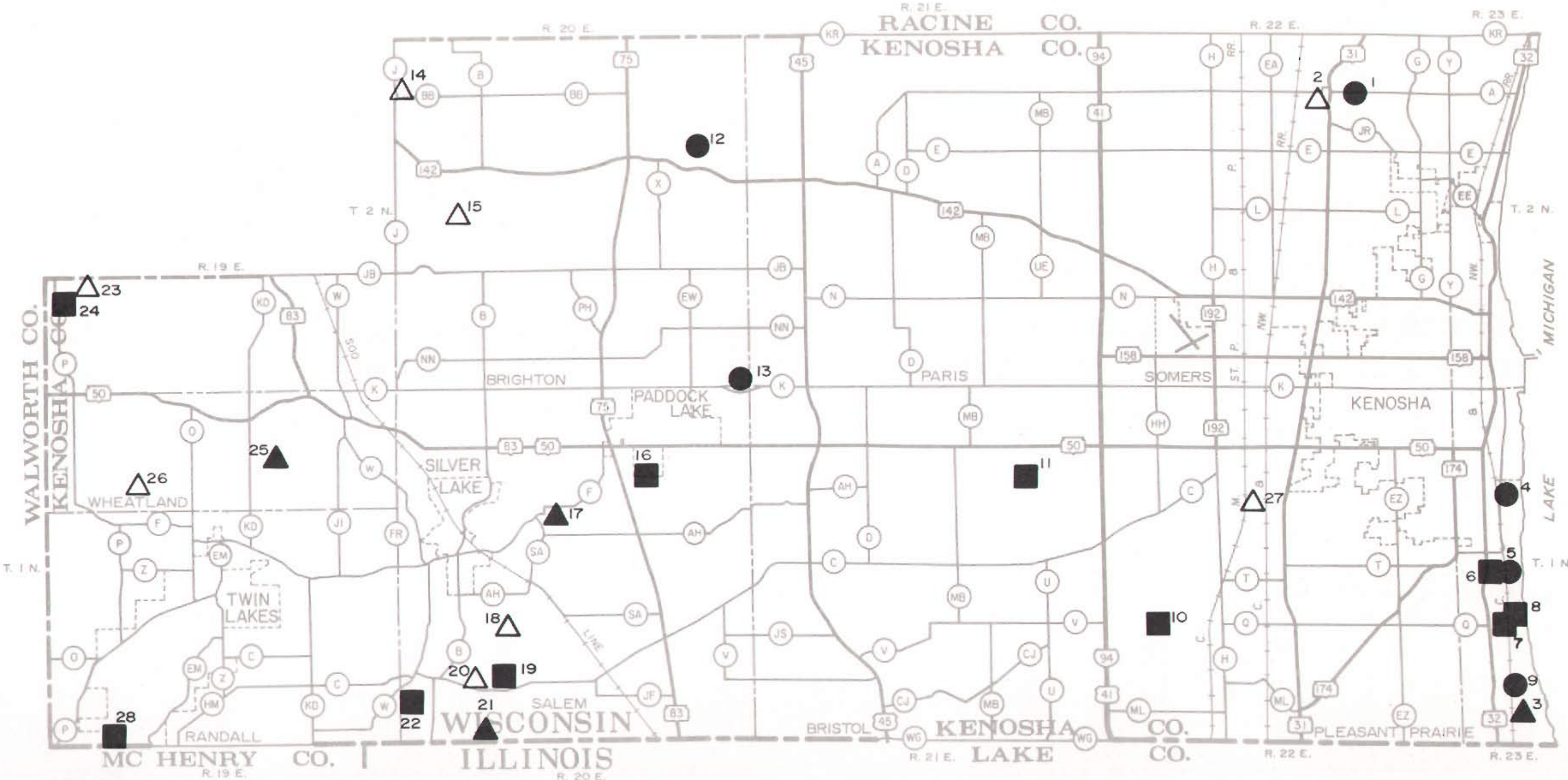
The existing park and open space sites in the County constitute an important recreational and natural resource, and the impacts of locating solid waste facilities near parklands would have to be evaluated in any site-specific studies which assess the overall suitability of various sites. It is also important to point out that some lands in southeastern Wisconsin formerly utilized for landfilling have, upon closure and reclamation, been converted to intensive recreational uses such as ballfields.

## Environmental Corridors

One of the most important tasks completed under the regional planning effort has been the identification and delineation of those areas in southeastern Wisconsin that contain concentrations of recreational, aesthetic, ecological, and cultural resources, and which therefore should be preserved and protected. Such areas normally include one or more of the following seven elements of the natural resource base which are essential to the maintenance of both the eco-

## Map 21

SCIENTIFIC AND NATURAL AREAS IN KENOSHA COUNTY: 1985




LEGEND

- ▲ STATE SCIENTIFIC AREA (SA)
- ● NATURAL AREA OF STATEWIDE OR GREATER SIGNIFICANCE (NA-1)
- ■ NATURAL AREA OF COUNTYWIDE OR REGIONAL SIGNIFICANCE (NA-2)
- △ NATURAL AREA OF LOCAL SIGNIFICANCE (NA-3)
- 15 SITE NUMBER (SEE TABLE 12)

GRAPHIC SCALE 0 1 2 MILES; 0 4000 8000 12000 FEET

Source: Wisconsin Department of Natural Resources and SEWRPC.

# Table 12

## KNOWN NATURAL AND SCIENTIFIC AREAS LOCATED IN KENOSHA COUNTY: 1985

| Number on Map 21 | Name | U. S. Public Land Survey Town, Range Section, Quarter Section | Acreage | Classification Code | Description |
|---|---|---|---|---|---|
| 1 | Petrifying Springs Hardwoods | T2N, R22G<br>SE, SW Sec. 2<br>NE, NW Sec. 11 | 140 | NA-1 | A rich southern mesic to dry-mesic hardwood forest containing white oak, red oak, ash, sugar maple, and basswood. The undulating topography is covered by a very diverse spring flora. One of the better woodland areas remaining in southeastern Wisconsin. |
| 2 | Hawthorne Hollow | T2N, R22E<br>SE Sec. 3<br>NE Sec. 10 | 50 | NA-3 | A lowland hardwood forest bordering Pike Creek. Area includes a 10-acre prairie. |
| 3 | Chiwaukee Prairie | T1N, R23E<br>NE, SE Sec. 31<br>NW, SW Sec. 32 | 271 | SA and NA-1 | Rich prairie and marsh on swell and swale topography created when the level of glacial Lake Michigan was lowered in stages. Over 400 plant species have been documented in the prairie, some of which are very rare in the State. Scattered oaks in portions give a savanna aspect to the tract. A National Natural Landmark and one of the most important prairies in Wisconsin. Critical plant species present. The officially designated state scientific area represents an 82-acre portion of this area adjacent to the Chicago & North Western Railway right-of-way. |
| 4 | Kenosha Sand Dunes | T1N, R23E<br>SE Sec. 7<br>SW Sec. 8 | 94 | NA-1 | One-half mile of frontage on Lake Michigan containing well-developed dunes and dune succession patterns (fore dunes to swale to wet prairie). The diversity of beach plant species is good. Some ditching has been done behind the dune area, but it remains in good condition and is an excellent observation area for migrating shore birds. An ancient hardwood forest bed was discovered in this area in the early 1960's as wave erosion exposed sections of the shoreline. The Lake Michigan shore has now been riprapped. |
| 5 | Carol Beach Low Prairie and Panne' | T1N, R23E<br>SE Sec. 18<br>NE Sec. 19 | 35 | NA-1 | A rich low prairie and calcareous fen on a dune and swale topography. Critical plant species present. |
| 6 | Carol Beach Estates Prairie | T1N, R23E<br>SE Sec. 18<br>NE Sec. 19 | 14 | NA-2 | A rich wet to mesic prairie with some shrub invasion on sandy soils. Critical plant species present. |
| 7 | Carol Beach Prairie | T1N, R23E<br>SE Sec. 19<br>SW Sec. 20<br>NW Sec. 29<br>NE Sec. 30 | 66 | NA-2 | A rich complex of low to dry prairie with fresh (wet) meadow, sedge meadow, shrub carr, and shallow marsh communities on a dune and swale topography. Critical plant species present. |
| 8 | Barnes Creek Dunes and Panne' | T1N, R23E<br>SW Sec. 20 | 9 | NA-2 | An unusual mixture of dry prairie and calcareous fen plant species on a dune and swale topography adjacent to Barnes Creek. Critical plant species present. |

## Table 12 (continued)

| Number on Map 21 | Name | U. S. Public Land Survey Town, Range Section, Quarter Section | Acreage | Classification Code | Description |
|---|---|---|---|---|---|
| 9 | Tobin Road Prairie | T1N, R23E<br>SE Sec. 30 | 4 | NA-1 | A portion of the northern Chiwaukee Prairie area containing a rich low prairie on a dune and swale topography. Critical plant species present. |
| 10 | Des Plaines River Marsh and Woods | T1N, R22E<br>SE Sec. 18<br>NE, NW, SW, SE Sec. 19<br>NW, SW Sec. 20<br>NE, NW, SW Sec. 29<br>NE, SE Sec. 30<br>NE Sec. 31<br>NW Sec. 32 | 910 | NA-2 | Woodland containing remnant oak-shagbark hickory with old growth of both red and white oak and black cherry timber. The undergrowth is generally shrubs, with hawthorns, black cherry, and raspberry dominant. An old meander of the Des Plaines River divides the woodland, now containing various wetland species. To the south there is an extensive wetland, ditched in many places but not traversed by a highway for nearly two miles. Significant because of its open space and wildlife habitat, it is one of the longest stretches of river without a highway in the County. |
| 11 | Benedict Prairie | T1N, R21E<br>SE Sec. 11 | 6 | NA-2 | A small, but rich, six-acre wet-mesic to mesic prairie remnant located in an abandoned railroad right-of-way. |
| 12 | Friendship Lake and Marsh | T2N, R20E<br>SW Sec. 12<br>NW Sec. 13 | 55 | NA-1 | A small, but good-quality, kettle lake and marsh. Valuable feeding and nesting habitat for a variety of marshland birds. |
| 13 | Harris Tract | T1N, R20E<br>NE Sec. 1<br>T2N, R20E<br>NE, SE Sec. 36<br>T2N, R21E<br>NW, SW Sec. 31 | 150 | NA-1 | A large, good-quality marsh adjacent to Brighton Creek. A grazed oak opening is located to the east of the marsh. Managed by the University of Wisconsin-Parkside. |
| 14 | Henning Tract | T2N, R20E<br>SW Sec. 6 | 10 | NA-3 | A small, moderate-quality lowland hardwoods and bog. |
| 15 | Bong Prairie Remnant | T2N, R20E<br>NW Sec. 20 | 6 | NA-3 | A small, low prairie remnant. |
| 16 | Hooker Lake Marsh | T1N, R20E<br>NE, NW, SW Sec. 11 | 60 | NA-2 | A large, deep and shallow marsh in Hooker Lake. |
| 17 | Silver Lake Bog | T1N, R20E<br>NE Sec. 16 | 20 | SA | A southern bog lake lacking many of the typical species of its type farther north, but with well-defined zones of succession and a number of unusual species for the Region. Poison sumac and a quaking sphagnum bog mat make visitation to the open water center a challenge. Under the shade of tamaracks grow such typical bog species as pitcher plant, round-leaved sundew, cranberry, and Michigan holly. |
| 18 | Valmar Marsh | T1N, R20E<br>SE Sec. 20, SW Sec. 21<br>NW Sec. 28, NE Sec. 29 | 105 | NA-3 | Cattail marsh adjacent to Camp Lake. Some ditching. |

Table 12 (continued)

| Number on Map 21 | Name | U. S. Public Land Survey Town, Range Section, Quarter Section | Acreage | Classification Code | Description |
|---|---|---|---|---|---|
| 19 | Camp Lake Marsh | T1N, R20E SW Sec. 28 NE, SE Sec. 29 NE Sec. 32, NW Sec. 33 | 125 | NA-2 | Marshland ditched, but rich in aquatic plants and waterfowl. |
| 20 | Kriska Property Marsh | T1N, R20E SE, SW Sec. 29 NE, NW Sec. 32 | 100 | NA-3 | A good-quality deep and shallow marsh. Some ditching attempts. |
| 21 | Peat Lake | T1N, R20E SE, SW Sec. 32 | 125 | SA | Shallow, slightly alkaline lake about 12 acres in size located in ground moraine. The muck bottom lake is surrounded by a wide belt of sedge meadow and cattail marsh, making it a valuable nesting and resting area for a variety of wetland bird species. This is one of the few undeveloped lakes in Kenosha County which is isolated from roads and homes. |
| 22 | Stopa Fen | T1N, R20E NW Sec. 31 | 5 | NA-2 | A small calcareous fen and springs located adjacent to the Fox (Illinois) River. Reportedly contains a large population of white lady's slipper orchids. Presently threatened by shrub invasion. |
| 23 | Dyer Lake Goat Prairie | T2N, R19E NE Sec. 30 | 3 | NA-3 | A small, dry prairie remnant located on steep slopes. Reportedly contains kitten-tails (Besseya bullii). |
| 24 | Dyer Lake and Marsh | T2N, R19E NE, NW, SW Sec. 30 | 105 | NA-2 | A small, undeveloped lake with a good-quality successional wetland complex of deep and shallow marsh, southern sedge meadow, and shrub carr. |
| 25 | New Munster Bog Island | T1N, R19E SW Sec. 2, SE Sec. 3 NE Sec. 10, NW Sec. 11 | 55 | SA | Lowland tract containing a diversity of southern Wisconsin shrub and timber swamp types, surrounding an upland knoll wooded with a dry-mesic forest. Yellow birch occurs in the swamp at the southern edge of its range. The vegetational diversity supports a wide array of nesting birds, as evidenced by breeding bird censuses. |
| 26 | Powers Lake Tamarack | T1N, R19E NE, NW, SW, SE Sec. 8 | 235 | NA-3 | A large but disturbed sedge marsh and tamarack-shrub carr wetland complex. |
| 27 | Bain Station Road Prairie | T1N, R22E SE, SW Sec. 9 | 10 | NA-3 | A small wet-mesic to mesic prairie remnant dominated by big bluestem grass, switch grass, and prairie dock. |
| 28 | Elizabeth Lake Wetlands | T1N, R19E SE Sec. 31, SW Sec. 32 | 45 | NA-2 | A large, good-quality sedge meadow, shrub carr, and shallow and deep marsh complex. |

Source: Wisconsin Department of Natural Resources and SEWRPC.

logical balance and the natural beauty of southeastern Wisconsin: 1) lakes, rivers, and streams and their associated floodlands and shorelands; 2) wetlands; 3) woodlands; 4) prairies; 5) wildlife habitat areas; 6) wet, poorly drained, or organic soils; and 7) rugged terrain and high-relief topography. While the foregoing elements constitute integral parts of the natural resource base, there are five additional elements which, although not part of the natural resource base per se, are closely related to or centered on that base and are a determining factor in identifying and delineating areas with recreational, aesthetic, ecological, and cultural values. These five additional elements are: 1) existing park and open space sites; 2) potential park and open space sites; 3) historic sites; 4) significant scenic areas and vistas; and 5) natural and scientific areas.

The delineation of these 12 natural resource and resource-related elements on a map results in an essentially linear pattern of relatively narrow, elongated areas which have been termed "environmental corridors" by the Regional Planning Commission. Primary environmental corridors include a wide variety of the important resource and resource-related elements and are at least 400 acres in size, two miles long, and 200 feet wide. Secondary environmental corridors generally connect with primary environmental corridors and are at least 100 acres in size and one mile long.

In any discussion of environmental corridors and important natural resource features, it is important to point out that there are many interacting relationships between living organisms and their environment. The destruction of any important element of the total environment may lead to a chain reaction of deterioration and destruction. The drainage of wetlands, for example, may have far-reaching effects, since such drainage may destroy fish spawning grounds, wildlife habitat areas, groundwater recharge areas, and the natural filtration and floodwater storage areas of interconnecting stream systems. The resulting deterioration of surface water quality may, in turn, lead to a deterioration of the quality of the groundwater, which serves as a source of domestic, municipal, and industrial water supply and upon which low flows of rivers and streams may depend. Similarly, the destruction of woodland cover may result in soil erosion, stream siltation, more rapid runoff, and increased flooding, as well as the destruction of wildlife habitat. Although the effects of any one of the environmental changes may not in and of itself be overwhelming, the combined effects must eventually lead to serious deterioration of the supporting natural resource base and of the overall quality of the environment for life. The need to maintain the integrity of the remaining environmental corridors and important natural resource features within Kenosha County should thus be apparent.

It should be noted that environmental corridors are generally poorly suited for intensive urban development. The intrusion of intensive urban land uses into the corridors can, because of the soil limitations, high groundwater tables, and flood hazards present, result in the creation of such problems as faulty foundations for pavements and structures, wet basements, excessive clearwater infiltration and inflow into sanitary sewerage systems, and poor drainage. Protection of the environmental corridors from urban encroachment serves to minimize these serious and costly developmental problems.

Primary Environmental Corridors: Primary environmental corridors in Kenosha County generally lie along major stream valleys and around major lakes. Primary environmental corridors are shown on Map 23. Delineations are available

## Table 13

## KENOSHA COUNTY PARK SYSTEM AND WISCONSIN DEPARTMENT OF NATURAL RESOURCES LANDS IN KENOSHA COUNTY: 1985

| Map Reference Number | Site Name | Size (acres) |
|---|---|---|
| 1 | Brighton Dale Park | 360 |
| 2 | Bristol Woods Park | 206 |
| 3 | Fox River Park | 154 |
| 4 | Ice Arena | 8 |
| 5 | Kemper Center | 15 |
| 6 | Old Settlers Park | 16 |
| 7 | Petrifying Springs Park | 358 |
| 8 | Silver Lake Park | 258 |
| 9 | New Munster Wildlife Area | 1,009 |
| 10 | Bong Recreation and Wildlife Area | 4,515 |
| 11 | Paddock Lake Marsh | 9 |
| 12 | Hooker Lake Marsh | 40 |
| 13 | Silver Lake Marsh | 39 |
| 14 | Camp Lake Fishery | 126 |
| 15 | Peat Lake Wildlife Area | 177 |
| 16 | Scattered Wetland | 60 |
| 17 | Scattered Wetland | 40 |
| 18 | State Wetland Area | 160 |
| 19 | Extensive Wildlife Habitat Peat Lake | 253 |
| | County Total | 7,803 |

Source: Wisconsin Department of Natural Resources.

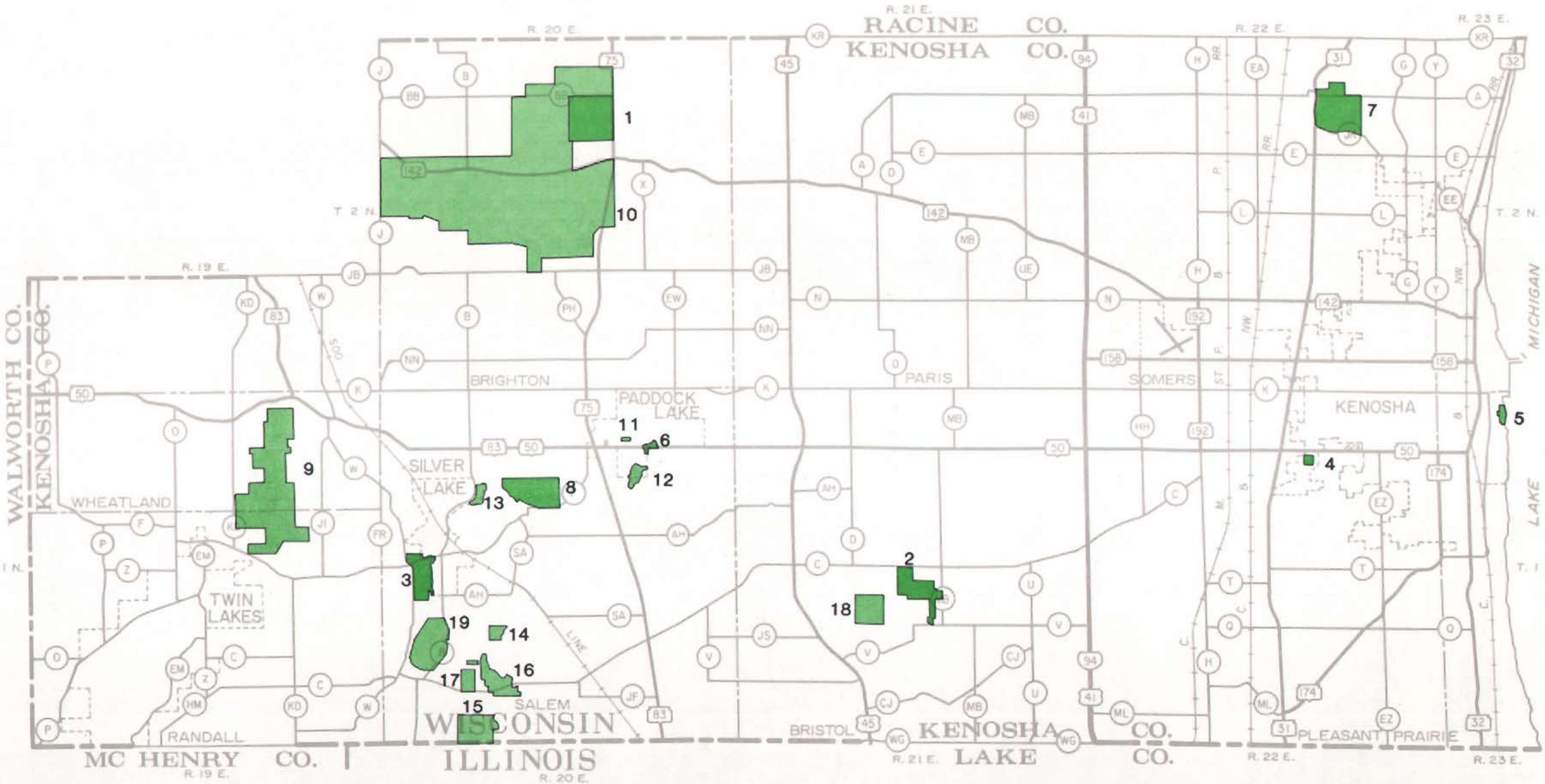
on 1 inch equals 400 feet scale aerial photographs for all of Kenosha County. These important inventory data should be consulted and carefully considered in any solid waste management facility siting analysis. These corridors contain important woodlands, wetlands, surface water, and wildlife habitat areas in the County; are, in effect, a composite of the best individual elements of the natural resource base; and have truly immeasurable environmental and recreational value.

In 1980, primary environmental corridors in Kenosha County encompassed 27,970 acres, or 16 percent of the total area of the County. Of this total acreage, 43 percent consisted of wetlands, 18 percent of woodlands, 19 percent of other open lands, 16 percent of surface water, and 3 percent of urban lands. Urban lands within the primary environmental corridors consist primarily of developed shorelands around the inland lakes and Lake Michigan.

Secondary Environmental Corridors: The secondary environmental corridors in Kenosha County, as shown on Map 23, are generally located along intermittent streams or serve as links between segments of primary environmental corridors. These corridors contain a variety of resource elements, often remnant resources from former primary environmental corridors which have been developed for agricultural purposes or urban land uses. Secondary environmental corridors

## Map 22

### KENOSHA COUNTY PARK SYSTEM AND WISCONSIN DEPARTMENT OF NATURAL RESOURCES LANDS IN KENOSHA COUNTY: 1985




LEGEND

COUNTY SITE

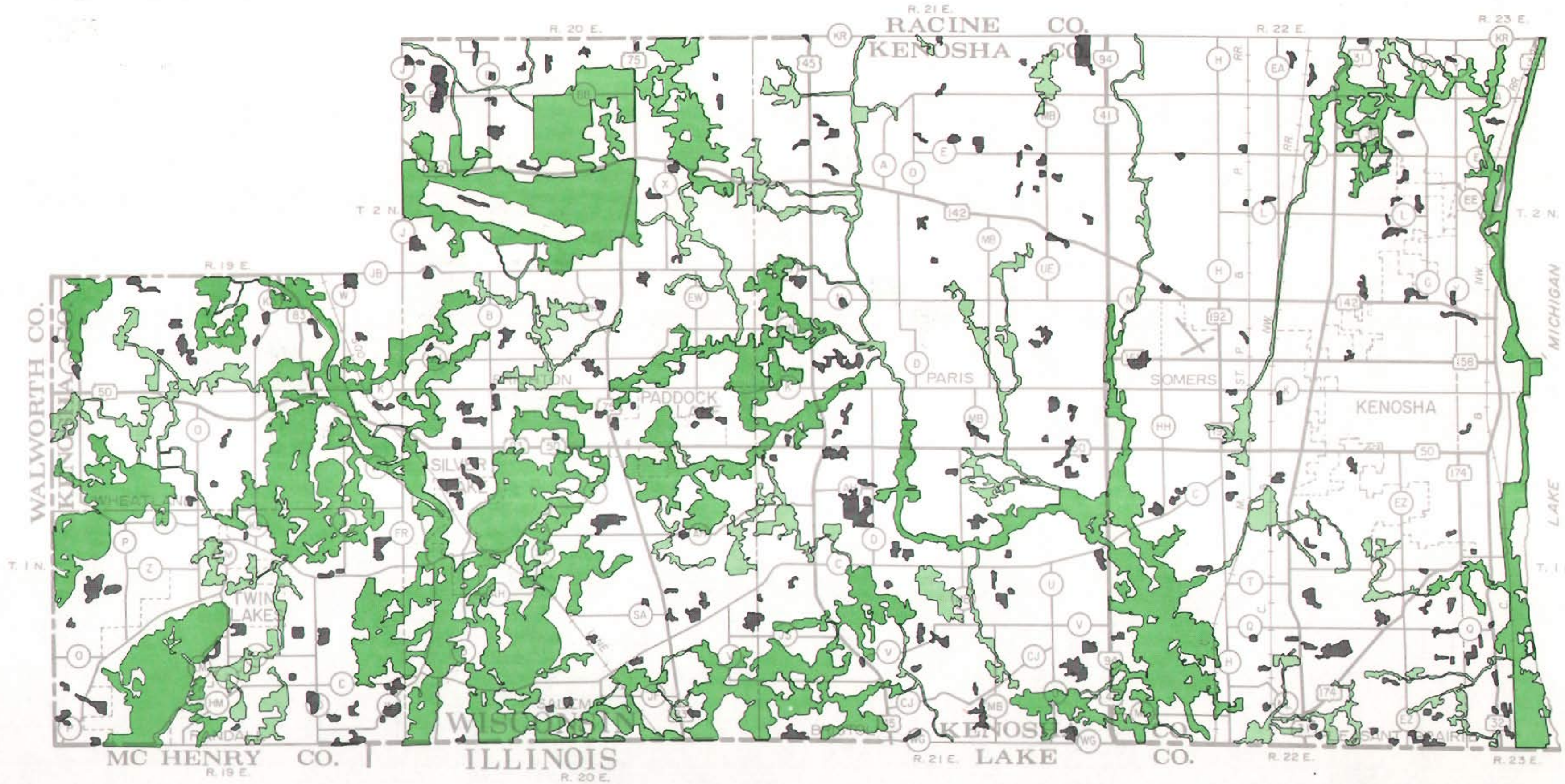
WISCONSIN DEPARTMENT OF NATURAL RESOURCES SITE

2 REFERENCE NUMBER IN TABLE 13

Source: SEWRPC.

## Map 23

### ENVIRONMENTAL CORRIDORS AND ISOLATED NATURAL AREAS IN KENOSHA COUNTY: 1980




LEGEND

PRIMARY ENVIRONMENTAL CORRIDOR

SECONDARY ENVIRONMENTAL CORRIDOR

ISOLATED NATURAL AREA

Source: SEWRPC.

facilitate surface water drainage, maintain "pockets" of natural resource features, and provide for the movement of wildlife, as well as for the movement and dispersal of seeds for a variety of plant species.

In 1980, secondary environmental corridors in Kenosha County encompassed 6,134 acres, or 3 percent of the total area of the County. Of this total acreage, 36 percent consisted of wetlands, 32 percent of woodlands, 30 percent of other open lands, 2 percent of surface water, and less than 1 percent of urban lands.

Isolated Natural Features: In addition to the primary and secondary environmental corridors, other, small concentrations of natural resource base elements exist within the County. As shown on Map 23, these resource base elements, which may have important natural values, are isolated from the environmental corridors. Isolated natural features may provide the only available wildlife habitat in an area, provide good locations for local parks and nature study areas, and lend aesthetic character and natural diversity to an area.

In 1980, isolated natural areas in Kenosha County encompassed a total of 3,869 acres, or 2 percent of the total area of the County. Of this total acreage, 33 percent consisted of wetlands, 52 percent of woodlands, 11 percent of other open lands, 4 percent of surface water, and less than 1 percent of urban lands.

## SOLID WASTE SOURCES, QUANTITY, AND CHARACTER

A knowledge of the amount, characteristics, and sources of solid waste is necessary to the development of an efficient and environmentally sound solid waste management plan. This portion of the report describes the existing quantities and characteristics of the solid waste generated in the study area and identifies the sources of these wastes. Information contained in this section was developed utilizing data obtained from the Wisconsin Solid Waste Recycling Authority, the Wisconsin Department of Natural Resources, and inventory data collected from the local units of government, industries, commercial establishments, institutions, landfill operators, and solid waste collection operations in the County as a part of the study. Copies of the questionnaires utilized in the inventory of the local units of government and county industries, commercial establishments, and institutions are provided in Appendix C.

Solid wastes generated within the County may be classified into five categories: residential, commercial, industrial, agricultural, and a special category for all other solid wastes. These five categories may be described as follows.

Residential--Solid wastes which are generated by both urban and rural households, including households residing in multifamily dwelling units within the County, and consisting mainly of food wastes, ashes, and rubbish. Rubbish includes paper, cardboard, garden and lawn trimmings, plastics, textiles, and dirt. These wastes contain limited amounts of hazardous materials such as paints, cleaning compounds, and pesticides. These wastes are sometimes referred to as domestic, municipal, or household wastes.

Commercial--Solid wastes which are generated by wholesale, retail, and service establishments such as stores, offices, restaurants, and hotels, as well as wastes generated by public institutions and recreational land uses. These wastes are variable in character, but when taken as a category are normally composed of materials similar to residential wastes.

Industrial--Solid wastes which are generated by a variety of light and heavy manufacturing and processing operations, lumbering, and chemical plants. These wastes are highly variable in character. Agricultural wastes, toxic and hazardous wastes, and wastewater treatment sludges which require special consideration in processing and disposal are not included in this category but are included in the special solid waste category.

Agricultural--Solid wastes which are generated by the agricultural industry and consisting primarily of livestock and poultry manure, crop residue, and dead animals.

Special--Solid wastes which consist of all wastes other than the above categories. This category includes construction/demolition wastes, hazardous wastes, wastewater treatment sludges, and septic and holding tank wastes. These wastes usually require special handling and disposal techniques.

Each of these waste categories is discussed below. It is important to note that as previously discussed, the solid waste quantities presented below account for contributions by seasonal residents in the County.

## Residential Wastes

Residential wastes include all wastes normally generated by all household activities. Several studies have been conducted to identify the amount of such wastes generated. In 1981, the Wisconsin Department of Natural Resources (DNR) developed a state solid waste management plan[4] which examined statewide solid waste management practices. That study indicated that the unit volume of residential solid waste generated within the State varies with community size. The average generation rates associated with four different community size categories were as follows:

- 2.0 pounds per capita per day for civil divisions having resident populations of fewer than 2,500 people.
- 2.7 pounds per capita per day for civil divisions having resident populations of between 2,500 and 10,000 people.
- 3.2 pounds per capita per day for civil divisions having resident populations of between 10,000 and 30,000 people.
- 3.6 pounds per capita per day for civil divisions having resident populations of greater than 30,000 people.

The total annual residential solid waste load in the County during 1984 was estimated using information provided in a solid waste management questionnaire

[4]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

which was completed by each municipality in the County. A copy of the questionnaire is presented in Appendix C. Based on this information, it was estimated that in 1984, 51,910 tons of residential solid waste, or 2.3 pounds per capita per day, were generated in the County. This does not include wastes generated by residents which are classified as bulk materials and trees and brush. This quantity also does not include that portion of residential solid wastes which is recycled. It was estimated that 850 tons per year, or 0.04 pound per capita per day, are recycled. These recycled materials are comprised primarily of paper, metal, and glass.

Seasonal variations in residential solid waste production were also evaluated. Normal changes in solid waste generation due to seasonal influences such as initial yard cleanup activity in spring and leaf raking in fall increase the volume of solid waste. As will be discussed below, this factor causes fluctuations in the rate of solid waste generation.

Residential waste contains a variety of components, with paper products generally making up slightly more than half of the weight, and food and yard wastes constituting the next largest components of the waste in that order. There have been many studies conducted to determine the composition of residential waste. Data provided by the Governor's Recycling Task Force on Solid Waste[5] and the Wisconsin Solid Waste Recycling Authority[6,7] pertaining to the average composition of residential wastes were used to estimate the residential solid waste composition in Kenosha County. Based on this information, the average composition of residential solid waste is as follows:

| Component | Percent by Weight |
|---|---|
| Paper.................. | 47 |
| Food................... | 12 |
| Yard Wastes............ | 10 |
| Glass.................. | 7 |
| Metals................. | 7 |
| Plastics............... | 6 |
| Textiles............... | 4 |
| Wood................... | 2 |
| Unclassified and Miscellaneous........ | 5 |

## Commercial Wastes

Commercial solid waste is generated by transportation, communications, wholesale trade, retail trade, finance, and service industry establishments,

[5]Board of Engineering Consultants, Wisconsin Solid Waste Recycling--Predesign Report, Governor's Recycling Task Force on Solid Waste, May 1973.

[6]Wisconsin Solid Waste Recycling Authority, Preliminary Engineering Report for Recycling in Region II, 1981.

[7]Wisconsin Solid Waste Recycling Authority, Final Report for Implementation of Recycling for Region I, March 1981.

including stores, restaurants, offices, hotels, motels, and warehouses. Additionally, this category includes solid wastes generated by governmental and institutional establishments, including hospitals and nursing homes, except special items such as pathological wastes and chemicals. Demolition and construction solid wastes are not included in the commercial wastes category but in the special wastes category.

The 1981 study by the DNR estimated that 1.1 pounds per capita per day of commercial solid waste is generated within the State. Economic activity, as measured by the proportion of workers employed in each major industrial category, is one means of relating commercial activity within the County to that within the State. In 1980, about 55 percent of the workers in Kenosha County were employed in activities generating commercial solid wastes, including transportation, communication, utilities, trade, finance, insurance, real estate, services, and government. This compares to 60 percent of the employment being related to these commercial activities statewide.

The annual amount of commercial solid waste generated in the County was determined using data provided by local officials in the municipal solid waste questionnaire, information provided in a separate solid waste questionnaire mailed to the 20 largest generators of commercial and institutional solid wastes in the County, information provided by private solid waste collection contractors, and the above-referenced DNR per capita commercial solid waste generation rate.

Based on this information, it was estimated that 23,585 tons of commercial solid waste are generated in the County per year, or about 1.1 pounds per capita per day. This quantity does not include an estimated 6,600 tons per year, or 0.3 pound per capita per day, of commercial solid wastes which are recycled or incinerated. The recycled materials are comprised primarily of paper and cardboard. The total commercial solid waste load was allocated spatially among the civil divisions in the County on the basis of the distribution of commercial land uses in the County and information provided by commercial refuse collection contractors.

The composition of commercial solid waste varies with the individual source. Overall, however, the composition of commercial wastes is similar to the composition of residential wastes. The previously referenced studies prepared for the Governor's Recycling Task Force on Solid Waste and the information provided by the Wisconsin Solid Waste Recycling Authority regarding the composition of commercial solid wastes were used to estimate the commercial solid waste composition in Kenosha County. Based on this information, the average composition of commercial solid wastes may be expected to be as follows:

| Component | Percent by Weight |
|---|---|
| Paper | 56 |
| Food | 10 |
| Metals | 9 |
| Glass | 6 |
| Plastics | 6 |
| Unclassified and Miscellaneous | 13 |

## Industrial Wastes

Industrial waste consists of the residue from a variety of manufacturing and processing activities. The waste from industries is primarily scrap paper, wood, metals, glass, sands, textiles, plastics, and sludges. This category does not include toxic and hazardous wastes, oils, solvents, or chemical sludges which are included in the special solid waste category. The type of industries located in the County are diverse and include those involved in the manufacturing and/or processing of nonelectrical and electrical machinery; fabricated metal products, equipment, and supplies; food; textiles; wood products; plastics; chemicals; precision instruments; and printed materials.

In Kenosha County, approximately 37 percent of the employed labor force is employed in some type of manufacturing industry. The waste generated from industrial sources in the County can be estimated by applying per capita or per manufacturing employee factors to the resident population or the manufacturing employment in the County, or can be determined from surveys conducted of major industries.

The Wisconsin Solid Waste Management Plan provides estimates of industrial solid waste generation for each industrial classification. The estimated waste generated by each industry, segregated by the Standard Industrial Classification (SIC) code, is shown in Table 14. A solid waste survey was conducted of 20 industries in the study area to further evaluate the amount of industrial solid waste being generated in the County, with eight industries, or about 40 percent of the industries, responding. The industries surveyed were selected to include a representative cross-section of the industrial employment and concomitant waste generation in the County. The SIC code data and the data from the industries which responded to the survey were used to determine the amount of industrial solid waste being generated in the County.

Based on these sources of information, it was estimated that in 1984, 46,030 tons of industrial solid waste, or about 2.1 pounds per capita per day, were generated in the County. The average composition of industrial solid wastes may be expected to be as follows:

| Component | Percent by Weight |
|---|---|
| Paper | 35 |
| Metal | 14 |
| Foundry Sand | 11 |
| Yard Wastes | 10 |
| Food | 7 |
| Glass | 7 |
| Plastics | 3 |
| Trees and Brush | 1 |
| Unclassified and Miscellaneous | 12 |

This quantity does not include an estimated 110,000 tons per year, or about 5 pounds per capita per day, of industrial wastes which are recycled or incinerated. These recycled materials are comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials.

## Table 14

### WASTE GENERATION RATES FOR INDUSTRIES BY STANDARD INDUSTRIAL CLASSIFICATION

| Standard Industrial Classification Code Number | Industry | Estimated Waste Generation Rate (pounds per employee per day) |
|---|---|---|
| 20-39 | All manufacturing | 26.7 |
| 20 | Food products | 1.7 |
| 22 | Textile mill products | 1.3 |
| 23 | Apparel | 89.0 |
| 24 | Lumber and wood products, except furniture | 6.8 |
| 25 | Furniture and fixtures | 81.7 |
| 26 | Paper and allied products | 6.2 |
| 27 | Printing and publishing | 45.0 |
| 28 | Chemicals | 159.2 |
| 29 | Petroleum refining | 6.1 |
| 30 | Rubber and plastics products | 1.1 |
| 31 | Leather and leather products | -- |
| 32 | Stone, clay, glass, and concrete products | 125.0 |
| 33 | Primary metals | 36.8 |
| 34 | Fabricated metal products | 20.4 |
| 35 | Machinery, except electrical | 19.9 |
| 36 | Electrical and electronic machinery | 14.7 |
| 37 | Transportation equipment | 7.1 |
| 38 | Precision instruments | 1.9 |
| 39 | Miscellaneous manufacturing industries | 6.6 |

Source: Wisconsin Department of Natural Resources.

## Agricultural Wastes

Agriculture is an important industry in Kenosha County, accounting for about 3 percent of the total employment in the County in 1980. Solid wastes result from agricultural activities such as the planting and harvesting of row, field, tree, and vine crops; the production of milk; and the production of animals for meat, including the operation of feedlots.

Most of the agricultural wastes that are produced are naturally recycled, and returned to the soil. The agricultural wastes are generally recycled on the agricultural fields of the farm where they are generated. Agricultural wastes are high in organic content and valuable for the maintenance of soil productivity. Data on the amounts of agricultural waste are provided in the state solid waste management plan, including waste generation rates associated with various crop acreages and numbers of livestock. Table 15 indicates the solid waste production rates based upon that DNR report and based upon analyses conducted by the Regional Planning Commission as a part of its regional water quality management planning effort.

Based upon the solid waste production rates provided in Table 15, the 1980 agricultural land use data collected by the Regional Planning Commission, and information contained in the 1985 Wisconsin Agricultural Statistics report, it is estimated that 405,280 tons of agricultural waste were generated in Kenosha County in 1984. Of this total, about 184,660 tons, or 46 percent, were animal wastes. Animal wastes can be a solid waste management problem in areas where certain agricultural practices result in the concentrated generation of these wastes. There are three major alternatives for processing and/or disposal of animal wastes--landfilling, digestion to stabilize the waste, and land application. It is reasonable to assume that most agricultural and animal wastes

## Table 15

## AGRICULTURAL SOLID WASTE PRODUCTION IN KENOSHA COUNTY: 1984

| Crop | Acres[a] | Annual Waste Production Factor per Year[b] (tons per acre) | Solid Waste (tons per year) |
|---|---|---|---|
| Corn | 44,900 | 3.00[c] | 134,700 |
| Soybeans | 31,200 | 1.50 | 46,800 |
| Grain Crops | 11,150 | 1.50 | 16,725 |
| Hay | 500 | 2.25 | 1,125 |
| Alfalfa | 10,500 | 2.00 | 21,000 |
| Potatoes | 80 | 1.50 | 120 |
| Snap Beans | 100 | 1.50 | 150 |
| Subtotal | -- | -- | 220,620 |

| Livestock | Number[a] | Annual Waste Production Factor per Year[d] (tons per acre) | Solid Waste (tons per year) |
|---|---|---|---|
| Dairy Cattle | 6,200 | 21.7 | 134,540 |
| Beef Cattle | 1,300 | 11.3 | 14,690 |
| Calves for Slaughter | 7,600 | Not available | -- |
| Hogs | 7,800 | 4.4 | 34,320 |
| Sheep | 300 | 0.7 | 210 |
| Poultry | 9,000 | 0.1 | 900 |
| Subtotal | -- | -- | 184,660 |
| Total | -- | -- | 405,280 |

[a] Data are from Wisconsin Agricultural Statistics, 1985.

[b] Annual waste production crop data are from the Wisconsin Department of Natural Resources report, Wisconsin Solid Waste Management Plan, February 1981.

[c] Annual waste production crop data for corn are from U. S. Soil Conservation Service.

[d] Annual waste production livestock data are from SEWRPC Technical Report No. 21, Sources of Water Pollution in Southeastern Wisconsin, September 1978.

Source: SEWRPC.

generated in the County will be recycled by application on agricultural lands. Accordingly, agricultural wastes will be considered in this study only to the extent of identifying the estimated quantities generated.

### Special Wastes

Special wastes include bulky wastes such as appliances; trees and brush; demolition and construction wastes; sewage sludge, septic and holding tank wastes; and hazardous wastes such as chemicals, solvents, and oils. These wastes appear in the waste stream and pose special disposal problems. In general, these wastes should not be mixed with residential, commercial, and nonhazardous industrial wastes, but rather should be collected and disposed of separately.

Bulky Wastes: This subcategory includes discarded appliances (white goods) and items of furniture. The white goods are increasingly finding their way to scrap dealers for metal recovery. These items, because of their size and weight, cannot normally be handled on regular residential and commercial collection systems. Rather, the transport of these wastes is generally by the homeowner or, as needed, by special municipal arrangements or by private collectors. These items may be handled in packer trucks or in special open vehicles. The generation of these items varies seasonally.

Bulky wastes require special consideration in landfilling since they can cause voids and take up considerable space. Most landfills set bulky wastes aside for pickup by private recycling operators. The Recycling Task Force on Solid Waste study indicates a bulky waste generation rate for the study area in 1984 of 0.1 pound per capita per day, or about 2,215 tons per year. Similar per capita generation rates for bulky materials have been found in other studies conducted in southeastern Wisconsin. This total does not include an estimated 200 tons of the white goods generated in the County which, according to information provided by communities in the County, are presently recycled. An additional undetermined amount of recycling by private contractors and landfill operators also occurs.

Trees and Brush: This is another subcategory of special solid waste which requires special collection and disposal. Data included in the 1973 Recycling Task Force on Solid Waste study indicate that about 0.1 pound per capita per day of tree and brush waste are generated in communities with fewer than 7,500 persons, and about 0.3 pound per capita per day in larger communities. Since that study was completed, there has been an increased use of wood as a supplementary fuel. Based upon observations within the County, it appears that most log-size tree wood is now salvaged for use as fuel and that wastes are mainly limbs and brush. For this reason, the generation rates found in the earlier study were reduced by 50 percent in estimating the quantity of solid waste generated in the study area. It was therefore estimated that 2,495 tons per year, or about 0.1 pound per capita per day, of tree and brush solid wastes were being generated in Kenosha County in 1984. This quantity does not include an estimated 700 tons per year, or about 0.03 pound per capita per day, which are recycled through composting or used for firewood.

Construction and Demolition Wastes: This subcategory of wastes includes residues generated by the building industries. Because of the size and weight of construction and demolition residue, firms have found it economically advantageous at times to dispose of this material on their own sites rather than pay the generally higher landfill fees. The Recycling Task Force on Solid Waste study estimated the construction and demolition waste generation rate to be 0.7 pound per capita per day for communities with a population greater than 10,000, and 0.3 pound per capita per day for communities of fewer than 10,000 people. Based upon the resident population of the County, about 7,215 tons per year of construction and demolition wastes, or about 0.3 pound per capita per day, were estimated to be generated in the County in 1984. This quantity does not include an estimated 5,000 tons per year, or about 0.2 pound per capita per day, of construction and demolition debris which is recycled or reused or not disposed of in licensed sanitary landfills.

Scrapped and Abandoned Automobiles: This subcategory is not presently a solid waste management concern in the County because scrapped automobiles are currently handled by private processors. The most prevalent public concern is over the unsightly appearance of discarded vehicles along roadways and on private properties, and the storage of junked vehicles at commercial salvage yards.

Discarded tires originate from a variety of sources, including scrap yards, commercial sales outlets, reprocessors, and all types of tire users. Generally, the majority of the tires requiring disposal are from automobiles. Truck, bus, and other more costly, specially designed heavy equipment tires are usually reused. Disposal of discarded tires is a significant problem. Whole tires do not compact well in landfills and have a tendency to "float" to the surface; shredding is impeded by the wire reinforcement contained in many tires; open burning results in smoke, odor, and air pollution problems; and reclaiming is often more expensive than the manufacturing of new tires.

Inventory information provided by the Wisconsin Department of Natural Resources regarding the number of waste tires discarded annually was used as the basis for estimating the number of tires being discarded annually in the County. Supplementary information provided by some communities regarding the number of tires disposed of was also evaluated. Based upon these two sources of information, it was estimated that 84,000 tires were discarded in Kenosha County in 1984.

Toxic and Hazardous Wastes: Toxic and hazardous wastes are defined as those wastes which, because of physical, chemical, or infectious characteristics, may pose a substantial threat to human health or safety or to the environment when improperly treated, stored, or disposed of. Characteristics of hazardous wastes include toxicity, flammability, corrosivity, reactivity, carcinogenicity, and bioaccumulation. These wastes occur in many forms including solids, liquids, sludges, and gases.

The federal and state levels of government are playing an increasingly important role in the establishment of regulations concerning the handling and disposal of these wastes. Toxic and hazardous wastes are presently regulated by the DNR under Chapter NR 181 of the Wisconsin Administrative Code. Further information on the regulation of these wastes is provided later in this chapter.

Hazardous wastes are generated by three major sources: 1) manufacturing industries, 2) end users of finished products such as paints and pesticides, and 3) institutions. All of these types of generating sources are located within the County.

Households can also be considered to be sources of toxic and hazardous wastes. Automotive supplies, pesticides, paints, solvents, cleaning products, and many other compounds used by residents can collectively be a significant source of potentially dangerous materials. Typically, these materials are disposed of by dumping them down household drains, or are discarded with residential solid wastes. This source of toxic and hazardous material in the County, which is estimated to generate 20 to 25 tons per year, is important in the evaluation of alternative solid waste management practices. A statewide program for assisting communities in the disposal of these materials is discussed in the section if this chapter entitled "Laws and Regulations Concerning Solid Waste."

As of May 1986, the City of Kenosha had held two collections of household toxic and hazardous wastes, with these wastes being brought to a centralized location by homeowners for packaging and shipping out of state by a private firm with expertise in handling such wastes. It is envisioned that this program will continue on an annual basis.

## Table 16

### ESTIMATED TOXIC AND HAZARDOUS WASTES GENERATED IN KENOSHA COUNTY: 1984[a]

| Toxic and Hazardous Waste Category | Toxic and Hazardous Waste Generated | |
|---|---|---|
| | Tons per Year | Pounds Per Capita per Day |
| Ignitables[b] | 219.1 | 0.01 |
| Halogenated Toxic Solvents[c] | 12.3 | 0.01 |
| Heavy Metals[d] | 2,957.7 | 0.13 |
| Corrosives[e] | 2,358.9 | 0.11 |
| Total | 5,548.0 | 0.25 |

[a]Represents toxic and hazardous waste quantities reported to the DNR as required under Chapter NR 181 of the Wisconsin Administrative Code.

[b]Ignitables are wastes with a flash point of less than 140°F and include substances such as acetone and mineral spirits.

[c]Halogenated toxic solvents include, but are not limited to, chemicals generally used as degreaser agents and include substances such as trichloroethylene and tetrachloroethylene.

[d]Heavy metals are generally sludges which contain heavy metals such as lead, mercury, and cadmium that are present in leachable quantities.

[e]Corrosives are materials which have a pH less than 2.0 (acids) or greater than 12.5 (bases), and include substances such as pickle liquors used in steel finishing processes.

Source: Wisconsin Department of Natural Resources and SEWRPC.

The DNR provided information on the amount and type of toxic and hazardous wastes being generated in the County in 1984. Generators of more than 220 pounds of toxic and hazardous material per month are required to report such quantities to the DNR under Chapter NR 181 of the Wisconsin Administrative Code. This information is presented in Table 16. Also evaluated were data provided by the industrial survey undertaken as a part of this study of major types of toxic and hazardous waste that were generated in the County in 1984 by the industrial sector. Based on these information sources, it was estimated that 5,548 tons of toxic and hazardous waste were generated in Kenosha County in 1984.

Presently, there are no licensed landfills within the State of Wisconsin for the disposal of these materials. Approximately 2,233 tons of corrosives, or about 40 percent of the reported toxic and hazardous wastes generated in the County, consisted of steel finishing pickle liquors used in a variety of manufacturing processes. Most of this material is recycled at treatment plants where it is used as an agent in the removal of phosphorus from wastewater prior to discharge. The remaining reported toxic and hazardous wastes are either recycled through a variety of chemical processes, incinerated at approved sites within Wisconsin, or disposed of at approved sites outside Wisconsin. The disposal of toxic and hazardous materials is of growing concern in highly industrialized areas such as Kenosha County. It is becoming increasingly more difficult and expensive to properly dispose of these materials. Because of the specialized character of the facilities required, however, an area larger than the County needs to be considered when identifying the means for disposal of such materials. Accordingly, it was concluded that toxic and hazardous wastes would be addressed in this study only to the extent necessary to ascertain the extent of the toxic and hazardous disposal problem based upon available data. The management of these special wastes will not be specifically planned for; rather, it will be assumed that the disposal of such materials will be considered at a geographically broader level, such as the Region or the State. However, residential sources and quantities of toxic and hazardous materials will be considered in the evaluation of solid waste management alternatives.

Sewage Treatment Plant Sludge and Septic and Holding Tank Waste: Sewage or wastewater treatment sludge is another subcategory of the special solid waste category. As noted earlier in this chapter, there were 11 public and eight privately owned sewage treatment plants located in Kenosha County in 1985. The names and locations of these plants are indicated on Map 4. Based upon data obtained from these treatment facilities, it is estimated that 6,322 tons per year of sewage sludge on a dry-weight basis were generated in 1985. Approximately 5,970 tons, or 95 percent of the total, were generated by the City of Kenosha wastewater treatment facility. This sludge is presently disposed of at the Pheasant Run landfill in the Town of Paris. Sludge generated at the remaining public and all of the private treatment plants is hauled by a private contractor and disposed of by land application in Walworth County, or, to a limited extent, by land spreading at approved sites in Kenosha County. The adopted regional sludge management plan recommends that provisions be made for short-term emergency disposal of sewage treatment plant sludges. Landfilling would be a logical method of providing sludge disposal backup capability. In addition to sewage treatment plant sludges, about 1,800 cubic yards of grit, grease, and screenings are generated at the public sewage treatment plants and require disposal.

Sewage treatment plant sludge disposal is becoming an increasingly costly process with important environmental considerations. Consequently, these materials will be included in the alternatives analysis along with solid wastes classified as residential, commercial, industrial, construction and demolition debris, bulk, and trees and brush.

It is important to note that present DNR policies generally prohibit the disposal of sludges in landfills unless the facility is engineered with a clay liner and a leachate collection and treatment system. Further, in landfills used for the disposal of a combination of residential, commercial, and industrial wastes, the quantity of sludge which is landfilled cannot exceed 10 percent of the waste deposited. In addition, the sludge must have a solids content of at least 40 percent. Sludge generated at the City of Kenosha sewage treatment plant presently has a solids content of 40 percent or more following treatment and partial dewatering. Sludges generated at the other facilities in the County have a solids content substantially less than 40 percent following processing. However, a limitation on sludge disposal in landfills does exist. Chapter NR 180 of the Wisconsin Administrative Code, which pertains to solid waste management, is undergoing revisions which will address disposal of these materials in landfills.

It was estimated that in 1984, 7,560 septic tank systems, 190 mound systems, and 535 holding tanks were in operation in Kenosha County. Based upon data contained in the adopted regional sludge management plan, it is estimated that these onsite sewage disposal systems produce 135 tons of solids per year on a dry-weight basis and 270 tons per year on a wet-weight basis. It is generally recommended that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant.

## Summary

The quantities of solid waste estimated to be generated in Kenosha County in 1984 are summarized by type of waste in Table 17. The total solid waste generated in the study area is shown to be 145,590 tons per year. Of this total, approximately 133,450 tons per year, or 92 percent, are generated from residential, commercial, and industrial sources, and sources of special wastes designated as bulky wastes, construction and demolition debris, and trees and brush. The per capita solid waste production rate of these categories combined is about 6.0 pounds per day, based upon the 1984 resident population of the study area. Individually, there are 51,910 tons per year of residential wastes generated, or 2.3 pounds per capita per day; 23,585 tons of commercial wastes, or 1.1 pounds per capita per day; 46,030 tons of industrial wastes, or 2.1 pounds per capita per day; and 11,925 tons of special wastes, including bulky wastes, construction and demolition debris, and trees and brush, or about 0.5 pound per capita per day. The quantities of solid waste to be considered in this study, as generated by civil division within the County, are summarized in Table 18. As noted, the sewage treatment plant sludge generated at the public and privately owned sewage treatment plants will be considered in the alternatives analysis as a special concern in this plan. As previously discussed, the remaining 12,140 tons, or 8 percent per year, of wastes entering the solid waste stream consist of toxic and hazardous wastes and septic and holding tank wastes and will not be considered in detail in this study.

When considering the feasibility of solid waste management alternatives such as resource recovery, knowledge is required not only of the quantities of solid wastes generated, but also of the characteristics of the wastes. The three general areas of information that are important are waste composition by material category, waste combustion characteristics, and seasonal variation of waste composition.

Based upon the data presented herein, the composition of the solid waste stream components which are to be the main focus of the study is set forth in Table 19.

Solid waste energy recovery processes require the combustion of the waste. Consequently, it is necessary to know the combustion characteristics of the waste in order to design an appropriate energy recovery device. The most important combustion characteristics are heating value, moisture content, and ash content. These three characteristics may vary widely depending on the sources of the waste and the degree and type of processing to which the waste is subjected.

Based upon a review of the waste stream components and an analysis of the combustion characteristics of each component, the following combustion characteristics were estimated for the Kenosha County solid waste stream:

## Table 17

## ESTIMATED SOLID WASTE QUANTITIES GENERATED IN KENOSHA COUNTY: 1984

| Solid Waste Category | Solid Waste Generated | |
|---|---|---|
| | Tons per Year | Pounds Per Capita per Day |
| Residential[a] | 51,910 | 2.3 |
| Commercial[b] | 23,585 | 1.1 |
| Industrial[c,d] | 46,030 | 2.1 |
| Special Wastes Considered as Part of the Solid Waste Stream | | |
| Bulk[e] | 2,215 | 0.1 |
| Construction and Demolition Debris[f] | 7,215 | 0.3 |
| Trees and Brush[g] | 2,495 | 0.1 |
| Subtotal | 133,450 | 6.0 |
| Other Solid and Liquid Wastes to be Treated Separately from the Solid Waste Stream | | |
| Hazardous Wastes | 5,548 | 0.25 |
| Sewage Sludge[h] | 6,322 | 0.29 |
| Septic and Holding Tank Wastes | 270 | 0.01 |
| Subtotal | 12,140 | 0.55 |
| Total | 145,590 | 6.55 |

[a] This quantity does not include approximately 850 tons per year, or 0.04 pound per day, of residential wastes comprised primarily of paper, glass, and metal which are recycled.

[b] This quantity does not include approximately 6,600 tons per year, or 0.3 pound per capita per day, of commercial wastes comprised primarily of paper and cardboard which are recycled or incinerated.

[c] This quantity does not include approximately 110,000 tons per year, or 5.0 pounds per capita per day, of industrial wastes comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials which are recycled or incinerated.

[d] Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for the generation of electricity.

[e] This quantity does not include approximately 200 tons per year, or 0.01 pound per capita per day, of white goods which are recycled.

[f] This quantity does not include approximately 5,000 tons per year, or 0.2 pound per capita per day, of construction and demolition debris which is recycled or used as rubble fill and not disposed of in sanitary landfills.

[g] This quantity does not include approximately 700 tons per year, or 0.03 pound per capita per day, of trees and brush which are recycled through mulching or composting or used by individuals for firewood.

[h] Sewage treatment plant sludge generated at public and private plants will be evaluated as part of the alternatives analysis.

Source: Wisconsin Department of Natural Resources, Wisconsin Solid Waste Recycling Authority, and SEWRPC.

## Table 18

## ESTIMATED SOLID WASTE QUANTITIES IN TONS GENERATED IN KENOSHA COUNTY: 1984

| Civil Division | 1985 Population[a] | Residential | Commercial | Industrial[b] | Special Wastes: Bulk | Special Wastes: Construction and Demolition | Special Wastes: Trees and Brush | Total |
|---|---|---|---|---|---|---|---|---|
| City of Kenosha | 76,285 | 31,050 | 10,970 | 39,225 | 1,392 | 5,568 | 2,088 | 90,293 |
| Village of Paddock Lake | 2,235 | 980 | 240 | 30 | 40 | 82 | 20 | 1,392 |
| Village of Silver Lake | 1,650 | 570 | 215 | 35 | 30 | 60 | 15 | 925 |
| Village of Twin Lakes | 3,660 | 1,760 | 415 | 40 | 67 | 134 | 33 | 2,449 |
| Town of Brighton | 1,150 | 475 | 120 | -- | 21 | 41 | 8 | 665 |
| Town of Bristol | 3,765 | 1,597 | 990 | 2,160 | 69 | 137 | 34 | 4,987 |
| Town of Paris | 1,520 | 624 | 560 | 120 | 28 | 55 | 13 | 1,400 |
| Town of Pleasant Prairie | 12,300 | 5,264 | 3,420 | 3,700 | 224 | 449 | 112 | 13,169 |
| Town of Randall | 2,110 | 1,200 | 765 | 80 | 38 | 77 | 19 | 2,179 |
| Town of Salem | 6,270 | 3,274 | 1,930 | 210 | 114 | 228 | 57 | 5,813 |
| Town of Somers | 7,530 | 3,758 | 3,380 | 360 | 137 | 275 | 69 | 7,979 |
| Town of Wheatland | 3,000 | 1,358 | 580 | 70 | 55 | 109 | 27 | 2,199 |
| Total | 121,475 | 51,910 | 23,585 | 46,030 | 2,215 | 7,215 | 2,495 | 133,450 |

[a]Estimated January 1, 1985, population was obtained from the Wisconsin Department of Administration.

[b]Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for the generation of electricity.

Source: SEWRPC.

| | |
|---|---|
| Heating Value of Total Waste Stream (British thermal units per pound) | 4,500 |
| Moisture Content of Total Waste Stream (percent by weight) | 27 |
| Ash Content of Total Waste Stream (percent by weight) | 22 |

These estimates are based on the assumptions that the solid waste is not processed and that certain readily segregated wastes such as bulky waste and industrial materials with a low combustibility will be segregated out of the waste stream.

Seasonal variation in solid waste quantities is a significant factor in Kenosha County. As shown in Figure 2, generally, the greatest quantities of solid wastes were generated during the summer and fall, with lesser amounts produced in the winter. For example, solid wastes generated in May, June, July, and October were 112 percent, 110 percent, 106 percent, and 106 percent, respectively, of the monthly average, while quantities generated in December, January, February, and March were about 93 percent, 94 percent, 89 percent, and 91 percent, respectively, of the monthly average. However, if only residential solid wastes are considered, the variability in the solid waste quantities ranges from 124 percent of the monthly average in May to 77 percent of the monthly average in February.

## EXISTING SOLID WASTE MANAGEMENT SYSTEMS

Solid waste management functions performed in the study area include source separation and recycling, collection, transportation, transfer, processing, and disposal. Each of these functions, as practiced in Kenosha County, is discussed below.

### Source Separation and Recycling

Resource recovery programs can be divided into pre-collection and post-collection categories. Pre-collection programs entail the separation of recyclable solid waste materials such as newspaper, glass, oil, and aluminum by the gen-

Table 19

COMPOSITION OF SOLID WASTES GENERATED IN KENOSHA COUNTY: 1984

| Component | Residential | | Commercial | | Industrial | | Construction and Demolition, Bulk, Trees and Brush | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Waste Generated (tons)[a] | Percent by Weight | Waste Generated (tons)[a] | Percent by Weight | Waste Generated (tons)[a] | Percent by Weight | Waste Generated (tons)[a] | Percent by Weight | Waste Generated (tons)[a] | Percent by Weight |
| Paper.............. | 24,398 | 47 | 13,208 | 56 | 16,110 | 35 | -- | -- | 53,716 | 40 |
| Metal.............. | 3,634 | 7 | 2,123 | 9 | 6,525 | 14 | -- | -- | 12,282 | 9 |
| Food............... | 6,229 | 12 | 2,358 | 10 | 3,300 | 7 | -- | -- | 11,887 | 9 |
| Glass.............. | 3,634 | 7 | 1,415 | 6 | 3,000 | 7 | -- | -- | 8,049 | 6 |
| Construction and Demolition Debris. | -- | -- | -- | -- | -- | -- | 7,215 | 60 | 7,215 | 5 |
| Plastic............ | 3,115 | 6 | 1,415 | 6 | 1,580 | 3 | -- | -- | 6,110 | 5 |
| Wood............... | 1,038 | 2 | -- | -- | 4,600 | 10 | -- | -- | 5,638 | 4 |
| Yard............... | 5,191 | 10 | -- | -- | -- | -- | -- | -- | 5,191 | 4 |
| Foundry Sand....... | -- | -- | -- | -- | 5,000 | 11 | -- | -- | 5,000 | 4 |
| Textiles........... | 2,076 | 4 | -- | -- | 460 | 1 | -- | -- | 2,536 | 3 |
| Trees and Brush.... | -- | -- | -- | -- | -- | -- | 2,495 | 21 | 2,495 | 2 |
| Bulk............... | -- | -- | -- | -- | -- | -- | 2,215 | 19 | 2,215 | 2 |
| Unclassified and Miscellaneous..... | 2,595 | 5 | 3,066 | 13 | 5,455 | 12 | -- | -- | 11,116 | 7 |
| Total | 51,910 | 100 | 23,585 | 100 | 46,030 | 100 | 11,295 | 100 | 133,450 | 100 |

[a]These quantities do not include previously discussed material which is recycled or incinerated.

Source: SEWRPC.

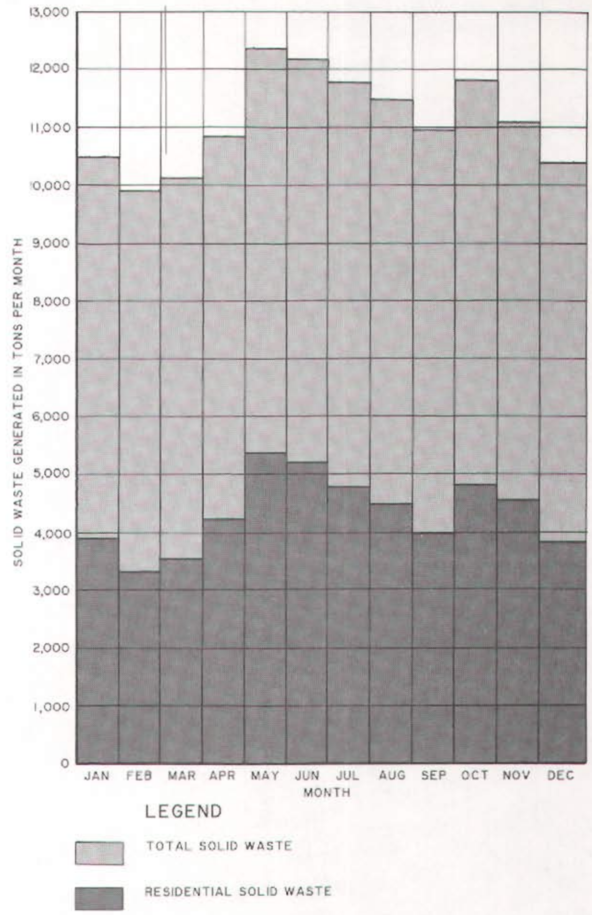
erator before these materials are collected with the other waste components. These source separation programs offer low-cost methods of reducing the need for further transport, processing, and disposal. However, such programs require a high level of public cooperation, and therefore must rely heavily upon public education. Post-collection materials recovery, or the recovery of materials after they have been mixed in collector vehicles, has higher technology requirements and greater initial capital and operating costs.

Source separation and recycling are significant elements of the existing solid waste management functions in Kenosha County. The known recycling operations serving the County are listed in Table 20.

Solid wastes are recycled in several ways within the County. The most significant are the recycling programs that are routinely carried out by many of the industries in the County. As previously indicated, based upon the industrial survey conducted, it is estimated that 110,000 tons of industrial waste per year, or about 70 percent of the solid waste generated by industries, are recycled or incinerated. Of the eight industries that replied to the survey, six practiced some type of recycling. The major industrial wastes recycled by the industries in the County include paper and cardboard, scrap aluminum, steel and other metals, oil and grease, chemicals, glass, wood, and miscellaneous materials. These wastes are recycled both by internal manufacturing processes and by transportation to recycling centers, both within and outside the County. Commercial generators of solid wastes are also practicing a significant amount of recycling. Based on information from major paper and cardboard recycling operations in the Region and data from the commercial solid waste questionnaire, it was estimated that 6,600 tons of commercial waste per year, or about 22 percent of the solid wastes generated by the commercial sector, are recycled or incinerated.

Figure 2

MONTHLY GENERATION OF SOLID WASTE IN KENOSHA COUNTY: 1984




A third type of recycling that is practiced in the County is source separation of paper, aluminum, glass, steel cans, and oil by citizens and collection by local community groups. Most of these recycling activities are carried out by private nonprofit groups such as the Jaycees, Boy and Girl Scouts, community rescue squads, and high school classes. Programs to collect paper, aluminum, or glass are being carried out by nonprofit groups in the City of Kenosha and the Town of Somers. The City of Kenosha also operated two waste oil recycling stations. It is estimated that 850 tons per year of residential wastes, or less than 2 percent of the residential solid wastes generated in Kenosha County, are recycled through these recycling programs and individual recycling.

## Table 20

## SOLID WASTE RECYCLING OPERATIONS SERVING KENOSHA COUNTY: 1984

| Recycling Operation | Location | Waste Accepted |
|---|---|---|
| A. Lakin & Sons, Inc. | Chicago, IL | Tires |
| Acme Solvents Reclaiming | Rockford, IL | Waste oil, solvents |
| Aluminum Recycling | Chicago, IL | Metal |
| American Paper Recycling Corporation | Chicago, IL | Paper |
| Anchor Glass Container Corporation | Gurnee, IL | Glass |
| Badger Paper Excelsior Corporation | Milwaukee | Paper, metal, batteries |
| Central Barrel & Drum Company, Inc. | Oshkosh | Barrels and drums |
| Consumer Steel & Supply Company | Racine | Metal, batteries, precious metals, barrels, and drums |
| Darling & Company-Chicago | Chicago, IL | Renderings |
| DG Plastics | Elk Grove Village, IL | Plastics |
| DRC Pallet Broker | Waukesha | Pallets |
| EF Madrigrano, Inc. | Kenosha | Metal |
| FCF Metal Salvage | Burlington | Metal, batteries, barrels, and drums |
| Foster Forbes Glass Company | Burlington | Metal, glass |
| Goeman Wood Products | Hartford | Pallets, wood |
| Goodwill Industries of Southeastern Wisconsin, Inc. | Racine | Paper, rags |
| H&R Scrap Metals Company, Inc. | Milwaukee | Paper, metal, batteries, plastic, precious metals, barrels, and drums |
| Harper Plastics, Inc. | Skokie, IL | Plastic |
| Haupt Barrel & Copperage Company | Milwaukee | Barrels and drums |
| Henning Pallet Service | Racine | Pallets, wood |
| Industrial Pumping, Inc. | Kenosha | Waste oil |
| Johnson Metal Company | Racine | Metal, batteries, precious metals |
| Joseph Bear & Sons, Inc. | Rockford, IL | Batteries, precious metals |
| Kenosha Beef International | Kenosha | Rendering |
| Kenosha, City of Public Works | Kenosha | Metal, waste oil-two stations |
| Kenosha Iron & Metal Company, Inc. | Kenosha | Metal, batteries, precious metals |
| Kenosha Recycling Company | Kenosha | Metal, batteries, barrels and drums |
| Loop Recycling, Inc. | Chicago, IL | Paper, pallets |
| Lubeck Tire, Inc. | Kenosha | Tires |
| National Can Recycling | Chicago, IL | Metal |
| Owens-Illinois, Inc.-Streator | Streator, IL | Glass |
| Racine Salvage Corporation | Racine | Paper, metal, batteries |
| Ruby's H&R Scrap Metals Company, Inc. | Milwaukee | Paper, metal, batteries, plastic, precious metals, barrels, and drums |
| Scherr Meyer | Milwaukee | Metal, batteries, solvents, precious metals |
| Schreiner's Waste Oil Service | Oak Creek | Waste oil |
| The Refinder | Chicago, IL | Waste oil |
| U. S. Aluminum Recyclers | Chicago, IL | Metal |
| William Lans Sons Company | Beloit | Paper, metal, batteries, precious metals |
| Wisconsin Paperboard Corporation | Milwaukee | Paper |

Source: Wisconsin Department of Natural Resources.

Another type of source separation recycling which is conducted in the County is the separation of bulky white goods which are then recycled. This is done both by the individuals prior to collection and by some communities following collection. Recycling of these goods is also conducted in the City of Kenosha and the Towns of Bristol and Randall.

## Storage, Collection, and Transport

Solid waste storage may be defined as the temporary holding of the material in containers either prior to collection or following collection at a transfer or processing station. Collection and transportation includes the gathering or picking up of solid wastes from the various sources and the hauling of these wastes to the location where the contents of the collection vehicles are emptied. The collection and transport of solid wastes in Kenosha County is provided primarily by municipally operated collection and transportation services which provide the majority of the residential waste collection service; private collection services which provide the majority of the commercial and industrial collection services; and individual residents, commercial establishments, and industries which transport their own wastes to either transfer stations or landfills in the County. The only municipally operated collection and transportation service in the County is in the City of Kenosha. Private contractors collect and transport residential wastes in the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and in the eight townships. Many residents in the Towns of Brighton, Bristol, Paris, Randall, Salem, Somers, and Wheatland haul their own refuse to either a transfer station or landfill. Most of the residents in the Town of Pleasant Prairie use private collection services. The existing solid waste disposal facilities and transportation pattern for the residential and commercial solid wastes generated in and around the County are shown on Map 24.

Private industry provides the vast majority of collection and transportation services for commercial and industrial wastes in Kenosha County. There are 44 licensed private collection services operating in the County, as shown in Table 21. Private collection services are arranged for either on an individual contract basis with each commercial establishment and industry, or by contracts with municipalities to collect and transport residential and, in some cases, commercial solid waste generated within that municipality. Individual agreements are usually the basis for industrial solid waste collection and transportation.

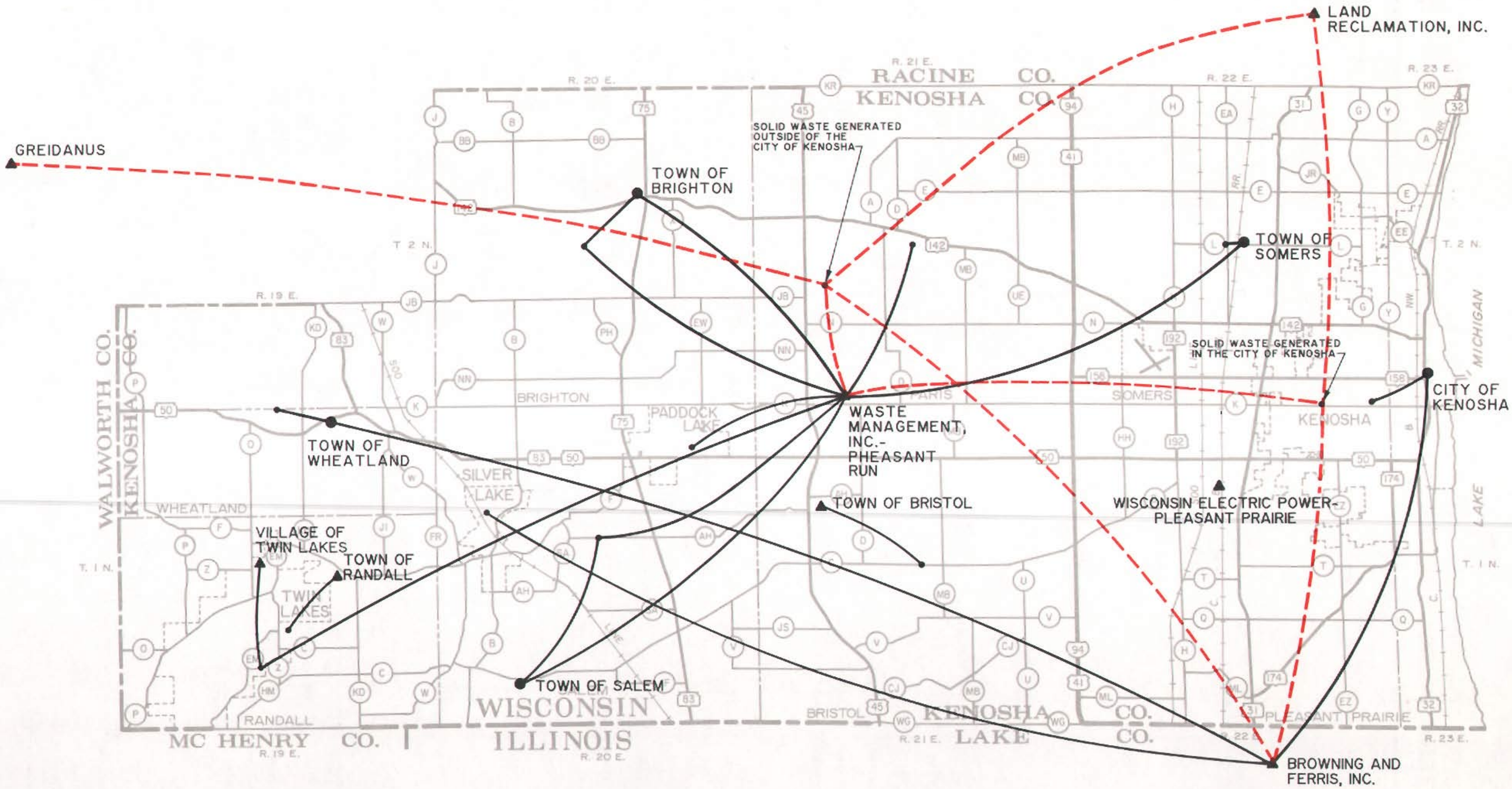
Residential and commercial solid wastes in the County are usually picked up once per week by municipally operated and private collection services. The frequency of industrial, commercial, and multifamily waste collection depends on the quantities generated and the capacity of the storage containers.

## Transfer and Transportation

Transfer and transportation refers to the means, facilities, and equipment used to transfer wastes from small collection vehicles to larger vehicles and to transport them to either processing centers or disposal sites. Transfer operations are used to accomplish the removal and transfer of wastes from collection vehicles and other relatively small vehicles to transport equipment which generally has a larger capacity than the collection vehicles.

## Map 24

## EXISTING RESIDENTIAL AND COMMERCIAL SOLID WASTE TRANSPORTATION PATTERNS AND DISPOSAL SITES FOR KENOSHA COUNTY: 1984




LEGEND

- ▲ LANDFILL
- ● TRANSFER STATION
- COMMERCIAL AND INDUSTRIAL WASTE STREAM
- RESIDENTIAL WASTE STREAM

NOTE: IN 1986, THE CITY OF KENOSHA BEGAN TRANSPORTING SOLID WASTE TO THE WASTE MANAGEMENT OF WISCONSIN PHEASANT RUN LANDFILL IN THE TOWN OF PARIS

IN ADDITION, COLLECTION IS PROVIDED IN THE TOWN OF PLEASANT PRAIRIE BY A NUMBER OF DIFFERENT SOLID WASTE COLLECTION FIRMS. THUS, A VARIETY OF LANDFILL LOCATIONS COULD BE USED AT ANY GIVEN TIME

Source: SEWRPC.

# Table 21

## LICENSED COLLECTION AND TRANSPORTATION SERVICES IN SOUTHEASTERN WISCONSIN THAT OPERATE IN KENOSHA COUNTY: 1984

| Name | License Number | Portion of Study Area Served | A | B | C | D | E | F | Other | Disposal Site(s) |
|---|---|---|---|---|---|---|---|---|---|---|
| Kenosha County | | | | | | | | | | |
| ABC Services, Inc.[a,b] | 10778 | Milwaukee County | | X | X | | | X | Solvents, oil, PCB's, | Land Reclamation, Ltd.-Mt. Pleasant; Browning and Ferris-Zion, Illinois; Waste Research and Reclamation-Eau Claire |
| Arneson Foundry, Inc. | 11532 | Arneson Foundry | X | X | | | | | Foundry waste | Waste Management-Pheasant Run |
| Chuck's Sanitary Service | 01595 | City of Kenosha, Towns of Pleasant Prairie and Somers | | | | | | | | Browning and Ferris-Zion, Illinois |
| City of Kenosha | 10012 | City of Kenosha | X | | X | | | | | Browning and Ferris-Zion, Illinois |
| City of Kenosha Water Utility | 11052 | MacWhyte Company | | | | | | | | Water Pollution Control plant |
| Gillmore Waste Processing | 10631 | Towns of Brighton, Bristol, Salem, and Wheatland | | | X | | | | | Town of Bristol; CCD Disposal-Illinois; Kenosha Trucking, Inc. |
| Harry Crow & Son., Inc. | 10759 | City of Kenosha | X | X | X | | | | | Land Reclamation, Ltd. |
| Heimes C & T | 11531 | Arneson Foundry | X | X | | | | | Foundry waste | Waste Management-Pheasant Run |
| Industrial Pumping, Inc. | 10898 | Acme Die Casting, Ladish, American Motors | | | | | | X | Hazardous/non-hazardous liquids | Browning and Ferris-Zion, Illinois; Waste Management, Inc.-I, II |
| Industrial Waste Haulers, Inc. | 11153 | Kenosha County | | | | | | X | Solvents, oil, PCB's | Land Reclamation, Ltd.-Mt. Pleasant |
| Kenosha Waste Oil Service | 10729 | City of Kenosha | | | | | | | Oil | Land Reclamation, Ltd. |
| Tri-County Disposal | 10915 | | | X | X | | X | X | | Land Reclamation, Ltd. |
| Milwaukee County | | | | | | | | | | |
| AAA Environmental Industries | 11066 | Kenosha Area | X | | | | | X | Gas, oil, sludge/PCB's | Waste Management, Inc.-I,II; Land Reclamation, Ltd.-Mt. Pleasant |
| Amber Oil Company | 10909 | Kenosha County | | | | | | | Waste and industrial oils | Motor Oils Refining Company-Illinois; Calumet City Landfill-Illinois |
| Ashland Chemical Company-Milwaukee | 11230 | Kenosha County | | | | | | X | Solvent degreasers | Waste Research and Reclamation-Eau Claire; Waste Management, Inc.-II; Chemical Waste Management-Illinois |
| Baron Blakeslee-Division of Purex Corporation[a] | 10982 | Kenosha County | | | | | | X | Hazardous liquids | Baron Blakeslee-Cicero, Illinois |
| Benlo Chemicals, Inc. | 11227 | Kenosha County | | | | | | X | Liquids, sludge | Waste Research and Reclamation-Eau Claire |
| Best Disposal Systems Company | 10561 | Kenosha County | X | X | X | | | | Sludge | Waste Management, Inc.-II,III, Kenosha |
| Chem-Bio Corporation, Aquasearch Division | 11536 | Kenosha County | | | | | | X | Hazardous liquids and solids | Chemical Waste Management-Emelle, Alabama; Fondessy Enterprises-Toledo, Ohio; U. S. Ecology-Beatty, Nevada |
| Commerce Industrial Chemicals[a] | 11134 | Kenosha County | | | | | | X | Toxic and hazardous solvents | Commerce Industrial Chemicals-Milwaukee; Hamilton Industries-Two Rivers, Wisconsin; Custom Organics-Chicago, Illinois |
| Hydrite Chemical Company-Milwaukee | 11237 | Kenosha County | | | | | | X | Solvents | Hydrite Chemical Company, PRF |
| National Tank Service of Wisconsin, Inc.[a] | 10848 | Kenosha County | | | | | | X | Coolants, oil/sludge | Waste Management, Inc.-I; National Tank Service |
| Northwestern Lumber and Wrecking | 10763 | Kenosha County | X | X | | | | | Asbestos | Refuse Hideaway Landfill; Land Reclamation Ltd.-Mt. Pleasant; Waste Management, Inc.-I,II |
| Overnite Transportation Company[a] | 11306 | Kenosha County | | | | | | X | | ENSCO-Eldorado, Arkansas |
| R. Hoge Company, Inc. C&T | 10237 | Kenosha County | X | X | X | | | | | Waste Management, Inc.-I, II |
| Roto Sewer Cleaners | 10817 | Kenosha County | X | | | | | | Car washes | Waste Management, Inc.-I, II |
| Transcology, Inc.[a,b] | 11293 | Kenosha County | | | | | | X | PCB's | CECOS-Cincinnati, Ohio; Rollins Environmental Service-Texas |
| Water Blasting, Inc.[a] | 11298 | Kenosha County | X | X | X | | | X | Foundry dirt, paint chips | Browning and Ferris Landfill-Zion, Illinois |
| Ozaukee County | | | | | | | | | | |
| Aqua-Tech, Inc.[a] | 11056 | Kenosha County | | | | | | X | | CWS/Aqua-Tech-Ft. Wayne, Indiana; Waste Management, Inc.-II; Fondessy Enterprises-Toledo, Ohio |
| GW, Inc.[a] | 11481 | Kenosha County | | | | | | | Liquid/sludge solids | Fondessy Enterprises-Oregon, Ohio; American Waste Pro-Maywood, Illinois; Chem Met-MI/American Chemical-Indiana |
| Racine County | | | | | | | | | | |
| GO of Wisconsin, Inc.[a] | 11193 | Kenosha County | X | X | X | | X | | Leachate | Land Reclamation Ltd.-Mt. Pleasant; Racine Wastewater Treatment Plant |
| Jung and Carreno Contractors[a] | 11473 | Kenosha County | X | X | | | X | X | | Land Reclamation Ltd.-Mt. Pleasant |
| Pat's Rubbish and Garbage Service, Inc. | 10451 | Town of Mt. Pleasant | | | X | | | | | Land Reclamation Ltd.-Mt. Pleasant; Sanitary Trans. and Landfill |
| Rowe Oil Service, Inc. | 11142 | City of Kenosha | | | | | | | Waste oils | Rowe Oil Service-Franksville |
| Washington County | | | | | | | | | | |
| Alliance Transportation Service[a,b] | 11416 | Kenosha County | X | | X | | | X | Sludges, PCB's | Waste Management, Inc.-I; CECOS-Cincinnati, Ohio; BFI-Waukegan, Illinois |
| Urgent Removal, Inc.[a] | 10709 | Kenosha County | X | | | | | X | Liquid, foundry | Waste Management, Inc.-II; Metro Disposal Service |
| Wisconsin Waste Alliance, Inc. | 11458 | Kenosha County | X | X | X | | X | | Sludge, ash | Waste Management, Inc.-II |
| Waukesha County | | | | | | | | | | |
| Filmite Oil Corporation | 10981 | Kenosha County | | | | | | | Waste oil | Waste Management, Inc.-Lauer 2 |
| High Voltage Maintenance Corporation[a,b] | 10832 | Kenosha County | | | | | | X | Askeral, PCB's | Chemical Waste Management-Emelle, Alabama |
| Milwaukee Solvents and Chemicals[a] | 10861 | Kenosha County | | | | | | X | Solvents | E.S.L., Inc.-Elmwood, Illinois; American Chemical-Griffith, Indiana; Milwaukee Solvents and Chemicals-Menomonee Falls |
| SED, Inc.[a,b] | 10952 | Kenosha County | | | | | | | PCB oils, mixtures | SED, Inc.-Ohio and North Carolina; CECOS-Ohio |
| Star Line Trucking Corporation | 10691 | Kenosha County | X | | | | X | | Sewage sludge | Barrett Landfill-New Berlin; UWS-Germantown |
| Tank Transport, Inc.[a] | 11261 | Kenosha County | | | | | | | Used oil | Oil Refinery-Chicago, Illinois |
| Visu-Sewer Clean and Seal, Inc.[a] | 10935 | Kenosha County | X | X | | | | | | Waste Management, Inc.-II; licensed landfills |

NOTE: Waste Management, Inc.: I - Franklin landfill; II - Omega Hills landfill; III - Muskego landfill
Waste type indicators mean: A - Noncombustible
B - Wood matter
C - Trash and refuse
D - Garbage
E - Demolition
F - Toxic and hazardous

[a]Licensed to haul toxic and hazardous wastes, except PCB's.

[b]Licensed to haul all waste materials.

Source: Wisconsin Department of Natural Resources.

The transportation of the majority of residential solid wastes and some commercial solid wastes in Kenosha County is a one- or two-step process. The first step begins when the collection vehicle leaves the last loading point and travels to a transfer station or landfill. Residential wastes generated in the City of Kenosha are transported primarily by municipal vehicles owned by the City. The residential wastes generated in the other municipalities are transported by either private contractors or individual residents. Commercial and industrial wastes are transported primarily by private contractors. The second step, if needed, is the transportation of the solid waste from the transfer station to the landfill. The City of Kenosha transports waste from the City transfer station to the Browning and Ferris landfill in Lake County, Illinois.[8] Waste from other communities in the County that goes to transfer stations is transported to landfills by private operators.

Transfer stations are an important aspect of solid waste management efforts in Kenosha County. As shown on Map 24, there are presently five transfer stations operated in the County. These five stations serve as temporary disposal and consolidation points for all or part of the residential, and some commercial, refuse collected in the City of Kenosha, and for the residential wastes generated in the Towns of Brighton, Salem, Somers, and Wheatland. Approximately 43,900 tons, or about 77 percent, of the residential, bulk, and yard wastes generated in Kenosha County are transported to one of these five transfer stations.

## Processing

Processing of solid waste means the transformation of the physical or chemical characteristics of solid waste by mechanical, chemical, or biological processes. Processing is practiced to accomplish three objectives. First, processing may be used to improve the efficiency of subsequent solid waste management functions by reducing storage requirements and hauling costs. One example of this is the baling of wastepaper to reduce hauling costs to the disposal site. Second, processing may be used to recover materials for recycling or reuse. Items such as paper, plastic, glass, ferrous metals, and aluminum are valuable and can be recovered for recycling or reuse. Finally, combustible organic materials can be converted to intermediate products and/or to energy by incineration or biodigestion.

As defined above, processing of solid waste is an important management element within the study area. As previously discussed, the separation of recylable bulk items and white goods takes place in selected communities following collection. Within the industrial sector, solid wastes which are to be recycled are often bundled or packaged in order to make subsequent handling and transportation more manageable. In addition, there are two licensed active incinerators in the County which process solid wastes, one operated by Kenosha Memorial Hospital and one operated by the Ocean Spray Cranberry Company, as well as one inactive incinerator owned by the Anaconda American Brass Company. In addition, there are some small, unlicensed incinerators operated primarily by institutional solid waste generators in the County. However, there are presently no active county owned or municipally owned and operated incinerators in the study area.

[8]In 1986, the City of Kenosha began transporting its solid waste to the Waste Management of Wisconsin Pheasant Run landfill in the Town of Paris.

## Disposal

As already noted, landfilling is the primary method of disposal of solid wastes in Kenosha County. As of 1984, there were nine licensed active landfills within and adjacent to the Southeastern Wisconsin Region receiving wastes from Kenosha County. As shown in Table 22, of these nine active landfills, six are located in Kenosha County. A brief description of each of these landfills follows.

Town of Randall Landfill: The Town of Randall owns and operates a landfill located in the northwest one-quarter of U. S. Public Survey Section 23, Township 1 North, Range 19 East, Town of Randall. This public general-use landfill is used to dispose of noncombustible materials, wood matter trash refuse, garbage, and demolition debris. Use of the landfill is restricted to town residents who transport refuse to the site. The licensed area of the landfill is 7.2 acres in areal extent. In 1983, 1,396 tons of material were disposed of at the site. The remaining service life is less than three years, with no potential for site expansion. The Town has signed an agreement with the Wisconsin Department of Natural Resources to close the site by 1999. Groundwater monitoring is not required at the site.

Kenosha County Highway Department Landfill: The Kenosha County Highway Department owns and previously operated a landfill site located in the northwest one-quarter of U. S. Public Land Survey Section 8, Township 1 North, Range 20 East, Town of Salem. This private special-use landfill was used to dispose of wood matter, tires, and demolition debris. Use of the landfill was restricted to the Kenosha County Highway Department, which transported refuse to the site from county highway construction operations. The licensed area of the landfill was approximately 1.0 acre in areal extent. Because of its sporadic use, records were not maintained on the amount of material annually disposed of at the site, and in 1984, the landfill site was closed. Groundwater monitoring was not required when the site was operational.

Village of Twin Lakes Landfill: The Village of Twin Lakes owns and operates a landfill located in the southeast one-quarter of U. S. Public Land Survey Section 16, Township 1 North, Range 19 East, Village of Twin Lakes. This public special-use landfill is used to dispose of small amounts of noncombustible inorganic material generated in the Village. The licensed area of the landfill is 40 acres in areal extent. In 1983, 150 tons of material were disposed of at the site. The remaining service life is less than three years, with no potential for site expansion. The Village has signed an agreement with the Wisconsin Department of Natural Resources to close the site by 1999. Groundwater monitoring is not required at the site.

Town of Bristol Landfill: The Town of Bristol owns and operates a landfill located in the northwest one-quarter of Section 17, Township 1 North, Range 21 East, Town of Bristol. This public general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. Use of the landfill is restricted to town residents who transport refuse to the site and to the private collection contractor that operates in the Town. The licensed area of the landfill is 10 acres in areal extent. In 1983, 1,700 tons of material were disposed of at the site. The remaining site life is less than three years, with no potential for site expansion. Groundwater monitoring is not required at the site.

## Table 22

## ACTIVE SOLID WASTE DISPOSAL SITES RECEIVING WASTES FROM THE KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA: 1984

| Owner/Operator | License Number | Location | Facility Type | Licensed Area (acres) | User Classification | Estimated Remaining Service Life (years) | DNR Capacity Category (cubic yds x 10³) | Cover Frequency | A | B | C | D | E | F | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Town of Randall | 0461 | Northwest one-quarter Section 23, T1N, R19E Town of Randall | Sanitary landfill | 7.2 | Public General Use | 3 | 50-500 | As needed | X | X | X | X | X | -- | -- |
| Kenosha County Highway Department | 0028 | Northwest one-quarter Section 8, T1N, R20E Town of Salem | Noncombustible landfill | 1.0 | Private Special Use | N/A | < 50 | As needed | -- | X | X | X | -- | -- | -- |
| Village of Twin Lakes | 0490 | Southeast one-quarter Section 16, T1N, R19E Village of Twin Lakes | | 40.0 | Public Special Use | 3 | 50-500 | As needed | X | X | -- | -- | X | -- | -- |
| Town of Bristol | 0732 | Northwest one-quarter Section 17, T1N, R21E Town of Bristol | Sanitary landfill | 10.0 | Public General Use | N/A | 50-500 | As needed | X | -- | X | X | -- | -- | -- |
| Waste Management, Inc.-Pheasant Run[a] | 1739 | Southeast one-quarter Section 32, T2N, R21E Town of Paris | Sanitary landfill | 20.0 | Commercial General Use | N/A | > 500 | Daily | X | X | X | X | X | -- | -- |
| Land Reclamation, Ltd. | 0572 | Northeast one-quarter Section 23, T3N, R22E Town of Mt. Pleasant, Racine County | Sanitary landfill | 81.7 | Commercial General Use | 3 | > 500 | Daily | X | X | X | X | X | -- | -- |
| WEPCo-Pleasant Prairie | 2786 | East one-half Section 9, T1N, R21E Town of Pleasant Prairie | Noncombustible landfill | 155.0 | Private Special Use | 36 | > 500 | As needed | -- | -- | -- | -- | -- | -- | Fly ash, bottom ash, and wastewater, and cooling tower sludge |
| Greidanus Enterprises | 0140 | Northwest one-quarter Section 9, T2N, R15E Town of Darien, Walworth County | Sanitary landfill | 20.0 | Commercial General Use | 3 | > 500 | Daily | X | X | X | X | X | -- | Foundry sand |
| Browning and Ferris, Inc. | --[a] | Northwest one-quarter Section 7, T46N, R15E Town of Benton, Lake County, Illinois | Sanitary landfill | 140.0 | Commercial General Use | N/A | > 500 | Daily | X | X | X | X | X | X | -- |

NOTES: N/A indicates data not available.
A - Noncombustible, B - Wood Matter, C - Trash Refuse, D - Garbage,
E - Demolition, F - Toxic and Hazardous

[a]Licensed under jurisdiction of the Illinois Environmental Protection Agency.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Waste Management of Wisconsin-Pheasant Run Landfill: Waste Management of Wisconsin owns and operates a landfill located in the southeast one-quarter of Section 32, Township 2 North, Range 21 East, Town of Paris. This commercial, general-use landfill is used to dispose of a variety of materials, including noncombustible wastes, wood matter, trash refuse, garbage, and demolition debris and foundry sand. Solid waste materials from Kenosha County deposited at this site are collected primarily by private contractors serving selected communities, commercial establishments, and industries. The licensed area of the landfill is 20 acres in areal extent. In 1983, 16,147 tons of material were disposed of at the site. The remaining service life is less than three years, with potential for expansion. Groundwater monitoring is required at the site, but there have been no reported incidences of groundwater contamination in the area. As of January 1988, the operator of this landfill was in the process of obtaining the necessary approvals for an 80-acre expansion of this landfill, which, if approved, incrementally would provide for about 15 years of capacity at current loadings. In addition, there are additional lands adjacent to the site that may be suitable for further expansion.

Wisconsin Electric Power Company Landfill: The Wisconsin Electric Power Company owns and operates a landfill located in the east one-half of Section 9, Township 1 North, Range 21 East, Town of Pleasant Prairie. This private, special-use landfill is used to dispose of fly ash and bottom ash produced as a result of burning coal for electric power generation. The licensed area of the landfill is 155 acres in areal extent. In 1984, 28,700 tons of material were disposed of at the site. The remaining service life of the site is greater than three years, with no potential for site expansion. Groundwater monitoring is required at the site, but there have been no reported incidences of groundwater contamination in the area.

**Land Reclamation, Ltd., Landfill:** The Land Reclamation, Ltd., Landfill is located in the northeast one-quarter of Section 23, Township 3 North, Range 22 East, Town of Mt. Pleasant, Racine County. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, and demolition debris. Solid waste materials from Kenosha County deposited at this site are collected by private contractors primarily serving commercial establishments and industries. The licensed area of the landfill is 81.7 acres in areal extent. In 1983, 127,623 tons of material were disposed of at the site. A revised plan of operation for this landfill was approved by the DNR in December 1984 which will extend the service life of the site. The remaining service life of the site is greater than three years. Groundwater monitoring is required at the site, and there has been some groundwater contamination in the sand and gravel aquifer due to the presence of sand and gravel lenses near the disposal area.

**Greidanus Enterprises Landfill:** Greidanus Enterprises owns and operates a landfill located in the northeast one-quarter of Section 9, Township 2 North, Range 15 East, Town of Darien, Walworth County. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, demolition debris, and foundry sand. Solid waste materials from Kenosha County deposited at this site are collected by private contractors serving selected communities, commercial establishments, and industries. The licensed area of the landfill is 20 acres in areal extent. In 1983, 17,500 tons of material were disposed of at the site. The remaining service life of the site is more than three years. The site recently received a plan of operation approval for expansion from the DNR. Groundwater monitoring is required at the site; however, there have been no reported incidences of groundwater contamination in the area.

**Browning and Ferris Landfill:** Browning and Ferris, Inc., owns and operates a landfill located in the northwest one-quarter of Section 7, Township 46 North, Range 12 East, Town of Benton, Lake County, Illinois. This commercial, general-use landfill is used to dispose of noncombustible materials, wood matter, trash refuse, garbage, demolition debris, and toxic and hazardous waste. Municipally collected residential and some commercial refuse generated in the City of Kenosha, as well as sewage sludge, and residential, commercial, and industrial refuse generated in other areas of Kenosha County, are disposed of at this site. The licensed area of the landfill is 140 acres in areal extent and is regulated by the Illinois Environmental Protection Agency. In 1984, 180,000 tons of material were disposed of at the site. The remaining service life of the site is greater than three years, with potential for site expansion. Groundwater monitoring is required at the site.

## Equipment and Personnel Available for Plan Implementation and Periodic Review

The operating equipment utilized for the collection, transportation, and disposal of solid waste in Kenosha County is owned and operated by both municipalities and private contractors as discussed in detail earlier in this chapter. However, the majority of solid waste in Kenosha County is collected and transported and disposed of by private contractors. The City of Kenosha Department of Public Works, and the public works departments in the other municipalities in the County, could provide the expertise required for the administration, operation, and maintenance of a county solid waste management system, and were considered in the development of the alternative solid waste management plans. Recommendations in this report which call for public ownership and operation of collection, transportation, or disposal facilities are accompanied by estimates of the cost of acquisition of appropriate equipment and technical expertise.

The following discussion of available personnel and equipment for plan implementation in specific areas related to solid waste management is provided to supplement data provided elsewhere in this report and thereby meet the requirements of Chapter NR 185 of the Wisconsin Administrative Code. All of these available resources were considered when evaluating alternative arrangements for ownership and operation of solid waste management facilities, as discussed in Chapter VIII.

Engineering and Hydrogeology: The county staff does have engineering capabilities in the environmental and public works engineering fields. The county staff has the expertise needed to perform some of the engineering functions necessary to conduct engineering for plan implementation, and to retain and oversee consultant services as needed should the County be directly involved in solid waste management in plan implementation. Engineering and hydrogeologic work, which the county staff could conduct or oversee, could include the preparation of detailed facility plans, detailed design, evaluation of proposals, and supervision of construction for such components as recycling facilities, compost operations, landfills, and incineration systems. To varying degrees, similar engineering experience is available at the local municipal level, with the larger communities generally having the ability to undertake major projects with or without consultant assistance. In addition, agencies such as the U.S. Soil Conservation Service could be consulted for portions of the work relating to solid waste management should special soils-related expertise be needed.

Administration: The county staff has the personnel to administer the implementation of solid waste management facilities and provide for the update of the solid waste management plan. This staff routinely conducts major projects with its own forces and also uses consultant services. The County also has legal and fiscal personnel who could provide expertise in those areas of administering solid waste management facilities.

Each of the municipalities also has expertise in administering public works facilities to various degrees, which could be used in the administration of solid waste management facilities.

Operation: The county staff has the capability to provide for the operation and maintenance of any solid waste management facility. The County has in the past been the operator of landfills. The local municipalities also have operational and maintenance capabilities in this regard but to varying degrees.

Legal Arrangements: Legal arrangements can potentially be carried out by the County's legal staff. The County has experience in large public works facility operations and the legal arrangements for these facilities. The local communities also have some legal capabilities but to varying degrees. The County or local community may need to hire additional legal counsel for help in specific tasks.

Training: Training of personnel to operate solid waste management facilities could be necessary. The County and, to varying degrees, the local units of government have the ability to train personnel in the same manner as described for the operation and maintenance of solid waste management facilities.

## Cost of Solid Waste Management

Utilizing the inventory data collected, the costs of existing solid waste management in the County were estimated. Table 23 indicates by civil division the estimated cost in 1984 of the collection, transportation, and disposal of residential, commercial, and industrial wastes in the study area. The total annual cost is estimated to be $4,941,295, or about $39.14 per ton of residential, commercial, and industrial solid waste collected, transported, and disposed of, and about $40.68 per capita per year. The disposal of sewage treatment plant sludge was estimated to cost $151,000 for the public sewage treatment plants, or $1.25 per capita per year, and $10,000 for the private sewage treatment plants, or $0.08 per capita per year.

# LAWS AND REGULATIONS CONCERNING SOLID WASTE

Within Kenosha County, the public regulation of solid waste management lies with the federal, state, and local levels and units of government. A brief discussion of the present laws, regulations, and institutional arrangements for governing solid waste management in Kenosha County follows.

## Federal Laws and Regulations

Public Law 94-580, the Federal Resource Conservation and Recovery Act (RCRA), was signed into law in 1976, replacing previous solid waste legislation. The RCRA relates to solid waste management planning in the following ways:

1. Establishment of Regulations--The RCRA authorizes the U. S. Environmental Protection Agency (EPA) to establish and enforce solid waste management guidelines. These guidelines can relate to all solid waste management functions. The Act also calls for the designation of state agencies for solid waste management planning and regulation.

2. Solid Waste Management Planning--The RCRA requires the U. S. Environmental Protection Agency to assist state governments in developing and implementing solid waste management plans. Such plans must be approved by the EPA. The State of Wisconsin plan was completed in February 1981, and approval by the EPA is expected.

3. Toxic and Hazardous Waste Management--The RCRA requires toxic and hazardous wastes to be regulated by the states following EPA guidelines. The federal guidelines identify the types of wastes that are toxic and hazardous, and call for control of the generation, collection, transportation, storage, treatment, and disposal of these wastes. A manifest system, requiring the maintenance of records relating to the production, transport, and ultimate fate of toxic and hazardous wastes, is presently being phased into use.

4. Financial and Technical Assistance--The RCRA will provide federal assistance to be allocated among the states, supplementing local funds for solid waste management. The law also provides for technical assistance from federal consultants to be available to state and local governments to help improve solid waste management practices.

## Table 23

## ESTIMATED COSTS FOR RESIDENTIAL, COMMERCIAL AND INDUSTRIAL WASTE COLLECTION AND DISPOSAL IN KENOSHA COUNTY: 1984

| Civil Division | 1985 Population[a] | Residential Solid Waste[b] (tons) | Cost per Ton | Cost | Commercial Solid Waste[b] (tons) | Cost[c] | Industrial Solid Waste[b] (tons)[c] | Cost[c] | Total Waste (tons) | Total Cost[d] | Cost per Ton[e] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| City of Kenosha | 76,285 | 34,530 | $40.46 | $1,397,200 | 10,970 | $383,950 | 39,225 | $1,255,375 | 84,725 | $3,036,525 | $35.84 |
| Village of Paddock Lake | 2,235 | 1,040 | 29.12 | 30,290 | 240 | 8,400 | 30 | 1,050 | 1,310 | 39,740 | 30.34 |
| Village of Silver Lake | 1,650 | 615 | 39.80 | 24,480 | 215 | 7,525 | 35 | 1,225 | 865 | 33,230 | 38.42 |
| Village of Twin Lakes | 3,660 | 1,860 | 40.59 | 75,500 | 415 | 14,525 | 40 | 1,400 | 2,315 | 91,425 | 39.49 |
| Town of Brighton | 1,150 | 504 | 55.35 | 27,900 | 120 | 4,200 | -- | -- | 624 | 32,100 | 51.44 |
| Town of Bristol | 3,765 | 1,700 | 61.18 | 104,000 | 990 | 34,650 | 2,160 | 75,600 | 4,850 | 214,250 | 44.17 |
| Town of Paris | 1,520 | 665 | 49.62 | 33,000 | 560 | 19,600 | 120 | 4,200 | 1,345 | 56,800 | 42.23 |
| Town of Pleasant Prairie | 12,300 | 5,600 | 68.57 | 384,000 | 3,420 | 119,700 | 3,700 | 129,500 | 12,720 | 633,200 | 49.78 |
| Town of Randall | 2,110 | 1,257 | 37.23 | 46,800 | 765 | 26,775 | 80 | 2,800 | 2,102 | 76,375 | 36.33 |
| Town of Salem | 6,270 | 3,445 | 56.89 | 196,000 | 1,930 | 67,550 | 210 | 7,350 | 5,585 | 270,900 | 48.50 |
| Town of Somers | 7,530 | 3,964 | 57.26 | 227,000 | 3,380 | 118,300 | 360 | 12,600 | 7,704 | 357,900 | 46.46 |
| Town of Wheatland | 3,000 | 1,440 | 52.85 | 76,100 | 580 | 20,300 | 70 | 2,450 | 2,090 | 98,850 | 47.30 |
| Total | 121,475 | 56,620 | $46.31 | $2,622,270 | 23,585 | $825,475 | 46,030 | $1,493,550 | 126,235 | $4,941,295 | $39.14 |

[a]Estimated January 1, 1985 population was obtained from the Wisconsin Department of Administration.

[b]These waste quantities do not include previously discussed material which is recycled or incinerated.

[c]Information provided by private contractors and additional data included in the municipal solid waste questionnaires were used to determine a disposal cost of $35 per ton for commercial and industrial wastes.

[d]The cost for the disposal of sewage treatment plant sludge from public and private plants has been estimated at $151,000 and $10,000 per year, respectively.

[e]Cost per ton is a weighted average of the costs of each of the individual solid waste components in the other columns.

Source: SEWRPC.

## State Authority

A state level regulatory program for solid waste management was established with the passage of Chapter 83, Laws of 1967. This legislation designated the Department of Resource Development (now the Department of Natural Resources) as the state agency responsible for the regulation of solid waste management in the State. This authority was extended to include the disposal of sludges from a treatment facility by the passage of Chapter 74, Laws of 1973, which established the Wisconsin Pollution Discharge Elimination System (WPDES). Chapter 377, Laws of 1977, established a hazardous waste management program under the Department of Natural Resources. State level regulatory authority for all types of solid waste generated in the State lies with the Department of Natural Resources.

Chapter 144 of the State Statutes authorizes the Wisconsin Department of Natural Resources to establish minimum standards for solid waste management functions. This chapter also provides for the preparation of county and regional solid waste management plans. Chapter 144 provides for the identification of hazardous wastes, for an analysis of the hazardous waste situation in the State, and for the regulation of the transportation, storage, treatment, and disposal of hazardous wastes. That chapter also grants the DNR the authority to develop standards regulating the disposal of hazardous wastes. These standards must be consistent with the EPA regulations governing hazardous wastes. Finally, Chapter 144 provides the authority and mechanisms to enforce requirements developed under the law, and sets forth the site approval process used to license land disposal facilities.

Chapter NR 180 of the Wisconsin Administrative Code contains definitions relating to, and provides fees and specifies requirements for, storage sites, collection and transportation services, transfer facilities, processing facilities, incineration, air curtain destructors, and long-term environmental protection measures. Waste types which are regulated under this code include garbage, refuse, demolition material, sludges, and fly ash. Dredge spoils are regulated under Chapter NR 347.

Chapter NR 181 of the Wisconsin Administrative Code establishes criteria for identifying the characteristics of hazardous waste to be used in the establishment of a list of such wastes which shall be used by a generator, transporter, or owner or operator of a solid waste facility to determine if the waste handled is hazardous and subject to regulation. This chapter of the code establishes minimum standards defining acceptable hazardous waste management practices, and sets standards for the review of plans and the issuance of licenses. Furthermore, the closure and long-term care responsibilities of hazardous waste facilities are described.

Chapter NR 187 of the Wisconsin Administrative Code establishes general conditions and eligibility requirements for grant applications, application procedures, approval criteria, and a priority system for the issuance of household hazardous waste collection and disposal grants. Through this program, financial assistance is made available to municipalities to create and operate "local clean sweep" programs for the collection and disposal of household hazardous waste. Regulations governing sewage treatment plant sludge as set forth in Chapter NR 204 of the Wisconsin Administrative Code and the Kenosha County Sanitary Code and Private Sewage System Ordinance were applied as criteria in the assessment of the suitability of areas for land application of sewage treatment plant sludge. Where the state and county regulations overlapped, the more stringent criteria were used.

Recently enacted Wisconsin Department of Natural Resources Administrative Codes for governing solid and hazardous waste management are set forth in chapters of the NR 500 Section of the Code, with most chapters being promulgated in January 1988. These recently promulgated sections of the Administrative Code govern the design, construction, and operation of all solid waste management facilities, including storage, transportation, transfer, incineration, air curtain destructors, processing, wood burning, one-time disposal and small demolition facilities, landfills, waste separation and recycling facilities, and abandoned container facilities. Review of these sections indicates that the codes are meant to be used primarily in the detailed design and operation of solid waste management facilities. A review of the Administrative Code indicates that the planning criteria set forth in NR 185 and 186 are consistent with the criteria used in the development of the recommended county plan. For example, the landfill location standards set forth in Section NR 504.04 with regard to distances from navigable lakes and ponds, rivers, floodplains, state trunk highways and airports, and public and private water supplies are all identical to those utilized and set forth in Chapter IV. These code sections should be utilized to provide for more detailed and specific guidance in the second level detailed feasibility and design phases of the plan as recommended in the plan.

## County and Local Government

Chapter 130, Laws of 1971, grants counties the authority to plan, organize, finance, and implement programs to effect the storage, collection, transportation, processing, recycling, or final disposition of solid waste. One particularly important provision of this law is that counties cannot compel facility use by member communities, although capital expenditures may still be financed on a countywide basis. Additionally, Chapter 105, Laws of 1973, gave to counties the power to create a solid waste management board and retain a solid waste manager to operate a county system. Counties and municipalities also have the authority to establish a regulatory program as provided under Chapter 144 of the Statutes.

## Recycling Legislation

Amendments to Chapter 144 of the Wisconsin Statutes transferred solid waste flow control powers to local units of government from the abolished Wisconsin Solid Waste Recycling Authority. The legislation provides solid waste flow control powers to all counties, cities, villages, and towns with populations of 10,000 or more. Further amendments to this legislation established state policy for solid waste management, emphasizing waste reduction, reuse, recycling, composting, and energy recovery. These amendments provide for planning grants to regional planning commissions and counties at a 50 percent cost-share rate for recycling projects. In addition, these amendments require that municipalities provide a minimum number of recycling collection facilities. In Kenosha County, cities, villages, and towns must establish collection centers according to the following criteria: no facilities if the population is under 10,000 persons; one facility if the population is 10,000 to 50,000 persons; two facilities if the population is 50,000 to 100,000 persons; and three facilities if the population is over 100,000 persons, plus one additional facility per every additional 100,000 population.

Based on these criteria, two recycling centers would need to be established in the City of Kenosha and one in the Town of Pleasant Prairie. In addition, landfills that are open to the public, which includes the Town of Randall, Village of Twin Lakes, Town of Bristol, and Pheasant Run landfills in Kenosha County, would also need to establish such centers. In all, seven recycling centers will need to be established in the County. The Department of Natural Resources may reduce the number of required facilities if other collection facilities exist in the area or if it is determined that the specified number of facilities is not economically feasible.

## LIMITATIONS OF EXISTING SOLID WASTE MANAGEMENT FUNCTIONS AND COMPLIANCE WITH LAWS AND REGULATIONS

A description of the existing facilities, including source separation, recycling, storage, collection, transportation, transfer, processing, and disposal facilities, is provided earlier in this chapter. Review of this section indicates that the existing public facilities include primarily the operating equipment utilized for collection, transportation, and transfer of solid waste in Kenosha County. Nearly all the waste is disposed of at private facilities. A brief discussion of the limitations and compliance status of each solid waste management system is presented below.

### Source Separation and Recycling

As noted earlier, substantial quantities of materials are recycled by industrial and commercial operations within the County. With regard to the recycling operations for residential solid waste, there are limitations, even though small-scale programs are being carried out in a number of communities. As of the end of 1987, only one of the seven recycling centers have been established in accordance with the criteria set forth in Chapter 144. Thus, additional recycling centers will be required and have been addressed as part of the alternative plan development.

### Storage, Collection, Transportation, and Transfer

The only indicated problem of the storage component is the limited and isolated use of unacceptable and unstandardized containers in the County. However, the existing regulations and ordinances are adequate to ensure proper storage practices, and problems in this area are limited. Because of the large number of private operators as well as relatively well-established municipal collection, transfer, and transportation systems, there do not seem to be any significant limitations with regard to those solid waste management functions. The only indicated potential problem is that of the transportation patterns, as can be seen from review of Map 24. These patterns appear to be inefficient in that wastes are often transported to disposal sites located at greater distances than necessary. However, this inefficiency results from the involvement of the private sector in the solid waste management business and the resulting market strategies and forces which are expected to continue to impact solid waste management in Kenosha County. Because of the relatively limited problems in this area, it was concluded that the countywide study would not focus on the storage, collection, transfer, and transportation of solid waste components.

## Processing

There are only limited amounts of solid waste directed to processing facilities in Kenosha County. These facilities, consisting primarily of two smaller incineration systems, are discussed on page 87. It does appear that due to the low volumes of waste that are handled in these facilities, many have not in the past been required to meet stringent air pollution standards. It appears that such standards are becoming more stringent and will require modifications in the incineration of special solid wastes--perhaps at more centralized locations.

Medical wastes in Kenosha County are disposed of at landfills or are incinerated with the ash being landfilled. It is anticipated that further restrictions on air emissions and on the disposal of the ash and unincinerated medical wastes will be enacted. It is possible that new offsite and perhaps special-purpose incinerators may be needed in or adjacent to the County in order to comply with new regulations presently being developed.

Another limitation in the area of processing is the lack of equipment for shredding and processing compost materials. In view of recent State legislation, it will be necessary by the end of 1992 to significantly increase the amount of material that is composted. Experience in southeastern Wisconsin indicates that it will likely be necessary to provide processing equipment, such as shredders for compost and chippers for trees and brush, to be used as part of the composting operation in order to provide a compost product that will be attractive enough to citizens to allow for disposal of the material. It appears that in most communities the production of compost by merely turning windrows or piles results in a product of lesser desirability for which there is not a large demand from the general public. Thus, it appears additional processing equipment in this area will be required.

## Disposal

As noted earlier, there are nine licensed, active landfills within and adjacent to Kenosha County receiving wastes from the County. An evaluation was made of the existing landfill capacities as compared to the quantities of solid waste generated. That analysis was done for all of the landfills in southeastern Wisconsin since intercounty transfer of solid wastes is an option. In southeastern Wisconsin, about 1,800,000 tons of unrecycled solid waste are currently generated per year. The presently approved landfill capacity provides for about seven years of landfilling at current generation rates. Since major landfill expansion can take up to five years for completion and approvals of technical data, it appears important to further reduce the dependence on landfilling by other means, such as recycling and incineration. This issue of landfill capacity is particularly of concern to Kenosha County where landfills being used to dispose of wastes generated in the County are also used to dispose of wastes from northeastern Illinois, a highly populated and growing area. Landfill capacity in this portion of Illinois is very limited and increasing pressure is being put on Wisconsin landfills--particularly those used by Kenosha County residents.

# Chapter III

# ANTICIPATED GROWTH AND CHANGE

## INTRODUCTION

The Kenosha County solid waste management planning effort is intended to identify the solid waste management needs of the County through the year 2010, and to propose the best means of meeting those needs. The formulation of such a long-range plan requires information regarding anticipated population, household, and employment levels in the study area to assess the probable quantity, character, and spatial distribution of the solid wastes to be collected, transported, and recycled or disposed of, and the size, characteristics, and location of the facilities necessary to properly manage these wastes. Accordingly, this chapter presents forecasts of those facets of the socioeconomic development of the County essential to the sound development of a long-range solid waste management plan.

The population, household size and distribution, and employment forecasts presented in this chapter are based upon demographic information presented in SEWRPC Technical Report No. 11 (2nd Edition), The Population of Southeastern Wisconsin, 1984, and SEWRPC Technical Report No. 10 (2nd Edition), The Economy of Southeastern Wisconsin, 1984. The forecast techniques used in these reports attempt to deal with the uncertainty which currently exists about future conditions by evaluating birth, death, and migration rates, changing lifestyles, and the changing age distribution of the population, and by postulating alternative future population and economic development conditions in the Region.

This chapter is divided into three sections. The first section describes a set of alternative futures relating to population, household size, and employment. These alternative futures provide a range of conditions for which plan components can be designed and against which alternative plans can be evaluated. The second section sets forth the future conditions within the range of the alternative futures selected for use in the plan design. The third section sets forth estimated future solid waste quantities, characteristics, and sources to be utilized in the plan design, test, and evaluation.

## CONSIDERATION OF FUTURE CONDITIONS

Traditionally, long-range system planning has involved the preparation of a single forecast of future levels of population, economic activity, and land use demand, and the use of these forecasts in the design, test, and evaluation of alternative system plans. This approach has worked well in periods of relative stability, when historic trends in the factors underlying and influencing changes in population and economic activity levels could be reasonably expected to extend over the plan design period. During periods of major changes in social and economic conditions, however, when there is great uncertainty as to whether historic trends will continue, an alternative to this traditional approach may be required. One such alternative approach proposed in recent years is termed "alternative futures."

Under this approach, the development, test, and evaluation of alternative plans is based not upon a single most probable forecast of future conditions, but rather upon a number of futures chosen to represent a range of conditions which may be expected to occur over the plan design period. The purpose of this approach is to permit the evaluation of alternative plans over a variety of possible future conditions so as to identify those alternatives that perform well under a wide range of such conditions. The alternative futures used under this approach are selected to represent the reasonable extremes of a range of future conditions on the assumption that alternative plans which perform well under the extremes of a range will also perform well at intermediate points in the range. In this way, "robust" plans which can be expected to remain viable under greatly varying conditions can be identified.

The Commission utilized the "alternative futures" approach in developing the series of projections presented herein. Using this approach, three alternative future scenarios were postulated--two intended to identify extremes and one intended to identify an intermediate future; that is, a future that lies between the extremes. Critical social and economic factors, including employment levels, characteristics of the labor force, and household size, that could be expected to impact mortality, fertility, and migration rates over the next 25 years within the United States, the State, and the Region were examined. A reasonably extreme range of values was established for each component of population change by logically linking various rates of component change to the critical social and economic factors. This provided "most reasonably optimistic" and "most reasonably pessimistic" scenarios of population change by combining all factors that were internally consistent and that would create favorable conditions for economic and population growth within the Region, and by similarly combining all factors that would create unfavorable conditions for economic and population growth within the Region.

## Resident Population

Historic and anticipated future resident populations for the Region and Kenosha County are shown in Figure 3. The resident population of the Region is anticipated to increase between 1980 and 2010 by about 551,000 persons, or about 31 percent, under the optimistic future; and by about 107,200 persons, or about 6 percent, under the intermediate future. Under the pessimistic future, regional population is anticipated to decline by about 247,800 persons, or about 14 percent.

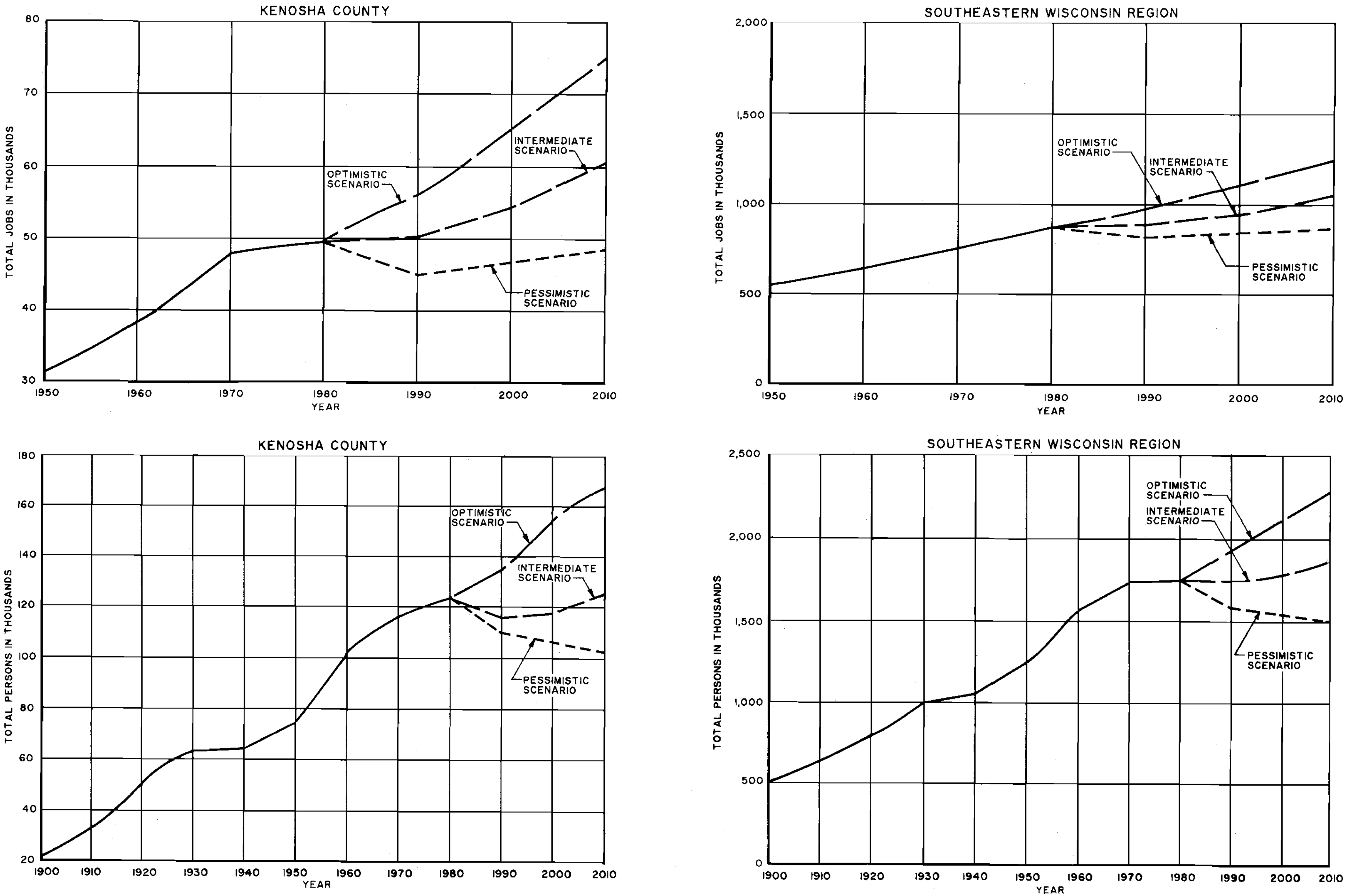
The alternative future conditions described above--optimistic, intermediate, and pessimistic--may be expected to result in year 2010 resident population levels in Kenosha County of 166,800 persons under the optimistic future, 123,300 persons under the intermediate future, and 101,800 persons under the pessimistic future. These alternative futures indicate, respectively, an increase of about 44,000 persons, or about 36 percent; a stable population with esssentially no change; and a decrease of about 21,000 persons, or about 17 percent, when compared with the 1980 resident population level of 123,137 persons.

## Households

The number of households in the Region is anticipated to increase over 1980 levels by about 230,600, or about 37 percent, under the optimistic future;

# Figure 3

## EXISTING AND PROJECTED REGIONAL AND KENOSHA COUNTY EMPLOYMENT AND POPULATION FIGURES




Source: U. S. Bureau of the Census and SEWRPC.

145,000, or about 23 percent, under the intermediate future; and 78,000, or 12 percent, under the pessimistic future. The number of households in Kenosha County may be expected to increase to 61,800 under the optimistic future, 50,500 under the intermediate future, and 46,700 under the pessimistic future by the year 2010. These alternative futures indicate increases of about 18,700 households, or about 43 percent, about 7,500 households, or about 17 percent, and about 3,700 households, or about 9 percent, respectively, over the 1980 level of 43,064 households.

## Employment

As shown in Figure 4, regional employment is anticipated to increase over 1980 levels by about 367,400 jobs, or about 42 percent, under the optimistic future, and 167,100 jobs, or about 19 percent, under the intermediate future by the year 2010. Under the pessimistic future, regional employment would decline by about 13,300 jobs, or about 2 percent, by the year 2010. Anticipated future employment levels are a particularly important consideration in the determination of future industrial and commercial solid waste quantities. As shown in Table 24 and Figure 4, regional employment in the commercial sector is anticipated to increase over 1980 levels by about 229,600 jobs, or about 33 percent, under the optimistic future, 115,500 jobs, or about 22 percent, under the intermediate future, and 13,700 jobs, or about 3 percent, under the pessimistic future by the year 2010. Regional employment in the industrial sector is anticipated to increase over 1980 levels by about 85,200 jobs, or about 26 percent, under the optimistic future, and 24,700 jobs, or about 9 percent, under the intermediate future, and to decrease by 23,600 jobs, or 11 percent, under the pessimistic future by the year 2010.

As shown in Figure 4, in Kenosha County total employment levels under the three future conditions in year 2010 would be 75,100 under the optimistic future, an increase of 25,600 jobs, or about 52 percent, over the 1980 level of 49,500 jobs; 61,000 under the intermediate future, an increase of 11,500 jobs, or about 23 percent, over the 1980 level; and 48,800 under the pessimistic future, a decrease of 700 jobs, or about 2 percent, from the 1980 level.

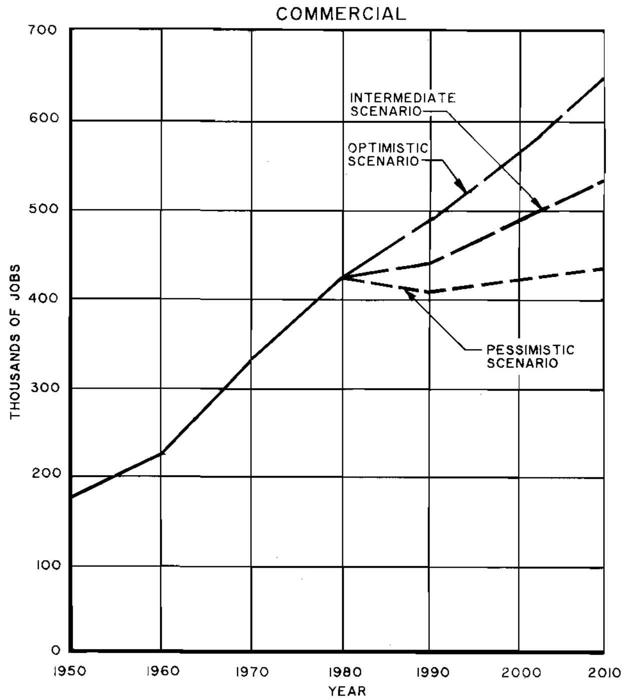
Based upon regional trends, employment in Kenosha County in the commercial sector is anticipated to increase over 1980 levels by about 20 percent under the optimistic future and about 5 percent under the intermediate future by the year 2010. Under the pessimistic future, commercial sector employment would decline by about 10 percent by the year 2010. Based upon the regional trends, industrial sector employment in Kenosha County is anticipated to increase very slightly over 1980 levels under the optimistic future by the year 2010. Industrial sector employment is anticipated to decline by about 10 percent under the intermediate future, and by about 20 percent under the pessimistic future by the year 2010.

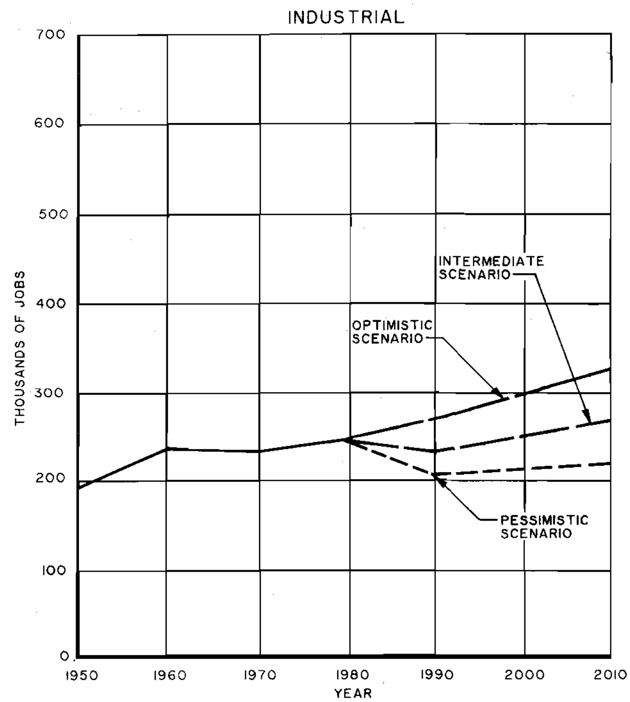
## Selection of Alternative Future Conditions

Following a review of these three sets of potential future conditions, the Technical Coordinating and Advisory Committee concluded that the development of alternative solid waste management plans should be based upon the intermediate future population growth scenario. Under this alternative, the plan would be based upon a year 2010 resident county population of about 123,300 persons, a level slightly higher than the 1980 resident population level, but

Figure 4

EXISTING AND PROJECTED COMMERCIAL AND INDUSTRIAL EMPLOYMENT IN THE REGION: 1950, 1960, 1970, 1980, 1990, 2000, AND 2010




Source: SEWRPC.

Table 24

EXISTING 1980 AND ALTERNATIVE YEAR 2010 COMMERCIAL AND INDUSTRIAL EMPLOYMENT IN THE REGION

| Employment Category | Year | | Number Change (thousands of jobs) | Percent Change |
|---|---|---|---|---|
| | 1980 (thousands of jobs) | 2010 (thousands of jobs) | | |
| Commercial | 419.9 | Pessimistic: 433.6<br>Intermediate: 535.4<br>Optimistic: 649.5 | 13.7<br>115.5<br>229.6 | 3.2<br>27.5<br>54.7 |
| Industrial | 246.1 | Pessimistic: 222.5<br>Intermediate: 270.8<br>Optimistic: 331.3 | -23.6<br>24.7<br>85.2 | -9.6<br>10.0<br>34.6 |
| Other (Government, Transportation and Agriculture) | 218.2 | Pessimistic: 314.8<br>Intermediate: 245.1<br>Optimistic: 270.8 | 96.6<br>26.9<br>52.6 | 44.3<br>12.3<br>24.1 |
| Total | 884.2 | Pessimistic: 970.9<br>Intermediate: 1,051.3<br>Optimistic: 1,251.6 | 86.7<br>167.1<br>367.4 | 9.8<br>18.9<br>41.6 |

Source: SEWRPC.

a reasonable indication of possible future conditions, given efforts to halt the continued decline of population levels in the County, and providing a reasonably conservative approach to facility sizing.

The Advisory Committee further concluded that the intermediate future employment growth scenario should be used as a basis for the plan design. Under this alternative, the plan would be based upon a year 2010 employment level of about 61,000 jobs, an increase of about 11,500 jobs over the 1980 level.

It was further concluded that it would be desirable to consider the range of solid waste quantities expected in the future assuming the optimistic and pessimistic growth scenario conditions.

## FUTURE RESIDENT POPULATION, HOUSEHOLD, AND EMPLOYMENT LEVELS CONSIDERED IN THE DESIGN OF ALTERNATIVE SOLID WASTE MANAGEMENT PLANS

### Resident Population

For solid waste management system planning purposes, the County was divided into two planning analysis areas, as shown on Map 25. The existing and probable future resident population levels of each of these areas under the intermediate growth scenario are indicated in Table 25. Historic and anticipated future resident populations for the Region and Kenosha County are shown in Figure 3. These population data were used as the basis for estimating future solid waste quantities and in the design of alternative solid waste management plans. As discussed in Chapter II, seasonal population levels were considered in the development of solid waste quantities, and the anticipated impact of seasonal residents on solid waste amounts are included in the determinations presented below.

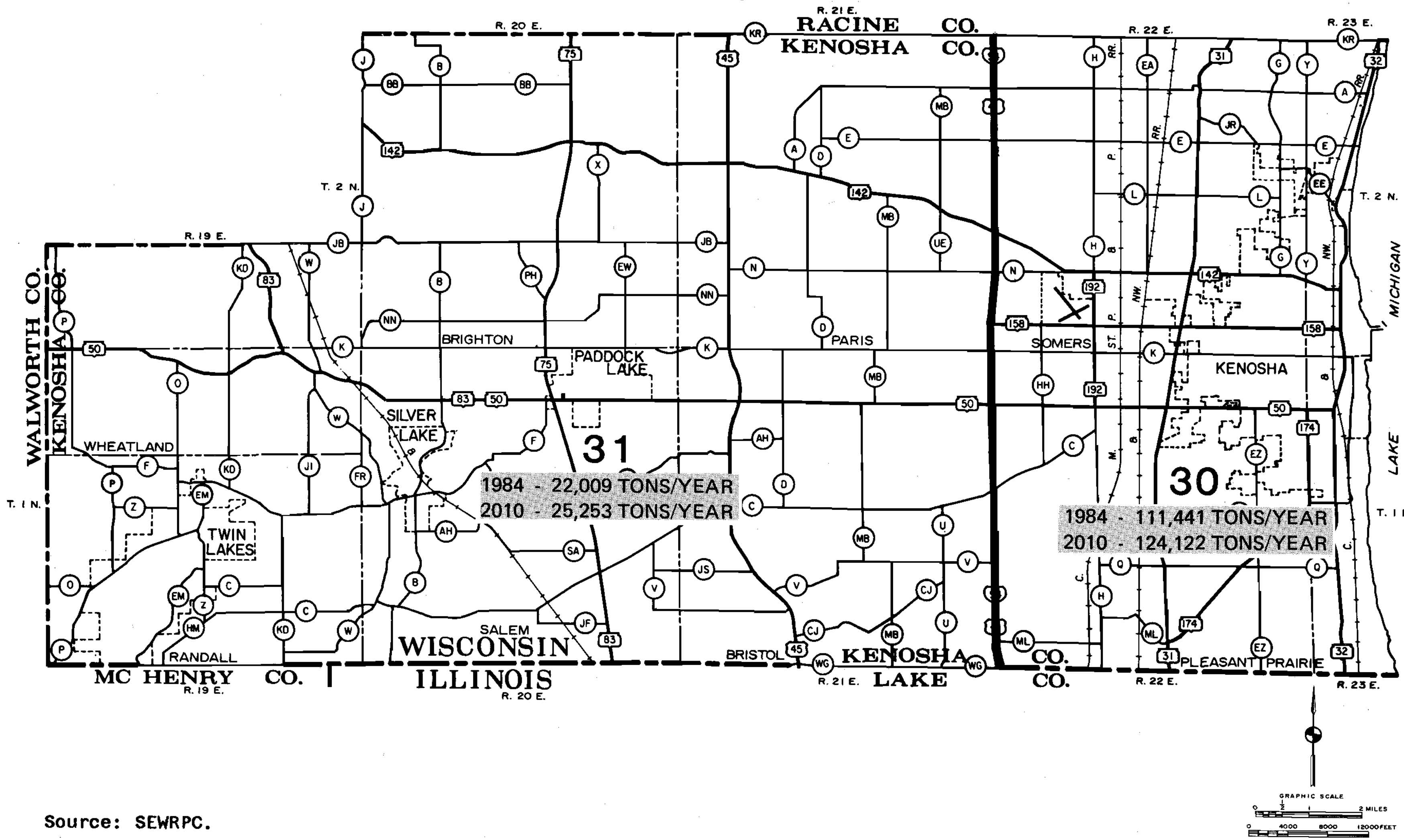
### Household and Employment Levels

Future population and lifestyle trends may be expected to result in an increase in the number of households, even in the absence of an increase in population. Forecasts of increases in the number of households have particularly important implications for long-range planning, since it is the household which generates residential solid wastes. The number of households in the study area is expected to increase from about 43,100 in 1980 to about 50,500 by 2010, an increase of about 17 percent.

As previously discussed, total employment in Kenosha County under the intermediate future is anticipated to increase from about 49,500 jobs in 1980 to about 61,000 jobs by the year 2010. Commercial sector employment is anticipated to increase by about 1,000 jobs, or about 5 percent, and industrial sector employment is anticipated to decline by about 2,100 jobs, or about 10 percent, by the year 2010. The increase in commercial sector jobs is an important consideration in developing future commercial solid waste quantities both at the county level and within the two planning analysis areas. Generally, it is anticipated that the amount of commercial solid waste quantities will increase by about 10 percent. Further, it is anticipated that, while the number of jobs in the industrial sector will decrease, the amount of industrial solid waste will remain about the same.

## Map 25

### PLANNING ANALYSIS AREAS WITH ESTIMATED 1984 AND FORECAST YEAR 2010 SOLID WASTE GENERATION QUANTITIES FOR KENOSHA COUNTY




Source: SEWRPC.

## Table 25

## ACTUAL AND FORECAST POPULATION LEVELS IN THE KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN STUDY AREA BY PLANNING ANALYSIS AREA: 1970-2010

| Planning Analysis Area | Actual 1970 | | Actual 1980 | | Forecast 1990 | | Forecast 2000 | | Forecast 2010 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Population | Percent of Total | Population | Percent of Total | Population | Percent of Total | Population | Percent of Total | Population | Percent of Total |
| 30 | 98,094 | 83.2 | 98,112 | 79.7 | 92,432 | 78.8 | 91,922 | 77.9 | 95,000 | 77.0 |
| 31 | 19,823 | 16.8 | 25,025 | 20.3 | 24,868 | 21.2 | 26,078 | 22.1 | 28,300 | 23.0 |
| Study Area | 117,917 | 100.0 | 123,137 | 100.0 | 117,300 | 100.0 | 118,000 | 100.0 | 123,300 | 100.0 |

Source: SEWRPC.

## Table 26

## ESTIMATED SOLID WASTE QUANTITIES GENERATED IN KENOSHA COUNTY ACCORDING TO WASTE TYPE: 1984 AND PLAN YEAR 2010

| Planning Analysis Area | Resident Population | Residential Wastes (tons per year) | Commercial Wastes (tons per year) | Industrial Wastes (tons per year) | Special Wastes | | | Total (tons per year) |
|---|---|---|---|---|---|---|---|---|
| | | | | | Bulk Wastes (tons per year) | Construction and Demolition (tons per year) | Trees and Brush (tons per year) | |
| EXISTING 1984 | | | | | | | | |
| 30 | 96,115 | 40,072 | 17,770 | 43,285 | 1,753 | 6,292 | 2,269 | 111,441 |
| 31 | 25,360 | 11,838 | 5,815 | 2,745 | 462 | 923 | 226 | 22,009 |
| Total | 121,475 | 51,910 | 23,585 | 46,030 | 2,215 | 7,215 | 2,495 | 133,450 |
| PLAN YEAR 2010 | | | | | | | | |
| 30 | 95,000 | 48,540 | 20,805 | 43,285 | 2,080 | 6,292 | 3,120 | 124,122 |
| 31 | 28,300 | 14,460 | 6,195 | 2,745 | 620 | 923 | 310 | 25,253 |
| Total | 123,300 | 63,000 | 27,000 | 46,030 | 2,700 | 7,215 | 3,430 | 149,375[a,b] |

[a]This quantity does not include 110,000 tons of industrial wastes, 5,000 tons of construction and demolition debris, 6,750 tons of commercial wastes, and 1,700 tons of residential wastes which are reused, recycled, and incinerated and do not enter the solid waste stream.

[b]Additional reuse, recycling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

Source: SEWRPC.

## SOLID WASTE TYPES, QUANTITIES, AND SOURCES TO BE UTILIZED IN ALTERNATIVE PLAN DESIGN

The type and quantity of solid waste generated within the County in 1984, and the sources of that waste, were described in Chapter II. This section of the report provides estimates of the quantities of solid wastes which may be expected to be generated within the study area over the planning period, as well as the characteristics of that solid waste, under the intermediate growth alternative future. In addition, the range of solid waste quantities expected under the optimistic and pessimistic alternative futures was also estimated for use in the evaluation of alternatives. The alternative plans are only for those wastes generated in the study area--that is, Kenosha County. It should be noted that the alternative scenarios described herein assume changes in the proportion of the solid waste based on changes in economic activity in the commercial and industrial sectors.

Table 26 summarizes the solid waste quantities which may be expected to be generated in each of the two planning analysis areas of the study area in 1984 and the year 2010. These data are also presented on Map 25. The estimated characteristics of the solid waste stream for the year 2010 are indicated in Table 27. The methodology utilized to estimate the quantities of each type of solid waste is described below, along with a range of solid waste quantities estimated to be generated under the optimistic and pessimistic alternative futures.

When considering the feasibility of solid waste management alternatives such as resource recovery, knowledge is required of not only the quantities of solid wastes generated, but also of the characteristics of the wastes. It is important that information be compiled on waste composition by material category, waste combustion characteristics, and seasonal variation. Based upon the data presented herein, the future composition of the solid waste stream components which are to be the main focus of the study was estimated as set forth in Table 27. The solid waste stream under consideration does not include that portion which is recycled, incinerated, or reused; fly ash; septic and holding tank wastes; or hazardous wastes. In addition, sewage sludge, which will be considered in the alternatives analysis, was not included in the combustibility evaluation. About 60 percent of the solid waste stream is anticipated to be combustible. The most important combustion characteristics are heating value, moisture content, and ash content. These three characteristics may vary widely depending on the sources of the waste and the degree and type of processing to which the waste is subjected. Based upon a review of the waste stream components and analysis of combustion characteristics of each component, the following combustion characteristics were estimated for the future Kenosha County solid waste stream:

| | |
|---|---|
| Heating Value of Total Waste Stream (British thermal units per pound) | 4,500 |
| Moisture Content of Total Waste Stream (percent by weight) | 27 |
| Ash Content of Total Waste Stream (percent by weight) | 22 |

Seasonal variation in solid waste quantities is a significant factor in Kenosha County, and thus is an important consideration in the design of alternative solid waste management systems. The main factor contributing to seasonal waste generation is the normal variation in activities such as yard work, construction, and some commercial and industrial operations from season to season.

Table 27

COMPOSITION OF SOLID WASTES GENERATED IN KENOSHA COUNTY: 2010

| Component | Total | |
|---|---|---|
| | Waste Generated[a,b] (tons) | Percent by Weight |
| Paper | 59,750 | 40 |
| Metal | 13,445 | 9 |
| Food | 13,445 | 9 |
| Glass | 8,960 | 6 |
| Plastic | 7,470 | 5 |
| Construction and Demolition Debris | 7,215 | 5 |
| Wood | 5,975 | 4 |
| Yard | 5,975 | 4 |
| Foundry sand | 5,000 | 3 |
| Textiles | 4,480 | 3 |
| Trees and Brush | 2,990 | 2 |
| Bulk | 2,215 | 2 |
| Unclassified and Miscellaneous | 12,455 | 8 |
| Total | 149,375 | 100 |

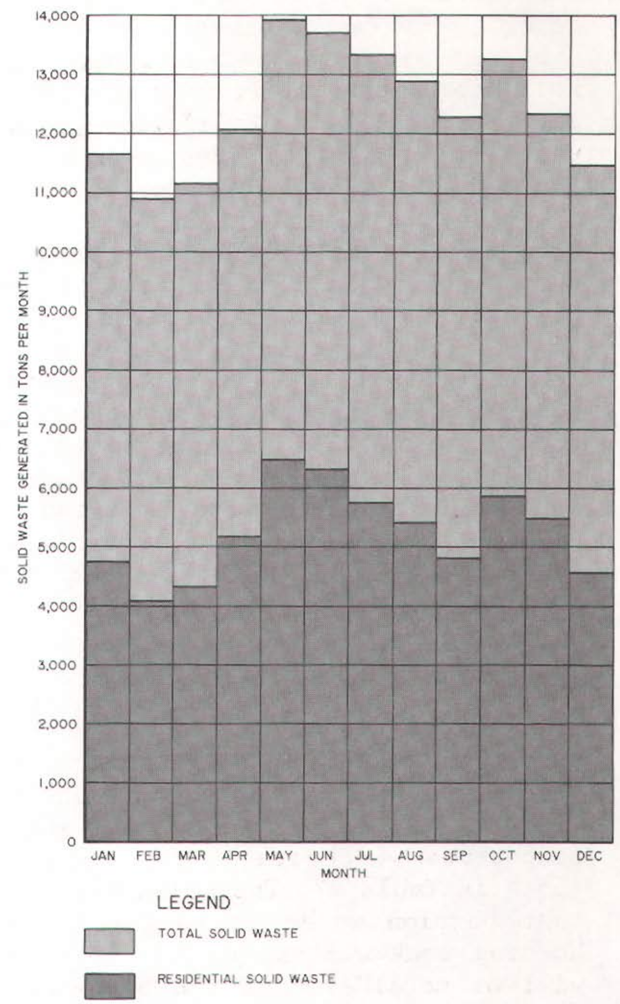
[a] These quantities do not include 110,000 tons of industrial wastes, 5,000 tons of construction and demolition debris, 6,750 tons of commercial wastes, 1,700 tons of residential wastes, 700 tons of trees and brush, and 200 tons of bulky materials which are reused, recycled, and incinerated and do not enter the solid waste stream.

[b] Additional reuse, recycling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

Source: SEWRPC.

Figure 5

MONTHLY GENERATION OF SOLID WASTE IN KENOSHA COUNTY: 2010




Source: SEWRPC.

Figure 5 illustrates the estimated monthly seasonal distribution of solid waste generation in the study area under existing and future conditions.

## Residential Solid Waste

As described in Chapter II, the existing residential solid waste quantities were estimated utilizing waste production data from local units of government, and by comparing these data to previously developed generation rates. Numerous attempts have been made at estimating possible future changes in solid waste generation rates. Historically, solid waste per capita generation rates have increased steadily in the United States. Between 1968 and 1979, the annual quantity of solid waste generated per capita increased every year except 1974 and 1975, both recession years.[1] This indicates, as might be expected, a

[1] The Tenth Annual Report of the U. S. Council on Environmental Quality, December 1979.

direct correlation between the levels of economic activity and the rate of solid waste generation. Studies conducted for the Wisconsin Solid Waste Recycling Authority[2] in the early 1970's estimated a moderate rate of increase in residential solid waste generation of about 2 percent per capita per year. However, the economic and other forces which may affect solid waste generation are not well understood. Information provided by communities in Kenosha County indicates that there has been an actual increase in the amount of residential waste generated in the County. Factors which may contribute to increased rates of generation include economic growth and the increased use of disposable products. Factors which may contribute to declining rates of waste generation include the increasing costs of disposal, increased recycling, increased efforts at source reduction, and decreasing affluence.

Over the last 10 years, it is estimated that the per capita generation rate for residential waste increased in Kenosha County by between 15 and 20 percent. During that period of time, the household size decreased from about 3.3 to about 2.9 persons per household, a decrease of 13 percent. The household size in Kenosha County is projected to continue to decrease but at a much slower rate, and is expected to reach about 2.4 persons per household by the year 2010, a reduction of about 27 percent. Based upon a review of the projected change in household size, and consideration that there will likely be additional emphasis placed upon recycling, it was concluded that a per capita generation rate of about 2.8 pounds per capita per day should be used to approximate the solid waste generation rate by the plan design year 2010. This represents an increase of about 22 percent, or slightly less than 1 percent a year, over the 1984 level. This is about the same as what appears to have taken place historically.

As shown in Table 26, about 63,000 tons per year of residential solid waste are anticipated under the intermediate future by the year 2010. This represents an increase of about 11,090 tons, or 21 percent, over the amount generated in 1984. This quantity does not include an estimated 1,700 tons per year of residential wastes, or 0.07 pound per capita per day, which are anticipated to be recycled. Under the optimistic future, the residential solid waste quantity would be 85,235 tons, or an increase of about 33,325 tons, or 64 percent, over the 1984 quantity. Under the pessimistic future, it was assumed that the residential solid waste generation rate would remain at 2.3 pounds per capita per day. The residential solid waste quantity under the pessimistic future would be 42,730 tons, or a decrease of about 9,180 tons, or about 18 percent, from the 1984 quantity.

### Commercial Solid Waste

Existing commercial solid waste quantities were estimated, as described in Chapter II, by using a 1981 Wisconsin Department of Natural Resources (DNR) study[3] which estimated a per capita generation rate of 1.1 pounds per day, and, where available, commercial solid waste quantity information obtained from the municipal solid waste questionnaire survey conducted for the Kenosha County solid waste study. Based on these data sources, a per capita generation rate of 1.1 ton per year was selected for use in estimating existing 1984 commercial

[2]Board of Engineering Consultants, Wisconsin Solid Waste Recycling-Predesign Report, Governor's Recycling Task Force on Solid Waste, May 1973.

[3]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

solid waste loads. It is expected that employment within the commercial sectors will increase by about 5 percent over the plan design period, given the shift in employment from the industrial to the commercial sector. Thus, it was concluded that the amount of commercial solid waste generated within the County could be expected to increase by about 10 percent over the 1984 level by the plan design year 2010.

As shown in Table 26, about 27,000 tons per year of commercial solid waste may be expected to be generated in Kenosha County in the year 2010, or about 1.2 pounds per capita per day. This represents an increase of 3,415 tons per year, or 14 percent, over the 23,585 tons generated in 1984. This quantity does not include an estimated 6,750 tons per year, or 0.3 pound per capita per day, of commercial solid wastes which are anticipated to be recycled or incinerated. It was further estimated that under the optimistic future, the commercial solid waste quantity would be 36,530 tons, or an increase of about 12,945 tons, or 55 percent, over the 1984 quantity. The commercial solid waste quantity under the pessimistic future would be 22,300 tons, or a decrease of about 1,285 tons, or about 5 percent, from the 1984 quantity.

## Industrial Solid Waste

Existing industrial solid waste quantities were estimated, as described in Chapter II, by using the 1981 DNR study which estimated per-employee industrial solid waste generation rates for a wide variety of industrial classifications. The per-employee generation rates were used in conjunction with Commission file information pertaining to the number of persons employed in the various industrial occupations, and with information obtained through the industrial solid waste questionnaire survey conducted under this study, to estimate existing industrial solid waste quantities. Employment in the industrial category is expected to decrease by about 10 percent over the plan design period. However, even though employment is expected to decrease, it was concluded that the industrial waste load will remain essentially the same as it is under existing conditions, given historic trends in per-employee generation rates.

As shown in Table 26, about 46,030 tons per year of industrial solid waste, or about 2.0 pounds per capita per day, may be expected to be generated in the year 2010. This is about the same amount as was generated in 1984. This quantity does not include an estimated 110,000 tons per year, or 4.9 pounds per capita per day, of industrial wastes which are anticipated to be recycled or incinerated. It was further estimated that under the optimistic future, the industrial solid waste quantity would be about the same amount as was generated in 1984. The industrial solid waste quantity under the pessimistic future would be 39,125 tons, or a decrease of about 6,905 tons, or about 15 percent, from the 1984 quantity.

## Special Wastes

Bulky Wastes: As described in Chapter II, the existing (1984) estimates of quantities of bulky wastes are based on a per capita generation rate of about 0.1 pound per day which was developed by the Wisconsin Recycling Task Force on Solid Waste. The per capita generation rate for residential wastes was assumed to increase by about 20 percent by the design year 2010. It was assumed that the per capita generation rate of bulk materials would increase by a similar amount.

As shown in Table 26, about 2,700 tons per year of bulky wastes, or about 0.12 pound per capita per day, may be expected to be generated in the year 2010. This represents an increase of 485 tons, or 22 percent, over the amount generated in 1984. This quantity does not include an estimated 200 tons per year, or 0.01 pound per capita per day, of bulky wastes which are anticipated to be recycled. It was estimated that under the optimistic future, the bulky solid waste quantity would be 3,650 tons, or about 1,435 tons, or 65 percent, greater than the 1984 quantity. Under the pessimistic future, it was assumed that the per capita generation rate of bulky materials would not increase over existing levels. Rather, the bulky solid waste quantity under the pessimistic future would be 1,860 tons, or a decrease of about 355 tons, or about 16 percent, from the 1984 quantity.

Construction and Demolition Debris: As described in Chapter II, the Wisconsin Recycling Task Force on Solid Waste estimated the construction and demolition solid waste generation rate to be 0.7 pound per capita per day for communities with a population greater than 10,000, and 0.3 pound per capita per day for communities of fewer than 10,000 people. The year 2010 forecast was based upon the same per capita rate used to estimate 1984 construction and demolition waste quantities. Although the gross population of the County is projected to increase slightly by the year 2010, the amount of construction and demolition debris may be expected to remain the same as in 1984.

As shown in Table 26, about 7,215 tons per year, or 0.33 pound per capita per day, of construction and demolition wastes may be expected to be generated in the year 2010. This quantity does not include an estimated 5,000 tons per year, or 0.2 pound per capita per day, of construction and demolition debris which is anticipated to be recycled or reused or not disposed of in licensed sanitary landfills. It was further estimated that under the optimistic future, the construction and demolition solid waste quantity would be 9,130 tons, or an increase of about 1,915 tons, or about 26 percent, over the 1984 quantity. The construction and demolition solid waste quantity under the pessimistic future would be 5,575 tons, or a decrease of about 1,640 tons, or about 23 percent, from the 1984 quantity.

Trees and Brush: As described in Chapter II, the existing quantity of tree and brush waste was estimated based on the generation rate of 0.1 pound per capita per day for communities with fewer than 7,500 persons, and 0.3 pound per capita per day for larger communities. These generation rates were developed by the Wisconsin Recycling Task Force on Solid Waste. Since those estimates were prepared, however, there has been an increase in the domestic use of wood as a fuel. Accordingly, the generation rates were reduced by 50 percent for use in estimating the existing 1984 quantity of tree and brush wastes. The revised generation rate was supported by limited data available from the local municipalities. This rate, however, was also increased by 20 percent to the design year.

As shown in Table 26, about 3,430 tons per year, or about 0.15 pound per capita per day, of trees and brush are expected to be generated in the year 2010. This represents an increase of about 935 tons, or 37 percent, over the amount generated in 1984. This quantity does not include approximately 700 tons per year, or 0.03 pound per capita per day, of trees and brush which are not entering the waste stream. It was further estimated that under the optimistic future, the tree and brush waste quantity would be about 3,650 tons, or an increase of about 1,155 tons, or about 46 percent, over the 1984 quantity. The tree and brush waste quantity under the pessimistic future would be 2,230 tons, or a decrease of about 265 tons, or about 11 percent, from the 1984 quantity.

Sewage Treatment Plant Wastes and Onsite Septic System and Holding Tank Wastes: Based on recommendations contained in the adopted areawide water quality management plan, eight public and six private sewage treatment plants will be operating in Kenosha County in the year 2010. These plants, which are shown on Map 26, will be generating about 7,740 tons of sludge per year on a dry-weight basis. The alternatives analysis will include an evaluation of ways in which to dispose of these materials.

Based upon data contained in the adopted regional wastewater sludge management plan, approximately 1,700 onsite sewage disposal systems will produce about 32 tons of solids per year on a dry-weight basis--or 64 tons per year on a wet-weight basis--by the year 2010. It is generally recommended that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant. Accordingly, the solid waste quantity forecasts do not include any septic or holding tank wastes, these being reflected in the municipal sewage treatment plant sludge generation.

Hazardous Wastes: Data on the present toxic and hazardous waste generation levels in the County were set forth in Chapter II. It is indicated in that chapter that approximately 5,548 tons of toxic and hazardous wastes were generated in Kenosha County in 1984. Recent federal and state regulations regarding the handling and disposal of these wastes have resulted in expanded efforts to reduce the generation and increase the recycling or reuse of such wastes. These changing conditions will likely result in significant reductions in the amounts of these materials entering the solid waste stream during the plan period. However, the amount of this change is difficult to forecast at this time. Of the quantities of material which could be classified as "hazardous," and which were reported to be generated by industries in the County as of 1984, over 40 percent were recovered and recycled. As discussed in Chapter II, this plan will not specifically develop a recommended plan for the management of toxic and hazardous wastes, but rather will consider this type of waste only as necessary to coordinate total solid waste disposal efforts within the County.

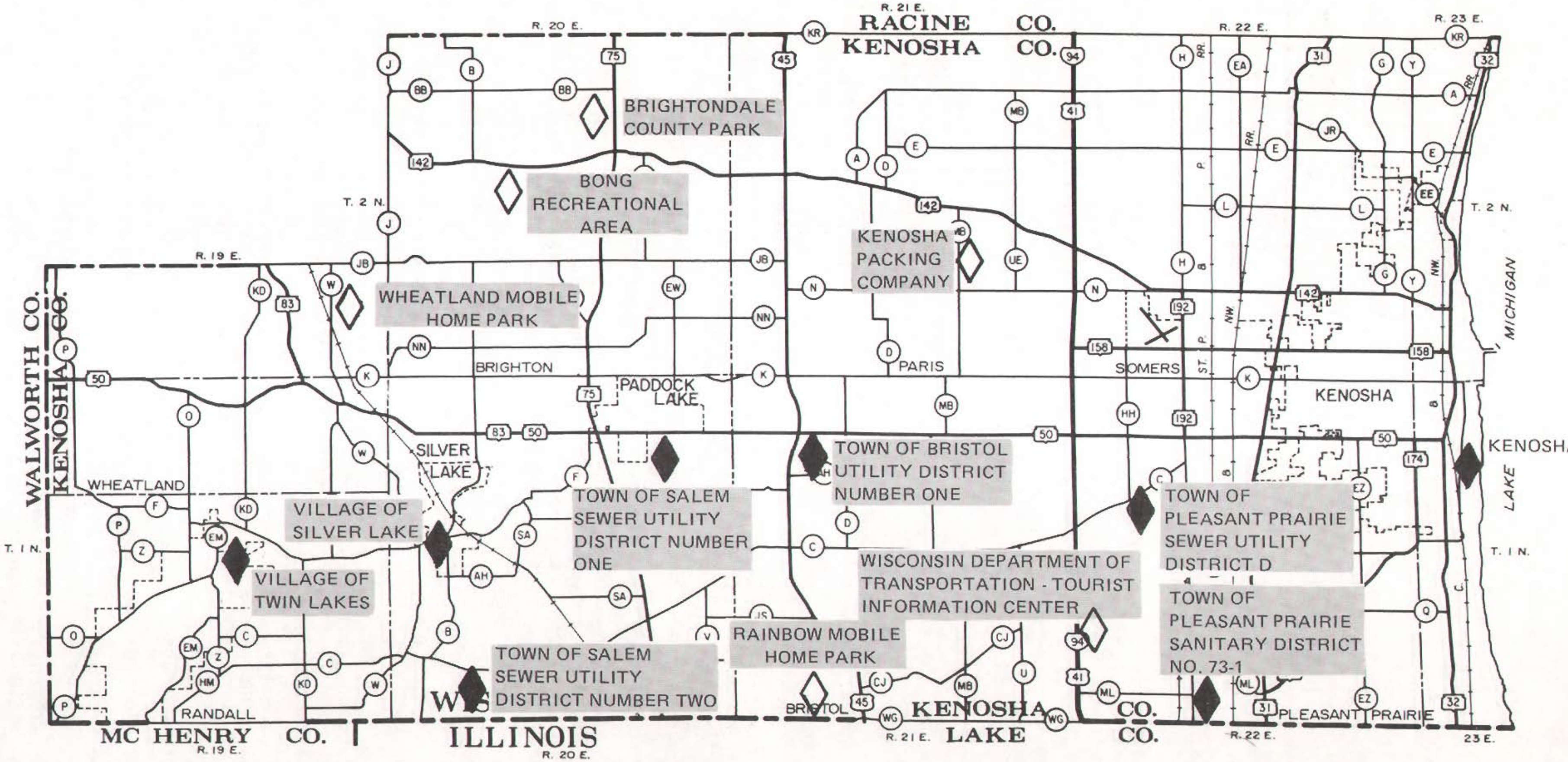
As indicated in Chapter II, residential solid wastes contain a variety of toxic and hazardous materials. Consequently, because of the presence of these materials and their potential to have an impact on the environment, they will be considered in the evaluation of alternatives.

## SUMMARY AND CONCLUSIONS

To prepare a technically sound and viable plan for solid waste management in Kenosha County, it is necessary to forecast the quantities and types of solid wastes which may be expected to be generated over the plan period. As shown in Table 28, the quantity of solid waste estimated to be generated in the study area in the year 2010, not including hazardous wastes, sewage sludge, and septic and holding tank wastes, is 149,375 tons per year. This represents an increase of 15,925 tons, or 12 percent, over the 133,450 tons estimated to be generated in 1984. These quantities do not include approximately 110,000 tons of industrial wastes, 6,750 tons of commercial solid waste, 5,000 tons of con-

Map 26

PUBLIC AND SPECIAL-PURPOSE SEWAGE TREATMENT
PLANTS IN KENOSHA COUNTY: 2010




LEGEND

EXISTING PUBLIC SEWAGE
TREATMENT PLANT

EXISTING SPECIAL-PURPOSE
SEWAGE TREATMENT PLANT

Source: Wisconsin Department of Natural Resources and SEWRPC.

## Table 28

## ESTIMATED SOLID WASTE QUANTITIES GENERATED IN KENOSHA COUNTY: 2010

| Solid Waste Category | Solid Waste Generated: Tons per Year | Solid Waste Generated: Pounds Per Capita per Day |
|---|---|---|
| Residential[a] | 63,000 | 2.8 |
| Commercial[b] | 27,000 | 1.2 |
| Industrial[c,d] | 46,030 | 2.0 |
| Special Wastes Considered as Part of the Solid Waste Stream | | |
| Bulk[e] | 2,700 | 0.1 |
| Construction and Demolition Debris[f] | 7,215 | 0.3 |
| Trees and Brush[g] | 3,430 | 0.15 |
| Subtotal[h] | 149,375 | 6.6 |
| Other Solid and Liquid Wastes to be Treated Separately from the Solid Waste Stream | | |
| Hazardous Wastes | 5,548 | 0.25 |
| Sewage Sludge[i] | 7,740 | 0.3 |
| Septic and Holding Tank Wastes | 32 | Less than 0.1 |
| Subtotal | 13,320 | 0.6 |
| Total | 162,695 | 7.2 |

[a]This quantity does not include approximately 1,700 tons per year, or 0.07 pound per day, of residential wastes comprised primarily of paper, glass, and metal which are recycled.

[b]This quantity does not include approximately 6,750 tons per year, or 0.3 pound per capita per day, of commercial wastes comprised primarily of paper and cardboard which are recycled or incinerated.

[c]This quantity does not include approximately 110,000 tons per year, or 4.9 pounds per capita per day, of industrial wastes comprised primarily of paper, cardboard, metal, wood, glass, and miscellaneous materials which are recycled or incinerated.

[d]Industrial solid wastes do not include fly ash produced by the Wisconsin Electric Power Company as a result of the burning of coal for the generation of electricity.

[e]This quantity does not include approximately 200 tons per year, or 0.01 pound per capita per day, of white goods which are recycled.

[f]This quantity does not include approximately 5,000 tons per year, or 0.2 pound per capita per day, of construction and demolition debris which is recycled or used as rubble fill and not disposed of in sanitary landfills.

[g]This quantity does not include approximately 700 tons per year, or 0.03 pound per capita per day, of trees and brush which are recycled through mulching or composting or used by individuals for firewood.

[h]Additional reuse, recycling, and incineration of solid wastes which may occur during the plan period will be addressed in the alternatives analysis and, if appropriate, the recommended plan.

[i]Sewage treatment plant sludge generated at public and private plants will be evaluated as part of the alternatives analysis.

Source: Wisconsin Department of Natural Resources, Wisconsin Solid Waste Recycling Authority, and SEWRPC.

struction and demolition debris, and 1,700 tons of residential solid waste which are anticipated to be recycled, incinerated, or reused annually. The estimated year 2010 per capita solid waste production rate is 6.6 pounds per day, based upon the year 2010 resident population of the study area. This is an increase of 0.6 pound per capita, or 10 percent, over the 1984 rate of 6.0 pounds per capita per day.

Sewage treatment plant sludge generated by the eight public and six private treatment plants anticipated to be operating in the year 2010 will also be addressed in the alternatives analysis. The increasing environmental concern regarding the disposal of these materials and rising disposal costs necessitate that this plan include such an analysis.

As previously discussed, solid waste quantities were also developed for the optimistic and pessimistic year 2010 future conditions. Total solid waste quantities were estimated to be 189,225 tons under the optimistic future and 113,820 tons under the pessimistic future. These waste quantities will be considered in the alternative plan evaluation to ensure that proposed solid waste management facilities can adequately handle the range of solid waste quantities which could occur over the plan period.

The following amounts of solid wastes may be expected to be produced in the year 2010: about 63,000 tons of residential wastes, or 2.8 pounds per capita per day, representing 42 percent of the total; 27,000 tons of commercial wastes, or 1.2 pounds per capita per day, representing 18 percent of the total; 46,030 tons of industrial wastes, or 2.0 pounds per capita per day, representing 31 percent of the total; and 13,345 tons of special wastes--including bulky wastes, construction and demolition debris, and trees and brush--or 0.6 pound per capita per day, representing 9 percent of the total. It was also estimated that hazardous wastes, sewage sludge, and septic and holding tank wastes would total 13,320 tons annually, or 0.6 pound per capita per day.

The monthly variation in solid wastes, and the combustibility of solid wastes, are important considerations in the development and evaluation of solid waste management alternatives. Generally, the greatest quantities of solid wastes are generated during the summer and fall, with lesser amounts produced in the winter. For example, in May, June, and October solid waste quantities are projected to be 112 percent, 111 percent, and 107 percent, respectively, of the monthly average; while in February, March, and December solid waste quantities are projected to be 88 percent, 90 percent, and 93 percent, respectively, of the monthly average. However, if only residential solid wastes are considered, solid waste quantities are anticipated to range from 124 percent of the monthly average in May to 77 percent of the monthly average in February. The heating value of the total solid waste stream was estimated to be 4,500 British thermal units (BTU's) per pound, with a moisture content of 27 percent by weight and an ash content of 22 percent by weight.

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# Chapter IV

# LANDFILL, INCINERATOR, AND SLUDGE DISPOSAL SITING ANALYSIS

## INTRODUCTION

A sanitary landfill is a necessary component of any county solid waste management system. Even alternative solid waste management systems incorporating a high degree of resource recovery, including incineration of waste for the generation of energy, land application of sewage treatment plant sludge, and recycling, require landfill disposal of incinerator ash and of other materials which cannot be removed from the waste stream and otherwise recycled or reused. Landfill disposal is also required as a backup system during periods when the resource recovery systems are not operational or when land spreading of sewage sludge is not feasible. Accordingly, a general siting analysis designed to identify areas with high, moderate, and low potential suitability for landfill siting is an important part of any solid waste management planning effort. An important aspect of the Kenosha County solid waste management planning effort is the development of an alternative solid waste management plan which includes incineration of combustible wastes. As discussed in Chapter II, in 1985 there were no publicly owned incinerators operating within the County. The incinerators that were operated by some industries and institutions within the County were used to dispose of relatively small amounts of waste. Consequently, the planning effort must also include analyses relative to the siting and construction of incinerators. As previously discussed, the disposal of sewage treatment plant sludge is of particular concern in Kenosha County. Accordingly, this chapter also includes a generalized siting analysis for areas suitable for the application of sewage treatment plant sludge.

A general siting analysis consists of an evaluation of the available data on the cultural and natural resource base of the planning area in relation to pertinent environmental protection, engineering, and regulatory criteria. The purpose of such an analysis is to identify lands with high, moderate, and low potential for the siting of the facilities concerned. Separate siting analyses are required for the siting of sanitary landfills and incineration facilities, and for the siting of areas suitable for land application of sewage treatment plant sludge. The information from the analyses can then be utilized in developing the alternative plan components as described in Chapter VII of this report.

The system planning level siting analyses are designed to be followed by more site-specific analyses of the best sites within Kenosha County, if it is determined that new landfill or incinerator facilities or land application of sewage treatment plant sludge are to be components of the recommended plan.

In addition to considering the man-made and natural resource base features of the study area, any landfill or incinerator siting analysis or analysis of areas suitable for the land-spreading of sludge must consider the existing regulations governing the siting of sanitary landfills and incinerators as set forth in Chapters NR 140, NR 180, and NR 185 of the Wisconsin Administrative Code. Because Kenosha County has only limited potential for the construction and use of a natural attenuation landfill, as defined in Chapter V, the analysis assumes that any landfill will be provided with engineered facilities for leachate control. It is important to note that zone of saturation landfills have been found to be environmentally acceptable. However, the ideal natural resource characteristics associated with a natural attenuation site will be sought in the general siting analysis for landfill facilities. Engineering features of the various types of landfills are discussed in Chapter V.

Regulations governing sewage treatment plant sludge as set forth in Chapter NR 204 of the Wisconsin Administrative Code and the Kenosha County Sanitary Code and Private Sewage System Ordinance were used in assessing an area's suitability for land application of sludge. Importantly, where regulations contained in the State Code overlap the county ordinance, the more stringent criteria are used.

The criteria used to identify potential sites for landfill and incinerator facilities, and for land application of sludge, are set forth below.

## CRITERIA

As noted above, the criteria utilized in the analysis were based on the requirements of Chapters NR 140, NR 180, NR 185, and NR 204 of the Wisconsin Administrative Code; the adopted Kenosha County Sanitary Code and Private Sewage System Ordinance; and pertinent engineering and transportation requirements for the siting of landfills, incinerators, and areas suitable for land application of sludge.

The criteria applied in the landfill siting analysis can be categorized as relating to geology, topography, soils, groundwater, surface water, environmentally significant areas, urban land uses, transportation routes, and historical and archaeological sites. Detailed inventory data on these natural and man-made features of the study area are presented in Chapter II. In some cases, application of the criteria may preclude use of a proposed landfill site, while in other cases, such application may only limit the site potential. For the purposes of the general siting analysis, the criteria were applied in a conservative manner in order not to categorically eliminate sites that may have potential for landfill development when further evaluated on a site-specific basis.

The criteria applied in the sewage treatment plant sludge land application analysis can be categorized as relating to geology, topography, soils, groundwater, surface water, urban land uses, transportation routes, and location of sewage treatment plants. As stated above, inventory data pertaining to these criteria are presented in Chapter II. For the purpose of this general siting analysis, the criteria were applied in a conservative manner, given the need for additional site-specific evaluations. The present sludge land application regulations contained in the Kenosha County Sanitary Code and Private Sewage System Ordinance and in Chapter NR 204 of the Wisconsin Administrative Code make no distinction for the characteristics of the sludge. The high solids content--about 40 percent--and the high lime content--20 percent by weight with a pH of about 11 to 12--of the sludge generated at the Kenosha Water

Utility appear to reduce the pollution potential of the sludge produced. In particular, the high pH essentially eliminates pathogenic organisms from the sludge. However, at this time the regulations for land application give no special consideration to these characteristics.

The criteria applied in the incinerator siting analysis can be categorized as relating to existing urban land uses, location of transfer stations, transportation routes, potential energy users, historic sites, and air quality. As in the landfill siting analysis, application of criteria may preclude use of a proposed incinerator site, while in other cases, such application may only limit the site potential. With regard to the incinerator locations, it should be noted that the highest potential sites will be either within existing or planned industrialized areas or within or adjacent to existing solid waste management facilities such as transfer stations. In addition, the site size required will generally be relatively small compared to the size of landfill sites or of areas where sewage treatment plant sludge is applied. Thus, criteria relative to such natural resource features as geology, topography, soils, groundwater, surface water, and environmentally significant areas were not specifically considered; however, further site feasibility studies would need to investigate these features.

## Geology

Depth to bedrock and the type of glacial deposits are the main geologic considerations discussed below.

Depth to Bedrock: Considerable excavation is usually required for the development of landfills. In addition, it is necessary to maintain adequate separation between the top of the bedrock and the confining layer, or liner, at the bottom of a landfill. The type and characteristics of this separation depend on the characteristics of the confining material, or type of liner, and of the bedrock. A depth to bedrock of greater than 20 feet is generally considered practical and desirable in order to meet the separation requirements and reduce the potential for groundwater contamination. As shown on Map 12 in Chapter II, depth to bedrock exceeds 20 feet throughout Kenosha County. Consequently, this criterion was not used to exclude areas from consideration in the landfill siting analysis.

Depth to bedrock is also an important consideration in the evaluation of whether a site is suitable for land application of sludge. The depth of the soil material, the physical and chemical characteristics of the soil, and the uses of the soil are the primary determinants to how much water will percolate downward. If sludge has been applied to the surface, these criteria also determine the amount of contamination of groundwater which may occur, as percolating water carries nutrients, heavy metals, or other materials downward in varying concentrations. Chapter NR 204 of the Wisconsin Administrative Code stipulates that sludge may not be applied to areas with a depth to bedrock of less than three feet unless the soil has an available water capacity greater than five inches above the bedrock. The adopted Kenosha County Sanitary Code and Private Sewage System Ordinance prohibits the application of sludge on lands with a depth to bedrock of less than two feet. However, as previously noted, there are no known areas in Kenosha County with depths of less than three feet to bedrock; consequently, this criterion was not used to eliminate areas from consideration for land application of sludge.

Glacial Deposits: The majority of materials that cover the bedrock surface in Kenosha County are glacial deposits of the Quaternary period of geological time and include end moraine, ground moraine, outwash, ice contact deposits, tills, organic deposits, and lake basin deposits. The surficial geology of Kenosha County is shown on Map 27.

End moraines and ground moraines consist of unsorted, unstratified debris ranging in size from clay to boulders. The potential for locating large quantities of clay materials necessary for the development of a solid waste landfill is relatively high in these formations of glacial origin. Accordingly, areas occupied by such formations were classified as having a high potential for landfill siting.

Outwash plains consist primarily of sands and gravels with small amounts of clay. Outwash plains are typically stratified in relatively thin layers, reducing the potential for locating extensive clay deposits in deep layers. Accordingly, areas occupied by such formations were classified as having moderate potential for landfill siting.

Ice contact deposits represent a wide variety of textural types ranging in size from silts and clays to coarse gravel and boulders. The potential for locating large quantities of clay materials is relatively low in these formations of glacial origin. Accordingly, areas occupied by such formations were classified as having moderate potential for landfill siting.

Sandy till consists primarily of intermixed clay, silt, sand, and gravel. All till is characterized by poor sorting and scattered boulders. The potential for locating large quantities of the dry materials necessary for the development of a solid waste landfill facility is relatively high. Accordingly, areas occupied by such formations were classified as having moderate potential for landfill siting.

Silty-clay till, like sandy till, consists primarily of clay, silt, sand, and gravel. The potential for locating the clay materials necessary for the development of a solid waste landfill facility is also relatively high in these formations of glacial origin. Accordingly, areas occupied by such formations were classified as having a high potential for landfill siting.

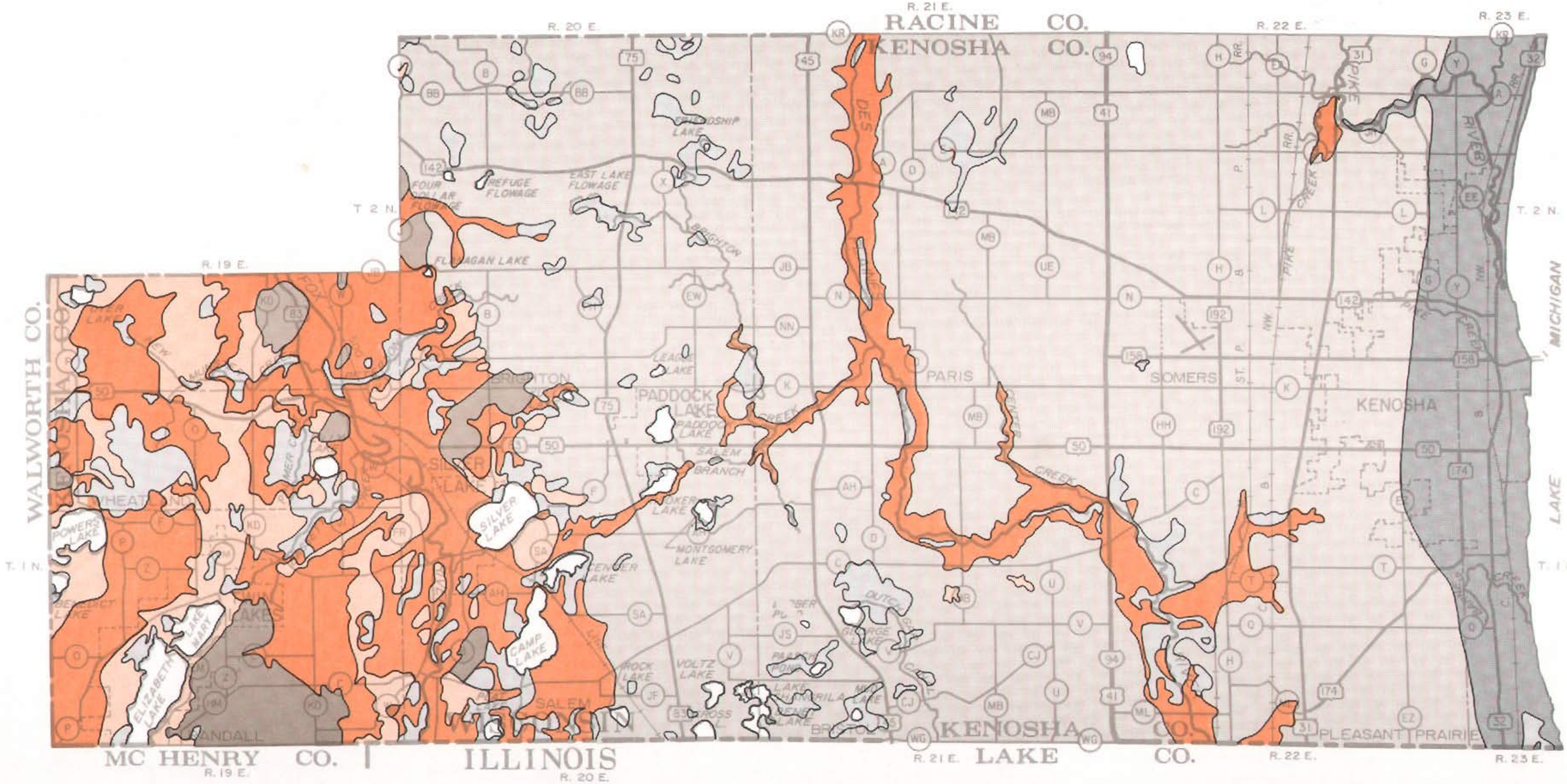
Organic deposits are not of glacial origin, but rather consist primarily of organic matter that has accumulated in marshes, swamps, and bogs. Organic deposits do not provide the low permeability required for the proper development of a landfill site. However, these deposits are often underlain by a nearly impermeable clay layer. Accordingly, areas occupied by such formations were classified as having a moderate potential for landfill siting.

Lacustrine or lake deposits, which consist of fine-grained strata, primarily silt and clay, have settled out from suspension in turbid lake waters. Lacustrine deposits form a stratified profile of silt and clay that may provide the low permeability necessary for the proper development of a landfill site. Accordingly, areas occupied by such formations were also classified as having a high potential for landfill siting.

Glacial deposits determine to a large extent the slope and soil types which characterize the land surface. Slope and soil type are two of the most impor-

## Map 27

### GLACIAL DEPOSIT TYPES IN KENOSHA COUNTY




LEGEND

- OUTWASH
- ICE-CONTACT DEPOSIT
- SANDY TILL
- SILTY-CLAY TILL
- LAKE DEPOSITS, DUNES AND ALLUVIUM
- ORGANIC DEPOSIT

GRAPHIC SCALE

Source: SEWRPC.

tant criteria used to evaluate the suitability of sites for land application of sewage sludge. Consequently, the use of these criteria will be discussed below under topography and soils, respectively.

## Topography

The topographic characteristics of Kenosha County, as noted in Chapter II, were determined primarily by glacial action and the resulting formation of ground, terminal, interlobate, and kettle moraines, and of glacial outwash terraces. Portions of the County are covered by glacial deposits with steep slopes, a topographic characteristic particularly important in the evaluation of the suitability of sites for the development of solid waste management facilities. As indicated below, the primary environmental corridors, which contain many of the steeply sloped areas of the County, were considered to have a low potential for the location and development of landfills. Other portions of the County that were considered to have potential for the siting and development of solid waste management facilities, including incinerators, may contain topographic features, including steep slopes, that would make such sites either more or less suitable for these facilities. Accordingly, the topographic characteristics of any site considered to have potential for the location of solid waste management facilities will have to be evaluated on a site-specific basis.

Chapter NR 204 of the Wisconsin Administrative Code prohibits land application of sludge on areas with slopes of greater than 12 percent, and stipulates that liquid sludge must be injected on slopes of between 6 and 12 percent. Consequently, when considering this criterion, it was assumed that areas with slopes of less than 6 percent would have high potential, areas with slopes of 6 to 12 percent would have moderate potential, and areas with slopes greater than 12 percent would have no potential for land application of sewage treatment plant sludge. The Kenosha County Sanitary Code and Private Sewage System Ordinance incorporates, by reference, the above-mentioned criteria regarding sludge application and land surface slopes.

## Soils

The geographic distribution and generalized engineering characteristics of the soil types that are found in Kenosha County are presented in Chapter II. In order to assess the significance of the diverse soils found in southeastern Wisconsin to the sound development of the Region, the U. S. Soil Conservation Service, under contract to the Commission, prepared detailed operational soil surveys for the entire seven-county Planning Region in 1963. These surveys produced detailed maps of the soils within the Region, together with data on the physical, chemical, and biological properties of the soils, and, more importantly, interpretations of those properties for planning, engineering, agricultural, and natural resource conservation purposes. Interpretations of the soil properties in terms of their suitability for sanitary landfill construction are accordingly available. As described in Chapter II, both generalized soils and detailed soils maps relating soil properties to suitability for landfill siting are available for use in the evaluation of potential landfill sites. A given land parcel may encompass several different soils with varying limitations for landfill development. The soils should be evaluated on a site-by-site basis, utilizing the detailed soils maps and interpretations for landfill siting. An example of the type of landfill soil suitability map which can be produced for any area of the County is illustrated on Map 28.

Map 28

SAMPLE MAP ILLUSTRATING SOIL SUITABILITY FOR LANDFILL DEVELOPMENT IN A PORTION OF THE TOWN OF BRIGHTON, KENOSHA COUNTY


LEGEND

SLIGHT LIMITATIONS

MODERATE LIMITATIONS

SEVERE LIMITATIONS

Source: U. S. Department of Agriculture, Soil Conservation Service; and SEWRPC.

It is important to note that certain specific characteristics, including chemical composition, slope, permeability, depth to groundwater, and depth to bedrock, are important considerations in the evaluation of an area's suitability for the land-spreading of sludge. These characteristics have been used to categorize the suitability of soils for land application of sewage treatment plant sludge.[1] Based on these characteristics, soils in Kenosha County were classified by the Regional Planning Commission as having slight, moderate, or severe limitations for the application of sludge. The results of this classification are reflected in the overall analysis and final mapping of the suitability of areas for the spreading of sludge in the County.

## Groundwater

Groundwater considerations which are important in landfill siting and for evaluating the suitability of sites for land application of sewage sludge are presented below.

Depth to Groundwater: Areas with a depth to groundwater of less than 10 feet are considered to have limitations for landfill siting and development. These areas are shown on Map 29.

There is some potential for landfill development in areas with high groundwater if the zone of saturation technique is used as described in Chapter V. However, because of the increased cost of constructing and operating this type of landfill, areas of shallow depth to groundwater were classified as having moderate potential for landfill siting.

As discussed above, depth to groundwater is an important criterion to consider when evaluating a site's suitability for land application of sludge. This is especially true in Kenosha County, since an estimated 110 square miles, or 40 percent of the County, has soils which exhibit a depth to groundwater of less than three feet. Chapter NR 204 of the Wisconsin Administrative Code stipulates that sludge may not be applied to soils with a high groundwater level at a depth of less than three feet unless it is demonstrated that the soil has an available water capacity greater than five inches above the high groundwater level. The adopted Kenosha County Sanitary Code and Private Sewage System Ordinance prohibits the application of sludge on lands with a depth to groundwater of less than two feet. For the purpose of this evaluation, upland areas with a depth to groundwater of greater than three feet will be considered to have no potential for land application of sludge.

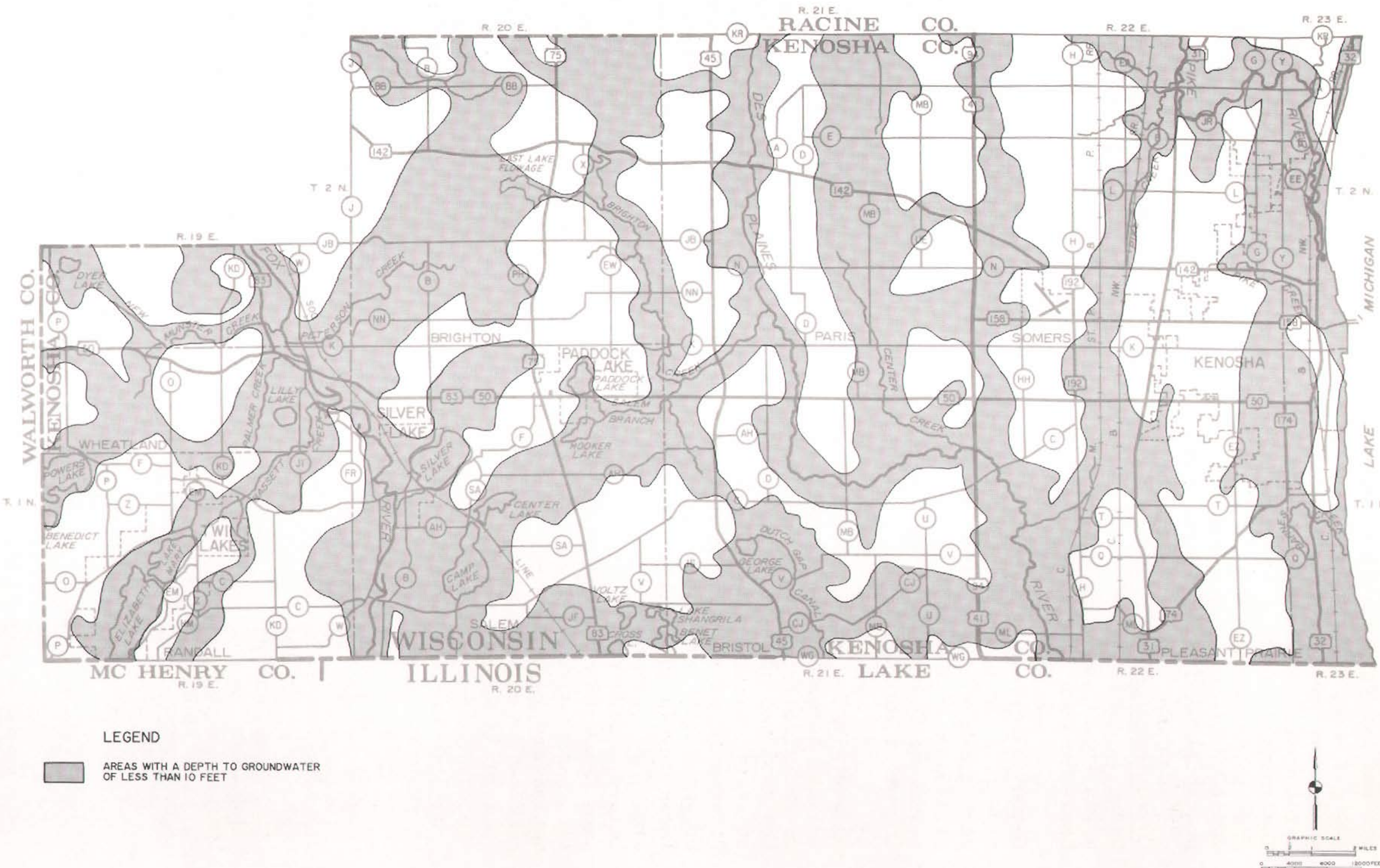
Well Locations: Chapter NR 180 of the Wisconsin Administrative Code requires that landfills be located at a horizontal distance of more than 1,200 feet from any public or private water supply well unless special conditions indicate that contamination of the well will not occur. This factor is discussed in a later section in conjunction with the consideration of urban development in landfill siting.

Chapter NR 204 of the Wisconsin Administrative Code requires that sludge not be land applied within 200 feet of a private water supply well and 1,000 feet of a public water supply well. The adopted Kenosha County Sanitary Code and

[1]Guidelines for the Application of Wastewater Sludge to Agricultural Land in Wisconsin, Wisconsin Department of Natural Resources Technical Bulletin 88, 1975.

## Map 29

### AREAS WITH A DEPTH TO GROUNDWATER OF LESS THAN 10 FEET IN KENOSHA COUNTY




Source: U. S. Geological Survey and SEWRPC.

Private Sewage System Ordinance prohibits land disposal of sludge within 500 feet of a private water supply well or 1,000 feet of a public water supply well. For the purpose of this analysis, distances of 200 feet from a private water supply well and 1,000 feet from a public water supply well will be used. Accordingly, areas within these distances of water supply systems were classified as having no potential for land application of sludge, and areas outside these distances from water supply facilities were classified as having a high potential for land application of sludge.

Groundwater Flow Direction: Generalized mapping of the groundwater flow patterns is available. However, local variation in the regional flow patterns is often significant, and thus this criterion must be evaluated on a site-specific basis for both landfills and land application of sludge.

General Groundwater Protection: Chapter NR 180 of the Wisconsin Administrative Code requires that a solid waste landfill not be located where the Department finds there is reasonable probability that the disposal of solid waste will have a detrimental effect on groundwater quality. This general site requirement was evaluated, to the extent possible, during review of the geological characteristics of the study area.

Chapter NR 140 of the Wisconsin Adminstrative Code establishes groundwater quality standards for substances detected in or having a reasonable probability of entering groundwater, specifies procedures for determining if a numerical standard has been attained or exceeded, specifies procedures for establishing standards application and monitoring, establishes responses by the Wisconsin Department of Natural Resources if a standard is attained or exceeded, and provides for exemptions for facilities and activities otherwise regulated. These regulations establish an enforcement standard and a preventive action limit for groundwater substances. The preventive action limit represents a lesser concentration of a substance than the enforcement standard, must be used in design codes and management specifications for facilities such as landfills so that contamination is prevented, and serves as a signal that remedial action may be necessary. Enforcement standards define when a violation has occurred, and generally require that a regulatory agency prohibit the continuation of the activity from which the substance came. These regulations are important considerations in the analysis of landfill siting, design, and operation, and in the evaluation of the suitability of an area for land application of sludge.

## Surface Water

Criteria for the siting of a landfill with regard to the surface waters of the Region are set forth in Chapter NR 180 of the Wisconsin Administrative Code, which does not permit the development of a landfill within the areas listed below. For the purpose of this analysis, these areas were considered to have a low potential for siting a landfill.

- Within 1,000 feet of any navigable lake, pond, or flowage;
- Within 300 feet of a navigable river or stream;
- Within a floodplain;
- Within wetlands; and

- Within an area where the Department of Natural Resources finds that there is a reasonable probability that disposal of solid waste will have a detrimental effect on any surface water.

The adopted Kenosha County Sanitary Code and Private Sewage System Ordinance does not permit land application of sludge within 100 feet of any ditch, dry run, pond, lake, stream, flowage, or floodplain. Accordingly, for the purpose of this analysis, these areas were categorized as having a low potential for land application of sludge.

## Environmentally Significant Areas

The siting of a solid waste management facility requires consideration of environmentally significant areas. Accordingly, primary environmental corridors were considered as having low potential for the location and development of solid waste landfills and sites for land application of sludge. Environmentally significant areas include lakes, ponds, flowages, rivers, and streams and their associated shorelands and floodlands; wetlands; woodlands; wildlife habitat areas; areas of steep slopes; prairies; existing park sites; and areas having scenic, scientific, or cultural value. The primary environmental corridors within Kenosha County, as delineated by the Regional Planning Commission, are shown on Map 3 in Chapter II. While the location of a sanitary landfill site is not recommended anywhere within these environmentally significant areas, the upland, wooded portions of such corridors may be used as buffer zones for landfills.

## Prime Agricultural Lands

As discussed in Chapter II, the rapid conversion of farmland to urban use has become a matter of public concern. The adopted regional land use plan recommended that the remaining prime farmlands be preserved in agricultural use. Chapter 91 of the Wisconsin Statutes establishes the Wisconsin farmland preservation program, under which a farmland owner may agree not to develop his land for urban uses and in return becomes eligible for tax relief in the form of a state income tax credit. The Farmland Preservation Act also established a grant program whereby counties could apply for cost-share dollars to be used in the preparation of a countywide farmland preservation plan. Kenosha County applied for and received a grant under the program and a plan has been completed, as documented in SEWRPC Community Assistance Planning Report No. 45, A Farmland Preservation Plan for Kenosha County, Wisconsin. The plan designated approximately 119 square miles, or about 43 percent of the County, as prime agricultural land. As of 1985, approximately 44 square miles, or about 37 percent of the designated prime agricultural land, had been zoned in exclusive agricultural districts.

Prime agricultural lands, for the purpose of this analysis, were categorized as having a high potential for the siting of a landfill or incinerator, primarily because of the space requirements needed by such facilities which can be provided by agricultural areas. In addition, prime agricultural land was considered to have a high potential for land application of sludge. It is important to note that some of the criteria used to categorize agricultural land as prime--such as soil type, slope, and areal extent--are also being used in the generalized siting analysis for land application of sludge.

## Existing Urban Areas

As already noted, Chapter NR 180 of the Wisconsin Administrative Code requires a horizontal distance of at least 1,200 feet between a landfill and any public or private water supply source. This limit may be increased or decreased if justified by site-specific groundwater studies. For purposes of landfill site selection, a distance of about one-quarter mile from areas of existing residential, commercial, and industrial urban development--where groundwater wells would be expected to be found in the absence of a public water supply system--was considered appropriate for the general siting analysis. Areas of residential, commercial, and industrial urban development served by groundwater wells that were located within this distance were classified as having no potential for the siting of a landfill. Areas within one-quarter mile of urban areas served by municipal water systems were considered to have a low potential for landfill siting. The existing urbanized areas in the study area are shown on Map 3 in Chapter II.

The Wisconsin Administrative Code prohibits the location of solid waste land disposal sites within 1,000 feet of the nearest edge of the right-of-way of any state trunk highway or federal and interstate or federal aid primary highway, or within 1,000 feet of the boundary of any public park, unless the site is screened by natural objects, plantings, fences, or other appropriate means so as not to be visible from the highway or park. Tree plantings, berms, and other site modifications are relatively simple engineering modifications that can provide adequate screening from roads and parks. Therefore, this criterion was not used to eliminate areas from consideration as potential landfill sites.

The potential incinerator facility sites were located within or adjacent to existing urban land uses for several reasons. Such sites need to be relatively near potential industrial energy users, and to be on or near major transportation routes.

Both Chapter NR 204 of the Wisconsin Administrative Code and the Kenosha County Sanitary Code and Private Sewage System Ordinance prohibit land application of sludge within 500 feet of a residence, business, or recreational area unless the owner and occupants agree in writing to a lesser distance. Accordingly, those areas were categorized as having a low potential for land application of sludge.

## Airports

The Federal Aviation Administration and the Wisconsin Department of Natural Resources have adopted restrictions on the development of solid waste landfills within the vicinity of airports. The primary conflict between these two land uses is the attraction of birds to the landfill sites, causing potential collision hazards for aircraft. The Federal Aviation Administration has published Order 5200.5, FAA Guidance Concerning Sanitary Landfills On or Near Airports, that sets forth federal policy concerning landfill siting near airports. These federal guidelines must be observed in order for federal grants-in-aid to be made available for airport development. The guidelines are also considered by the Wisconsin Department of Natural Resources in the review of any solid waste site development proposal.

The following criteria are to be utilized in the siting analysis for a solid waste landfill:

- Landfills should not be developed in areas located within 10,000 feet of any runway used or planned to be used by turbojet-powered aircraft.

- Landfills should not be developed in areas located within 5,000 feet of any runway used only by reciprocating engine-powered aircraft.

- Landfills should not be developed in any area located between the runway approach and departure patterns of an airport and bird feeding, watering, or roosting areas.

As noted in Chapter II, there are currently 13 airports in the study area. The only airport in Kenosha County which presently allows the operation of turbojet-powered aircraft, or that is proposed to accommodate such aircraft, is Kenosha Municipal Airport. Landfills should not be located within 10,000 feet of any runway at this airport. Camp Lake Airport, Vincent Airport, and Westosha Airport are privately owned facilities which are open for public use. For the purposes of this evaluation, a 5,000-foot-long buffer zone has been used, within which there is a low potential for landfill siting. The remaining nine airports are privately owned and are not open for public use. In addition, they all have three or fewer based aircraft and only a limited number of take-offs and landings. The impact of locating a solid waste landfill within the general vicinity of those small private airports is more appropriately addressed in a site-specific analysis. These regulations were established to ensure that bird species that are typically attracted to landfill sites are kept away from airport traffic patterns and approaching and departing aircraft. The airports and appropriate buffer zones, where applicable, are shown on Map 30.

## Location of Transfer Stations

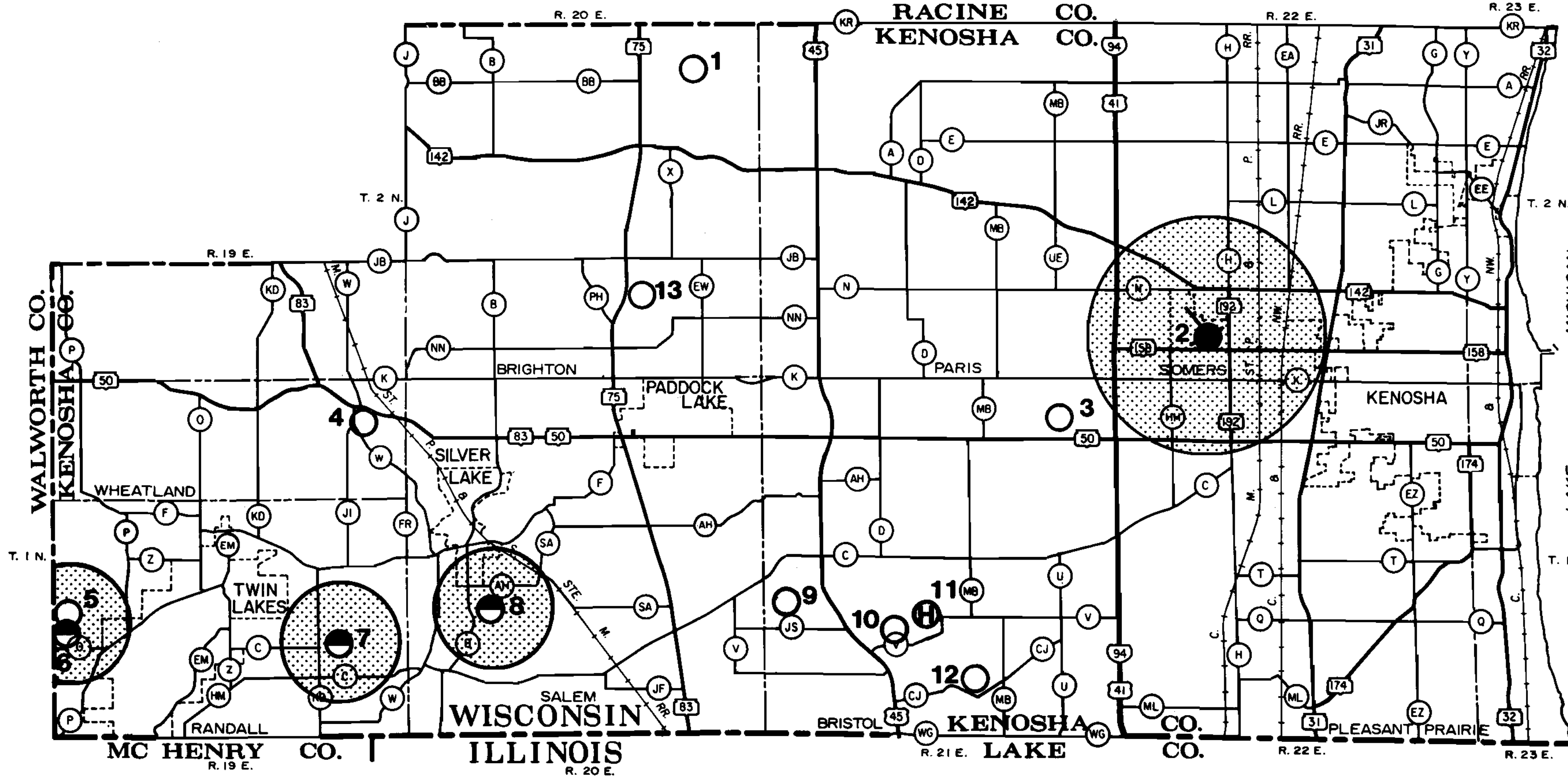
In the evaluation of potential incinerator sites, it is important to consider the proximity of such sites to existing transfer stations. Criteria relating to transfer stations were not used for siting a landfill facility because of the overriding environmental considerations concerning the siting of such facilities. There are presently five active transfer stations in Kenosha County. The advantages of locating an incinerator at the same site as the transfer station are a reduction in transportation costs, a more efficient use of labor and equipment, the potential for reduced land costs, public acceptability since the site is already in use for solid waste management, and the benefits of onsite processing and resource recovery. The location of the five active transfer stations in Kenosha County are shown on Map 24 in Chapter II.

Transportation costs can be reduced by locating an incinerator at the site of a transfer station, because there is no need to haul portions of the solid wastes beyond that point. There is also the potential for a more efficient use of labor and equipment since fewer workers would be needed if they can be involved in a single, larger operation rather than in two separate operations. Less equipment may need to be purchased because of the overlap in use. Costs are reduced by placing an incinerator at the site of a transfer station because no new land will need to be purchased. It should be noted, however, that in order for the savings to be realized, the transfer station site must have enough space for an incinerator facility.

Another advantage of the dual facility site is that recyclables can be processed and separated at the incinerator site, and all nonrecyclable materials can be disposed of immediately and efficiently. There also is a reduction in

Map 30

# EXISTING AIRPORTS AND ASSOCIATED LANDFILL BUFFER ZONES IN KENOSHA COUNTY: 1985




## LEGEND

1 OLSON'S AIRPORT
2 KENOSHA MUNICIPAL AIRPORT
3 THOMPSON STRAWBERRY FARM AIRPORT
4 FOXEWOOD AIRPORT
5 VOLIDS AIRPORT
6 VINCENT AIRPORT
7 WESTOSHA AIRPORT
8 CAMP LAKE AIRPORT
9 WINDSONG INTERNATIONAL AIRPORT
10 WINFIELD AIRPORT
11 DUTCH GAP AIRSTRIP
12 ELFERING
13 TREFTC AIRPORT

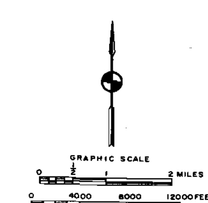
PUBLIC USE-PUBLIC OWNERSHIP

PUBLIC USE-PRIVATE OWNERSHIP

PRIVATE USE-PRIVATE OWNERSHIP

PRIVATE USE HELIPAD-PRIVATE OWNERSHIP

BUFFER ZONE




Source: SEWRPC.

## Table 29

## INDUSTRIES WITH THE GREATEST AMOUNT OF FOSSIL FUEL ENERGY USE IN KENOSHA COUNTY: 1985

| Location of User | Total Annual Energy Consumption (billion BTU's) | Rank |
|---|---|---|
| Northeast one-quarter of northwest one-quarter of Section 6, T1N, R23E, City of Kenosha | 410 | 1 |
| Northeast one-quarter of southeast one-quarter of Section 31, T2N, R22E, City of Kenosha | 400 | 2 |
| Southeast one-quarter of northwest one-quarter of Section 12, T2N, R22E, Town of Somers | 310 | 3 |
| Southeast one-quarter of southeast one-quarter of Section 36, T2N, R22E, City of Kenosha | 240 | 4 |
| Southeast one-quarter of southeast one-quarter of Section 33, T2N, R22E, Town of Somers | 181 | 5 |
| Northwest one-quarter of northwest one-quarter of Section 36, T2N, R22E, City of Kenosha | 180 | 6 |
| Northwest one-quarter of southwest one-quarter of Section 7, T1N, R23E, City of Kenosha | 53 | 7 |
| Southeast one-quarter of northwest one-quarter of Section 6, T1N, R23E, City of Kenosha | 31 | 8 |
| Northeast one-quarter of southeast one-quarter of Section 24, T2N, R21E, Town of Paris | 14 | 9 |
| Northwest one-quarter of northeast one-quarter of Section 14, T2N, R22E, Town of Somers | 3 | 10 |

Source: Wisconsin Department of Natural Resources and SEWRPC.

the number of times the wastes must be processed and separated when both facilities are at the same location.

### Potential Energy Users

An incinerator should be located near potential energy users in order to be most cost-effective. Table 29 lists the 10 largest energy users, based on fossil fuel consumption, in Kenosha County. The British thermal unit (BTU) value of the fuel type was computed for these energy users, and the industries were ranked according to their respective BTU consumption.

The locations of the largest energy users were mapped, together with potential incinerator sites selected through an initial analysis based upon other considerations noted above. For the purposes of this study, it was assumed that an industry would need to be within one-half mile of an incinerator facility to be considered a potential energy user. This distance was selected on the basis that steam generated by an incinerator facility could generally be most efficiently used by a potential energy user within one-half mile of the point of generation.

It should also be noted that this systems level analysis did not include direct contact with potential energy users to assess their present interest in and compatibility with a potential incinerator system, since the plan recommendations have not been formulated and since plan implementation will take place over a 20-year period, during which such decisions may change. These contacts would be made as part of the implementation phase, should it be recommended that incineration with energy recovery be incorporated into the plan.

## Air Quality

Air quality is an important consideration in the evaluation of potential incinerator sites. As discussed in Chapter II, federal and state air quality standards have been established which are intended to protect human health and the public welfare. For southeastern Wisconsin, ambient air quality standards have been set for ozone, carbon monoxide, sulfur dioxide, nitrogen oxides, lead, and particulate matter. All of Kenosha County has been designated as an ozone nonattainment area, and portions of the County have been designated as a secondary nonattainment area for particulate matter. The areas of nonattainment for these pollutants are shown on Map 31.

An incinerator facility in Kenosha County would constitute a point source of air pollution. According to federal and state air quality regulations, any new point source in a nonattainment area would need to be offset by a reduction of emissions at a ratio of greater than one to one. The amount of emission offset would be dictated by the size of the new facility, the quality of the emissions, and the areas which would be impacted. It is important to note that present Wisconsin Department of Natural Resources guidelines require that such emission offsets be attained either through internal reductions or by using emissions credits obtained from another existing source, providing that the other source was determined to be impacting the nonattainment area to the same or greater degree than the new source. Alternatively, the size of the facility and the use of sophisticated pollution controls could be such that the emissions would be below 10 tons per year for each of the above-referenced pollutants. Accordingly, this criterion was not used to preclude the siting of an incinerator facility in the County.

## Historical and Archaeological Sites

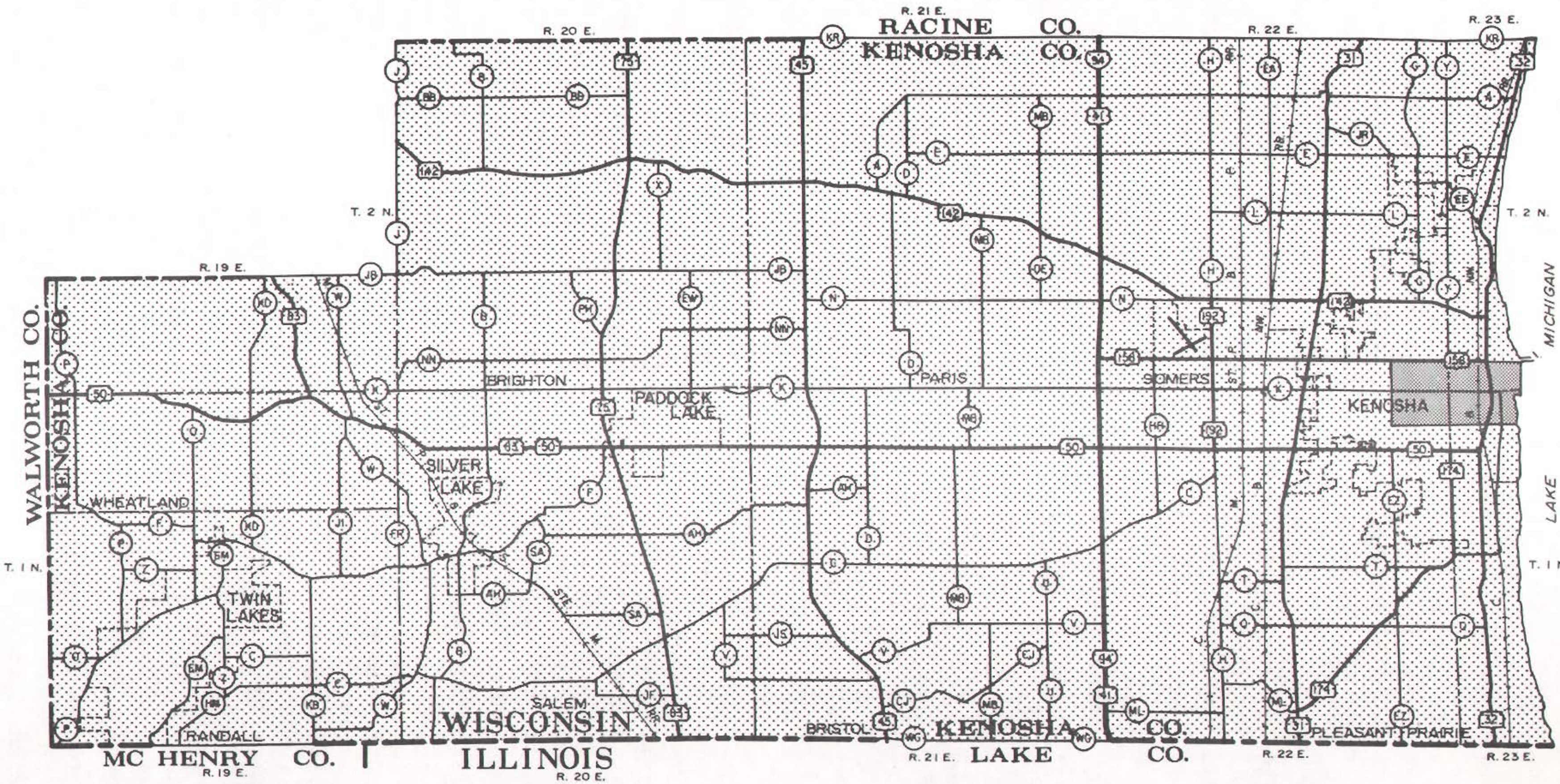
As indicated in Chapter II, there are more than 300 known historical and archaeological sites in Kenosha County, including 11 sites that have been placed on the National Register of Historic Places. Regulations require that detailed analyses be conducted by the State Historic Preservation Officer should a project such as the siting of a landfill or incinerator have the potential to adversely affect a historically or archaeologically important site or area.

## Additional Siting Considerations

The criteria set forth herein for use in evaluating the suitability of sites for locating a landfill or an incinerator facility or for land application of sludge deal primarily with physical considerations. There are certain nonphysical factors, however, which must also be considered in evaluating the suitability of a potential landfill or incinerator site. One of these factors is anticipated changes in land use as indicated by adopted local land use plans, zoning ordinances, and pending development projects. Another factor is potential public opposition. While these nonphysical criteria are important and must be considered, such consideration is more appropriate at the facility level of planning. Accordingly, these considerations were not included in this planning effort with the exception of proposed land developments committed in the form

## Map 31

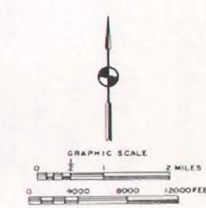
## AMBIENT AIR QUALITY NONATTAINMENT AREAS IN KENOSHA COUNTY: 1985




**LEGEND**

OZONE NONATTAINMENT AREA

SECONDARY PARTICULATE MATTER NONATTAINMENT AREA




Source: Wisconsin Department of Natural Resources and SEWRPC.

of an approved project plan which would be inconsistent with the siting of a solid waste facility. In such cases, the site was considered to have no potential for the location of solid waste facilities.

## SITE LOCATION RANKING

After applying each category of criteria for siting either a landfill, an incinerator, or a site for land application of sludge, composite maps were prepared. Three suitability classifications were used in determining the suitability of a site for a landfill or for land application of sludge. Approximately 278 square miles, or the total area of the County, were initially considered for landfill development in the study area. As shown on Map 32, approximately 167 square miles, or 60 percent, were categorized as having no or low potential for landfill siting. In some areas in this this category, it might be possible to site a special-use landfill for incineration of fly ash but not a general-use landfill. In addition, approximately 76 square miles, or 27 percent of the total area of the County, were classified as having moderate potential for landfill siting. This potential, however, is somewhat limited, as any sites located in these areas may be expected to require more intensive engineering and entail higher site development costs. Finally, about 37 square miles, or 13 percent of the County, were classified as having high potential for landfill siting. The general siting analyses focused on physical criteria which have been used chiefly for siting evaluations for general, mixed-refuse solid waste landfills. There are somewhat different design requirements for landfills designated only for particular solid wastes, such as incinerator ash or sewage sludge. These special-use landfills might be more readily engineered for sites with moderate or low potential for a landfill. These areas should be given first consideration in future landfill siting studies should it be concluded that a new landfill is to be part of the recommended plan.

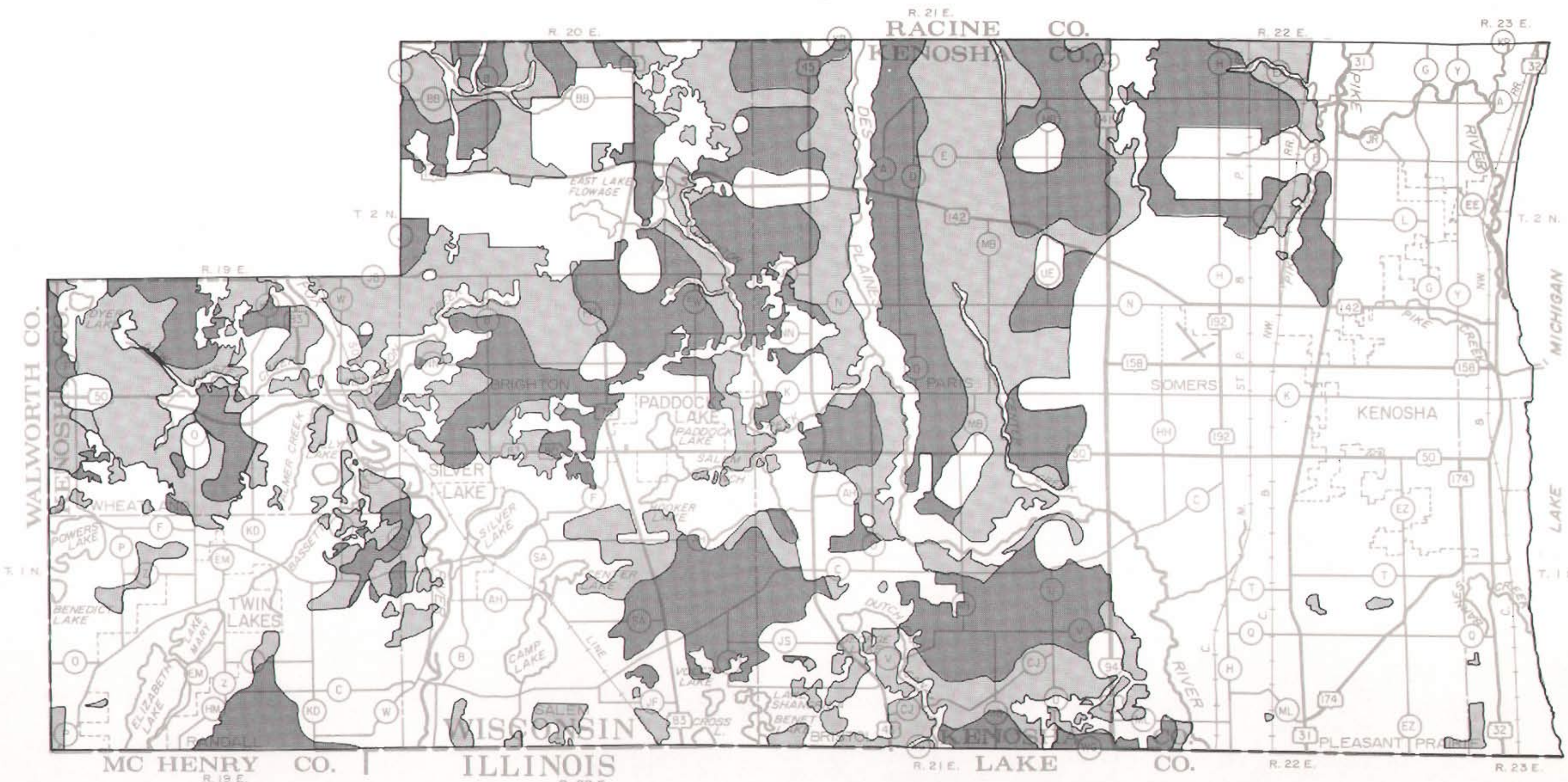
The suitability of areas for land application of sewage treatment plant sludge is shown on Map 33. Approximately 174 square miles, or 63 percent, were categorized as having no potential for land application of sewage treatment plant sludge. The large extent of this area is due primarily to the extent of urban areas and areas characterized as having a depth to groundwater of less than three feet. In addition, about 68 square miles, or 24 percent of the County, were categorized as having a moderate potential for land application of sludge. Finally, approximately 36 square miles, or 13 percent of the County, were categorized as having a high potential for land application of sludge.

The analyses for land application of sludge were based solely upon physical criteria and did not take into account landowner or operator concerns and preferences. The Kenosha Water Utility reports that in some instances, landowners or operators do not allow application of sludges on only portions of a field, but rather want entire fields conditioned uniformly. Thus, while the physical criteria may indicate a portion of a field to have a high potential for land application of sludge, the field may not be available without difficult-to-make special arrangements if other parts of the field are not suitable for land application. Thus, while 36 square miles, or 13 percent of the County, were categorized as having a high potential for land application, only a portion of that area may actually be available without meeting the desires of landowners and operators for uniform conditioning of fields through special arrangements or additional incentives.

With regard to incinerator siting, eight potential sites were determined to have a high enough potential to warrant further consideration, as shown on Map 34. A more detailed analysis of these sites is necessary to determine their cost-effectiveness and overall feasibility.

## Map 32

## LANDFILL SITING POTENTIAL IN KENOSHA COUNTY




LEGEND

AREAS WITH HIGH POTENTIAL FOR LANDFILL SITING

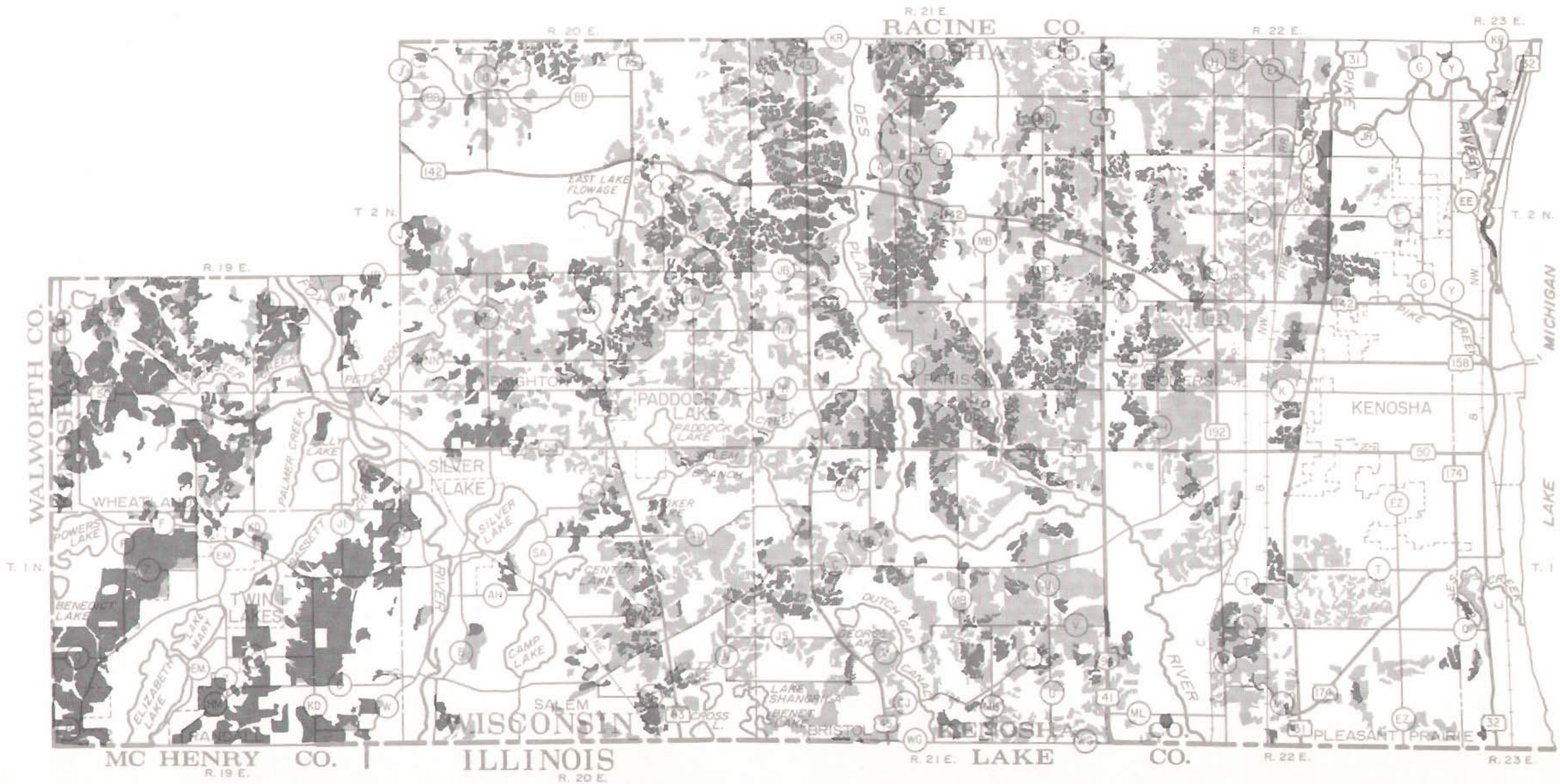
AREAS WITH MODERATE POTENTIAL FOR LANDFILL SITING

AREAS WITH NO POTENTIAL FOR LANDFILL SITING

Source: SEWRPC.

## Map 33

## POTENTIAL FOR LAND APPLICATION OF SEWAGE TREATMENT PLANT SLUDGE IN KENOSHA COUNTY



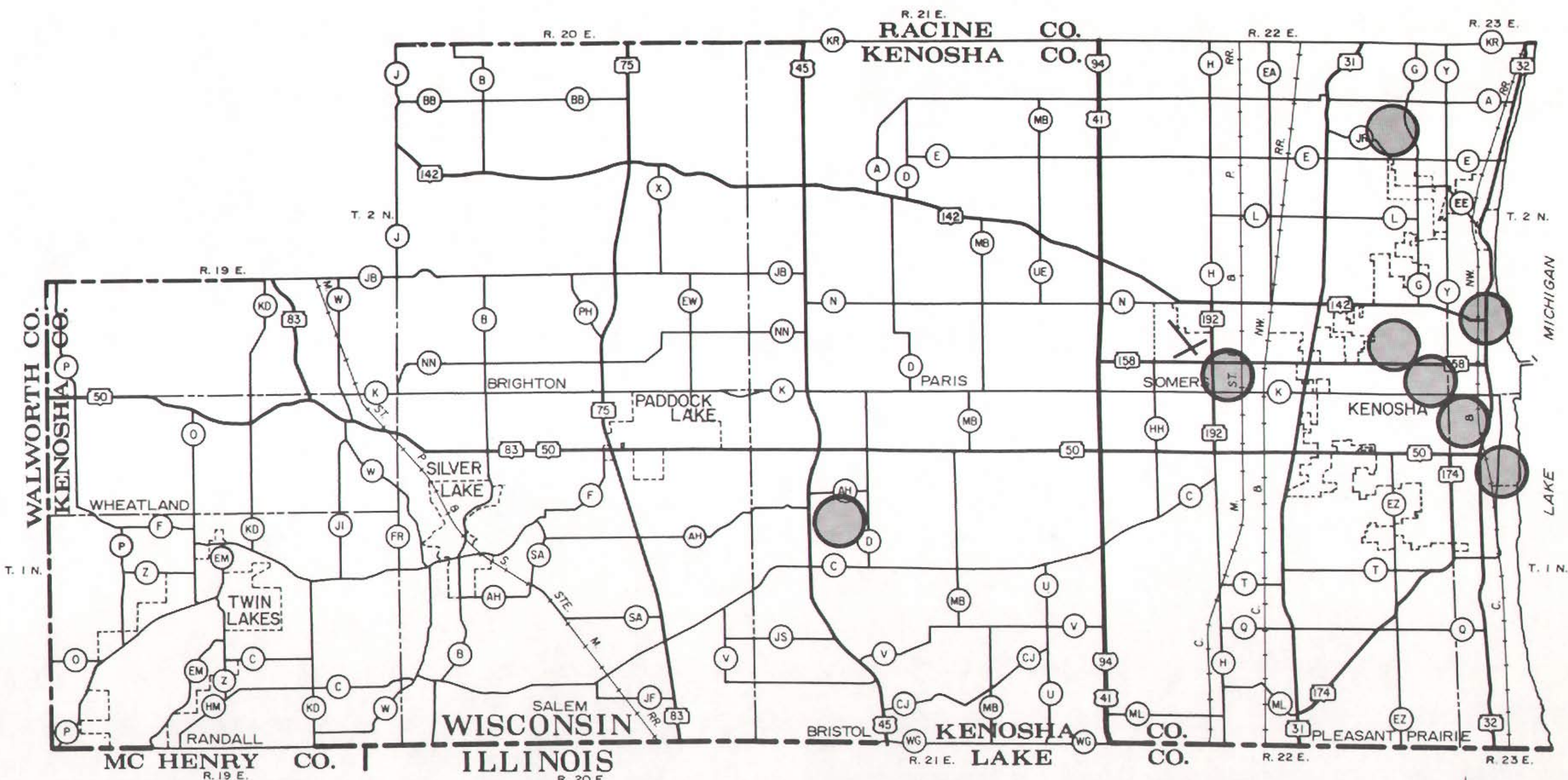

LEGEND

- HIGH POTENTIAL
- MODERATE POTENTIAL
- NO POTENTIAL

Source: SEWRPC.

Map 34

POTENTIAL INCINERATOR SITES IN KENOSHA COUNTY




LEGEND

POTENTIAL INCINERATOR SITE

Source: SEWRPC.

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# Chapter V

# INVENTORY AND EVALUATION OF SOLID WASTE MANAGEMENT TECHNIQUES

## INTRODUCTION

The principal objective of the Kenosha County solid waste management planning effort is the development of a cost-effective plan for the management of the solid wastes generated within the County. As previously discussed, particular attention will be given to management of sewage treatment plant sludge. This chapter describes various solid waste management techniques that may be applicable in Kenosha County. The techniques are related to 10 solid waste management functions: source reduction, source separation, storage, collection, transfer, transportation, processing, treatment, resource recovery, and disposal. This chapter also briefly describes 16 alternative plans which were developed under the study by combining these techniques in various ways to meet the needs of the study area. Ten of the alternative plans evaluate methods for the management of conventional residential, commercial, and industrial solid wastes, and six alternatives evaluate methods for the management of sewage treatment plant sludge. These 16 alternative plans will be considered in greater detail in Chapter VII, and the 10 conventional solid waste management alternatives will be integrated with the six sludge management alternatives.

This chapter is divided into three sections. The first section describes each of the solid waste management functions, including the four necessary functions of pre-collection storage, collection, transportation, and disposal, and the six optional functions of source reduction, source separation, transfer, processing, treatment, and resource recovery. This section also describes the various techniques which can be used to perform each of the 10 solid waste management functions. It should be noted that decisions concerning the need for, and techniques to be used in performing, certain solid waste management functions--including pre-collection storage and collection--are best made by the individuals and local units of government concerned and are therefore not considered in detail in this study. Also set forth in this section are factors considered in determining the applicability of the various techniques within the study area.

In considering sewage treatment plant sludge management, the focus of the alternative evaluation is on the final recycling or disposal steps, and not on in-plant processing such as dewatering and stabilization. However, in Chapter VII, consideration is given to alternative in-plant processing options when such options would be required to make recycling or disposal alternatives viable.

The second section of the chapter identifies those techniques which were found to have the greatest potential for application within the study area, and which, as such, warrant more detailed consideration. The third section of the chapter sets forth 16 alternative plans developed by combining the applicable solid waste management techniques into logical sets. A comparative evaluation of the alternative plans, including comparative cost analyses, is presented in Chapter VII of this report.

## SOLID WASTE MANAGEMENT FUNCTIONS

Solid waste management in the State of Wisconsin, and throughout the country, is undergoing change. This change is due, in part, to the development of improved methods of storage, collection, transfer, transportation, and disposal, and to increased public interest in source reduction, source separation, processing, treatment, and resource recovery. This change is also due to the need to minimize both the monetary and environmental costs of managing the increasing quantities of solid wastes generated by our society. Consequently, any solid waste management study must consider the latest techniques for solid waste management. Yet, to assure a workable solid waste management plan, it is also important that the techniques to be considered have been proven to be practicable and reliable. This section discusses the various solid waste management functions and techniques available to perform each function.

Table 30 lists these solid waste management functions and associated techniques, and presents pertinent data on those techniques. This section also identifies those techniques which are considered applicable within Kenosha County. More detailed data on each process can be found in the references listed in Appendix D.

### Source Reduction

Source reduction can be defined as the implementation of policies and practices to reduce the rate of solid waste generation. The purpose of source reduction is to reduce the quantity of solid waste to be handled in the subsequent solid waste management functions which deal with solid waste once it is generated.

There are four means of source reduction: product reuse, conservation of nonconsumable materials in products, reduced product use, and increased product life. The option of product reuse requires a shift from the use of disposable products designed to be used only once to the use of products which can be reused, such as returnable beverage containers in lieu of nonreturnable containers. One example of an attempt to apply source reduction has been the introduction of legislation to promote the reuse of beverage containers through special charges on nonreusable containers. Such legislation has been proposed but not yet enacted in Wisconsin; however, the neighboring states of Michigan and Iowa do have such legislation in effect. The option of decreasing material usage in products involves practices such as eliminating excess packaging. The option of decreasing consumption promotes reduced use by consumers of disposable products. The option of increased product life involves the redesign of products for longer use and for ease of repair and maintenance. This type of source reduction applies particularly to durable goods such as tires, appliances, and furniture.

The advantages of source reduction as a solid waste management function are that it involves no direct local costs, it provides potential savings in the energy required in production, and it reduces the costs of solid waste management. It is estimated that through source reduction measures, the quantity of

## Table 30

## SELECTED INFORMATION ON SOLID WASTE MANAGEMENT TECHNIQUES

| Solid Waste Management Function and Associated Techniques | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | General Cost Data | Conclusions Regarding Incorporation into Alternative Systems | Comments |
|---|---|---|---|---|---|
| Source Reduction<br>Product Reuse<br>Reduced Material Use in Products<br>Increased Product Life<br>Decreased Product Consumption | No direct local costs<br>Provides for an energy savings in manufacturing | Requires changes in consumer habits<br>No direct control beyond changes in local procurement policies | No direct local costs<br>Potential savings in other solid waste management functions | Not specifically included in county plan alternative development because of limited local control | Legislation to promote the reuse of containers, which has been considered but not adopted by the State, is a form of source reduction |
| Source Separation<br>Precollection Material Separation and Recycling Center Dropoff | Low technology<br>Reduces disposal cost and landfill needs<br>Reduces energy and resource needs<br>Greater variety of materials can be collected<br>Low equipment needs | Relies on volunteer workers and citizen willingness to participate<br>Fluctuating markets<br>Possible noise, potential traffic and vandalism problems | Initial startup cost of typical system--$10,000-$30,000<br>Product Market Prices<br>Newspaper $20-$40 per ton<br>Glass $45 per ton<br>Ferrous metal $6-$45 per ton<br>Aluminum $500-$700 per ton | Included in county plan alternative development | -- |
| Precollection Material Separation and Collection of Separated Materials | Low technology<br>Reduces disposal cost and landfill needs<br>Reduces energy and resource needs<br>Higher participation than drop-off center | Relies on citizen willingness to participate<br>Can be costly to incorporate into collection system<br>Fluctuating markets<br>May require added equipment | Same product market prices as noted above | Included in county plan alternative development | -- |
| Storage<br>Standard Metal or Plastic Containers 20 to 32 gallon size | Animal-proof if in good condition<br>Strength | Potential for rusting or cracking<br>Higher initial cost than bags | $15-$25 per container | Not specifically addressed in county plan alternative development. General data are included | Analysis of alternative precollection storage systems should be made individually or locally |
| Plastic Bags | Reduce collection energy manpower and cost<br>Add to heat content of waste | Increased susceptibility to animal entry<br>Limited use for storing heavy or sharp items | Bag costs of about $0.10 each<br>Can reduce collection costs by about 25 to 35 percent | Not specifically addressed in county plan alternative development. General data are included | Analysis of alternative precollection storage systems should be made individually or locally |
| Mobile Cart | Reduces hand labor<br>Reduces number of containers | Requires special equipment | $54 per cart | Not specifically addressed in county plan alternative development. General data are included | Analysis of alternative precollection storage systems should be made individually or locally |
| Mechanized Bulk Containers | Reduce hand labor<br>Reduce number of containers<br>Represent potential cost savings | Require special equipment<br>Require storage and access space<br>Require maintenance | Potential cost savings must be evaluated for each situation | Not specifically addressed in county plan alternative development. General data are included | Analysis of alternative precollection storage systems should be made individually or locally |

# Table 30 (continued)

| Solid Waste Management Function and Associated Techniques | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | General Cost Data | Conclusions Regarding Incorporation into Alternative Systems | Comments |
|---|---|---|---|---|---|
| Collection | | | | | |
| Direct Haul by Residents to Disposal Site | Potential low costs | Not applicable to urbanized areas<br>Potential traffic problems<br>Individual vehicle fuel usage | -- | Not specifically addressed in county plan alternative development. Applicable in Kenosha County for some areas | -- |
| Centrally Located Bulk Containers | Potential cost savings<br>Reduce hand labor<br>Reduce number of containers to be handled | Requires special equipment<br>Requires storage and access space<br>Requires attendance and maintenance | -- | Not specifically addressed in county plan alternative development. General data are included | -- |
| House-to-House Backyard | Cans are not sitting at curb<br>High level of service<br>No individual participation or labor needed<br>Higher flexibility in routing of collection vehicles | Costly<br>Collectors enter private property | $6-$12 per month per household | Not specifically addressed in county plan alternative development. General data are included | Analysis of this alternative collection method should be made individually or locally |
| House-to-House Curbside | Lower cost than backyard<br>Reduces fuel usage | Requires individual participation and labor<br>Routing flexibility is reduced<br>Aesthetics of containers at curb<br>Special consideration may be needed for elderly and handicapped | 15 to 40 percent less costly than backyard pickup<br>$5-$9 per month per household | Not specifically addressed in county plan alternative development. General data are included | Analysis of this alternative collection method should be made individually or locally |
| Transfer | | | | | |
| Transfer Station | Potential savings in transport costs<br>Reduces collection crew and equipment needs | Added materials-handling requirements<br>Requires additional capital, operator, and maintenance costs | $3-$7 per ton | Included in county plan alternative development | -- |

## Table 30 (continued)

| Solid Waste Management Function and Associated Techniques | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | General Cost Data | Conclusions Regarding Incorporation into Alternative Systems | Comments |
|---|---|---|---|---|---|
| Transportation | | | | | |
| Individual Vehicle | Potential low cost | Traffic problems<br>Not applicable in urban areas<br>Individual vehicle fuel usage | -- | Included in county plan alternative development for selected areas | -- |
| Direct Haul by Collection Vehicles | Less costly if haul distance is short | -- | $0.18-$0.24 per ton per mile | Included in county plan alternative development for selected areas | -- |
| Larger Capacity Truck Transport Following Transfer | Potential cost savings for longer haul distances<br>Reduces collection crew manpower and equipment | Requires additional equipment and transfer station investment and maintenance<br>Added materials handling | $0.10-$0.15 per ton per mile | Included in county plan alternative development for selected areas | -- |
| Processing | | | | | |
| Baling | Reduces volume<br>Improves handling and transport<br>Reduces landfill needs | Increased capital and operational cost<br>Mechanical equipment maintenance requirements | $9-$14 per ton | Not included in county plan alternative development | Most applicable in areas which generate adequate quantities but have limited landfill capacity or long transport distances |
| Shredding | Reduces volume<br>Improves handling and transport<br>Reduces landfill needs<br>Step toward resource recovery | Increased capital and operation cost<br>Mechanical equipment maintenance requirements | $10-$17 per ton | Included in county plan alternative development only in conjunction with refuse-derived fuel resource recovery alternatives | -- |
| Densifying | Reduces volume of waste<br>Reduces landfill needs<br>Potential for energy recovery | High capital costs<br>Lack of established market for product | $15-$25 per ton if adequate markets for the product are available | Not included in county plan alternative development | -- |
| Incineration | Reduces volume of waste<br>Reduces landfill needs<br>Potential for energy recovery | High capital and operation cost<br>Requires air quality consideration<br>High technology | $25-$50 per ton depending upon energy customers and type of facility<br>Capital cost $50,000 to $150,000 per ton of capacity | Included in county plan alternative development | -- |

## Table 30 (continued)

| Solid Waste Management Function and Associated Techniques | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | General Cost Data | Conclusions Regarding Incorporation into Alternative Systems | Comments |
|---|---|---|---|---|---|
| Treatment | | | | | |
| Pyrolysis | Reduces volume of waste<br>Potential energy recovery<br>Reduces landfill needs | High capital and operation cost<br>Feasibility not proven | -- | Included in county plan alternative development | -- |
| Composting | Proven technology<br>Reduces landfill needs | Little historical success in U. S.<br>Lack of viable markets | $10-$15 per ton | Included in county plan alternative development | -- |
| Bioconversion | Potential energy recovery<br>Reduces landfill needs | Still in development stages<br>Residue disposal problem | $50-$90 per ton | Considered in county plan alternative development as a special recycling item | -- |
| Resource Recovery | | | | | |
| Landfill Methane Recovery | Energy recovery | Requires large existing landfill<br>Requires gas cleaning<br>Irregular gas production<br>Process is in early development stages | -- | Not included in county plan alternative development | -- |
| Steam or Electricity Production with Incineration | Technology is improving<br>High level of energy recovery<br>Reduces landfill needs | High capital cost and operational requirements<br>Need market for product<br>High technology | $15-$50 per ton | Included in county plan alternative development | -- |
| Refuse-Derived Fuel | High level of energy recovery<br>Reduces landfill needs | High capital cost and operational requirements<br>Limited markets | $15-$25 per ton including metal and glass | Included in county plan alternative development | -- |
| Land Application of Sewage Treatment Plant Sludge | High level of resource recovery | Public opposition, and lack of suitable sites | $10-$35 per ton | Included in county plan alternative development | -- |
| Disposal | | | | | |
| Sanitary Landfill | Proven low level technology<br>Generally low cost | Land required<br>Limited resource recovery | $10-$25 per ton | Included in county plan alternative development | -- |

Source: SEWRPC.

waste generated could be reduced by up to 10 percent by weight.[1] The disadvantages of source reduction are that it requires changes in producer and consumer behavior, and since production and distribution systems are often national in scope, local units of government have limited ability to implement a waste reduction program which extends beyond the procurement policies of the local government itself. The inventory data presented in Chapter II indicated that local government activities account for a small proportion of the total county solid waste stream. Consequently, it may be concluded that there is little that can be done at the county and local level to significantly reduce the amounts of waste generated. The reduction of wastes generated is, nevertheless, a desirable goal. Public education efforts at the state level could provide information on the potential for reducing wastes through individual actions, and on the potential for State legislation to promote the use of reusable containers. Accordingly, it was determined that this function would not be addressed further as a component of alternative solid waste management plans for Kenosha County.

## Source Separation

Source separation can be defined as the division of solid wastes into recoverable and nonrecoverable fractions by segregating one or more materials--such as paper, glass, or cans--from the refuse prior to collection. A discussion of sewage treatment plant sludge is not included in this section because of its relatively homogeneous nature. For the purposes of this study, the term "source separation" was defined to include the steps needed to collect, store, and market the separated recyclable materials. The two main purposes of source separation are: 1) the recovery and reuse of recyclable materials, and 2) a reduction in the amount of solid waste which must otherwise be disposed of.

Source separation programs for residential wastes involve either providing centers to which the segregated materials can be brought, or collecting the segregated materials at the point of generation. As already noted, an amendment to Chapter 144 of the Wisconsin Statutes requires that six recycling centers be established in Kenosha County. This number may be reduced if there are other recyclables collection facilities in the area, or if it is found that the specified number of facilities is not economically feasible. The segregated materials that are collected are transported to a site for processing and subsequent delivery to a manufacturer for use as raw materials. Industrial and commercial wastes are recycled through internal manufacturing processes, by transportation of the wastes to private recycling operations, or by collection and transport to processing facilities by private contractors.

Newspaper and mixed wastepaper are the materials most often collected in source separation programs. These are normally the most abundant recyclable materials in the total solid waste stream, and are readily separated from other refuse. In Kenosha County, paper is estimated to make up 75 percent by weight of the recyclable materials in the solid waste stream, and 40 percent by weight of the total solid waste stream. Cans and glass are also often separated and

[1]Wisconsin Department of Natural Resources, Wisconsin Solid Waste Management Plan, February 1981.

collected. For these materials to have a market value, ferrous and aluminum cans must be separated from each other as well as from the rest of the solid wastes, and glass must usually be separated by color. The volume of the separated material is normally decreased by flattening, shredding, or crushing. Waste oil is another material which can be effectively recycled after collection at central locations. The materials most readily recycled--paper, glass, metals, and oil--constitute by weight about 50 percent of the total solid waste stream generated in Kenosha County.

As discussed in Chapter II, source separation and recycling are significant elements of the solid waste management function in Kenosha County. Industries and commercial establishments in the County perform a major role in the recycling effort. The major industrial and commercial wastes recycled include paper and cardboard, scrap aluminum, scrap steel, oil and grease, chemicals, plastics, and food processing wastes. As previously mentioned, these wastes are recycled by internal manufacturing processes, by transport to private recycling operations, or through collection and transport by private contractors.

Another important contribution to the recycling effort is made by citizens and local community groups. Most of these recycling efforts are carried out by nonprofit community organizations such as the Boy and Girl Scouts, churches, and high school classes.

Further consideration herein of recycling relates primarily to residential solid wastes. For the purpose of this planning effort, it was assumed that industrial and commercial wastes would continue to be recycled in the manner described herein. Consequently, further evaluations will not be concerned with the recycling of industrial and commercial wastes.

There are several steps involved in initiating a source separation program for residential wastes. These steps include a survey of citizen support, a survey of markets for recoverable products, a public information program on the benefits of recycling and on the actions required, an assessment of equipment and labor needs and of cost-feasibility, consideration of source separation ordinances, selection of operating procedures and hours, and implementation and monitoring.

Figure 6 shows the volume of materials that would be collected in a source separation program in Kenosha County under varying levels of participation. Based on national studies,[2] the most successful source separation programs have recovered from 50 to 65 percent of the newspaper, 40 to 50 percent of the glass, and 20 to 30 percent of the metal cans in the total solid waste stream. Even voluntary programs that are well publicized and have some recycling experience, such as waste paper drives by community organizations, may expect to achieve only moderate participation at best. Mandatory programs may approach the maximum participation level, while programs with little publicity and minimum citizen interest may be expected to achieve only a minimum participation level. In Kenosha County, it is estimated that an average of 10,000 tons per

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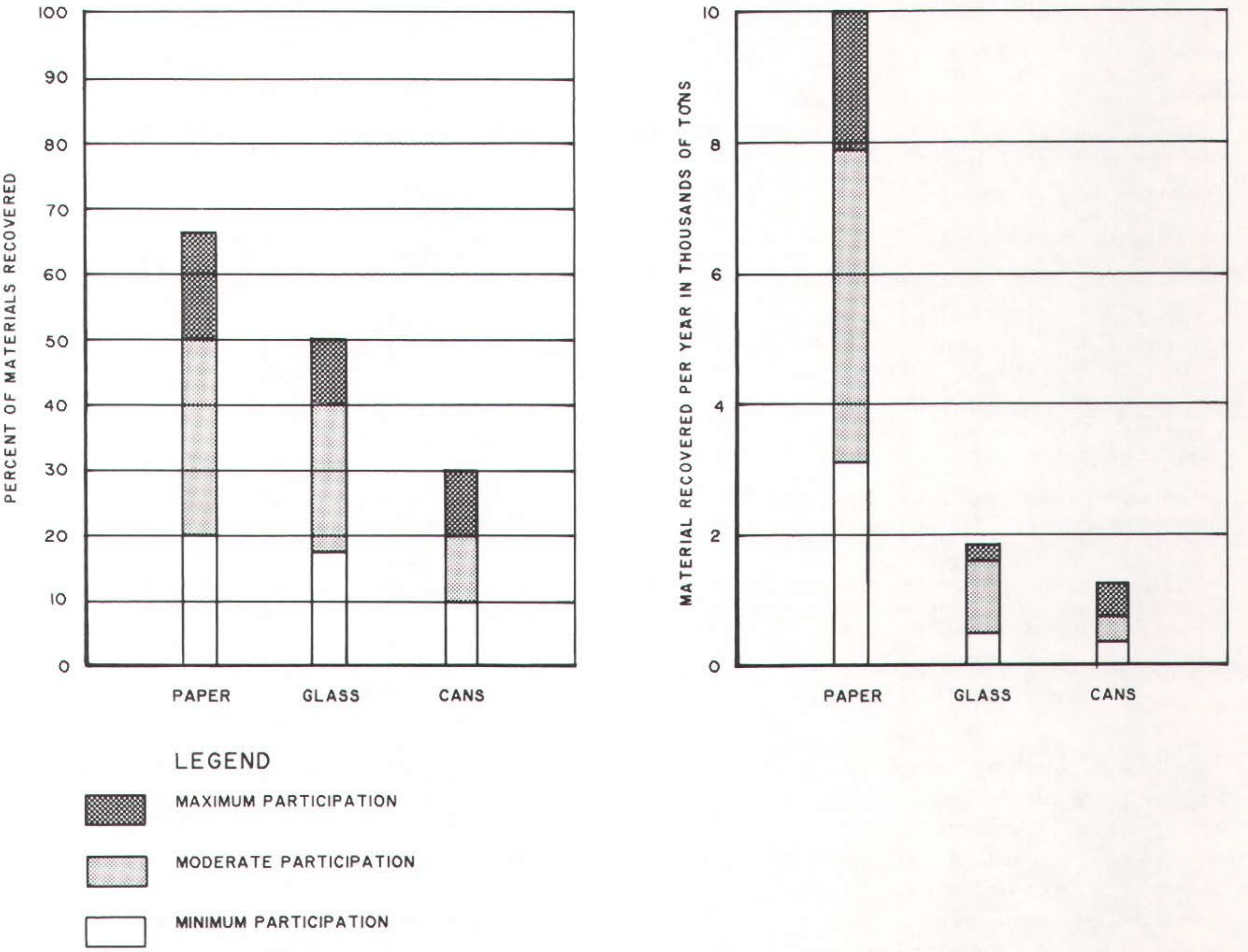
[2]U. S. Environmental Protection Agency, Source Separation Collection and Processing Equipment, A User's Guide, 1980.

Figure 6

ESTIMATED AVERAGE ANNUAL RECOVERY OF SOURCE-SEPARATED MATERIALS UNDER DIFFERING LEVELS OF PARTICIPATION IN KENOSHA COUNTY




Source: SEWRPC.

year over the plan period, or about 20 percent of the residential solid wastes generated, could be recycled through highly successful, maximum participation, source separation programs; while an average of 5,000 tons per year, or about 10 percent of the residential solid wastes generated, could be recycled through moderately successful programs.

The value of recycled materials varies considerably, as shown in Table 31. It is possible to increase the market value of the source-separated materials by processing to improve uniformity and size. By processing the materials, however, the programs may incur additional capital and labor costs. Thus, the decision to process should be preceded by careful analyses of the potential increase in revenues which may be expected to offset the additional costs incurred.

## Table 31

### RANGE IN MARKET PRICE OF UNPROCESSED RECYCLABLE MATERIALS: 1985

| Product | Industrial Market Price (FOB) of Unprocessed Recyclables (dollars per ton) | Industrial Market Price (FOB) of Processed Recyclables (dollars per ton) | Local Prices for Unprocessed Recyclables: 1984 Range (dollars per ton) |
|---|---|---|---|
| Baled Newspaper...... | 0-25 | 20-60 | 20-40[a] |
| Glass Cullet......... | 0-25 | 35-60 | 45[b] |
| Ferrous Metal........ | 0-45 | 10-80 | 6-45[c] |
| Aluminum Metal....... | 450 | 500-700 | 500-700[d] |

[a]Between 1980 and 1985, the maximum price paid for baled newspaper increased by as much as $25 per ton. However, the average annual maximum price remained relatively constant during that time period.

[b]Between 1980 and 1985, the maximum price paid for glass cullet increased by as much as $15 per ton. However, the average annual maximum price increased by about $10 per ton during that time period.

[c]Between 1980 and 1985, the maximum price paid for ferrous metal increased by as much as $30 per ton. However, the average annual maximum price increased by about $5 per ton during that time period.

[d]Between 1980 and 1985, the maximum price paid for aluminum increased by as much as $100 per ton. However, the average annual maximum price increased by about $20 per ton during that time period.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Paper can be upgraded at a lower cost than can glass or metals because paper is readily shredded, baled, or sorted, and because markets do not require that paper be as pure as other recyclable materials. Paper can also be recovered in relatively greater volumes in comparison to cans or glass, and therefore its recycling is potentially more effective in reducing the demand for landfill space. The market price of paper varies, but baled paper is usually worth more than unbaled paper. Systems to separate ferrous from nonferrous cans are slightly more complex than systems to process paper. The cans are separated magnetically and then flattened or shredded for shipment. Metal cans make up a smaller portion of the total recyclable material in the waste stream than do paper or glass, and the market price is generally lower than that of glass (see Table 31). Processing, however, can significantly improve the value of metal cans. Mixed cans have little or no no industrial market, but separated steel cans were worth $6.00 to $45 per ton in 1985. Aluminum cans bring the highest market price of any recyclable, $500 to $700 per ton in 1985, and, while occurring in lower quantities than other recyclables in the total waste stream, provide the highest profit margin per ton.

Glass recycling systems are considerably more complex than recycling systems for paper or cans. The glass not only must be separated by color, but also from ceramic contaminants. Glass can be separated prior to collection or at the recycling center. After the glass has been cleaned, it is crushed and screened to remove metal caps, rings, and labels. Labor and equipment needed to process glass are more costly than that needed to process paper or cans; however, glass recycling often generates greater revenues. Glass can be recovered in large quantities, and in 1985 had a market price of $45 per ton.

In general, processing beyond that which can be done readily by unskilled hand labor is difficult to implement at the local level. However, certain commercial recyclers do have mechanized equipment to process the glass prior to sale for reuse.

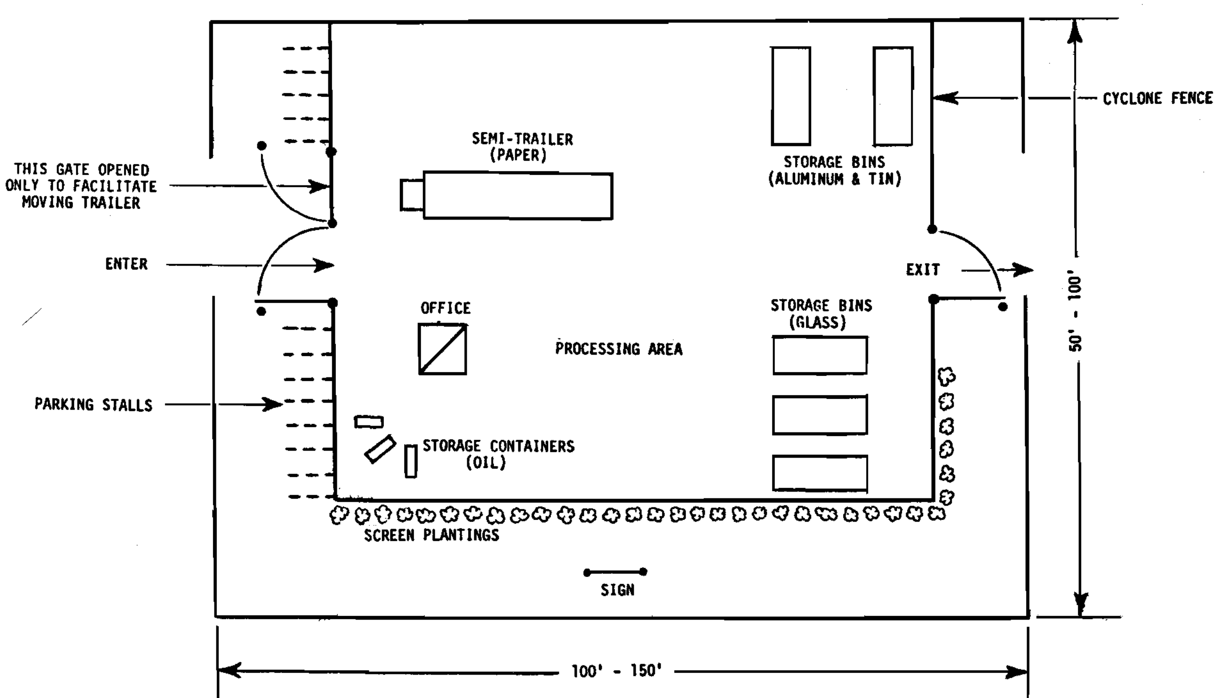
The principal advantage of a source separation program is its potential to reduce the costs of subsequent solid waste management functions. Also, this option involves low technology which has been proven to be workable. Another advantage is that revenue can be obtained from the sale of the recyclable material.

One of the disadvantages of source separation is a potential reduction in the heat content of the total solid waste stream, along with a reduced potential for heat recovery. Also, any successful source separation and recycling program may be expected to entail significant operation and administrative costs. Volunteer labor may not be consistent or reliable. Finally, the sale of recyclable materials, as well as the net cost of the program, may be affected by fluctuating market prices.

It is concluded that source separation is a viable component of an overall solid waste management program in Kenosha County. As discussed in Chapter II, new state regulations will require that six recycling centers be operating in Kenosha County by July 1, 1986. Three of the centers are to be operated by the local municipalities, with three additional centers operated by local units of government that own and operate landfills. A recycling center is a site for the temporary storage of materials before transport, processing, and reuse. Figure 7 illustrates the usual components of such a center.

**Figure 7**

**RECYCLING CENTER SCHEMATIC**




Source: SEWRPC.

Recycling Centers: The initial cost of establishing a recycling center varies with the size of the area required, the size and number of storage facilities needed, and the equipment required. The cost of a center designed to collect and store paper, glass, plastic, aluminum, metal, and waste oils may be expected to range from $10,000 to $30,000, excluding land costs, for a community, or a portion of a community, with between 10,000 and 25,000 households, which is the size range which is expected to be served by a typical recycling center. Costs can often be reduced substantially by making use of existing facilities and equipment which are not fully used for other purposes. There are private recycling firms which will assist in the establishment of a recycling center by providing storage containers as part of an agreement for the purchase of the recyclable materials.

The principal advantage of the use of recycling centers is that less labor and equipment is needed than for point-of-generation separate collection systems. As a result, lower costs are entailed. Because they can provide many different kinds of storage containers, recycling centers also can collect a greater variety of recyclable materials than can separate collection systems. The recycling center needs a staff to oversee operations and to transport the materials to a market or processor. Since recycling centers can operate independently of refuse collection programs, they can be staffed by volunteer labor provided by civic groups, which would be compensated from the revenue resulting from the sale of the materials.

The disadvantage of a recycling center program is that the volume of materials brought to such centers is generally significantly less than that collected under separate collection programs.

Because of the DNR requirements regarding recycling centers, and the relatively low cost of equipment and operation, the recycling center system was considered a viable option for Kenosha County, and was utilized as a component in the development of alternative solid waste management plans.

Separate Collection System: If the source separation program is to be implemented through a separate collection system, the recyclable materials will normally be collected by public works vehicles, such as pickup or stake body trucks. Use of these "adapted" vehicles, which can be used for a variety of other municipal operations, minimizes capital costs. Moreover, the vehicles are generally reliable and easily maintained. A growing number of municipalities, however, are using "special" collection equipment such as racks, trailers, and compartmentalized vehicles. Some collect two or more recyclable materials simultaneously, while others combine their recycling and refuse collection programs.

The purpose of a separate collection system is to provide a more convenient outlet for recyclable materials than a recycling center, and thereby encourage separation and recycling of materials. This type of collection can be more costly than recycling centers, particularly if provided on a regular basis, but two such operations currently being carried out in the Cities of Madison and Racine have proven that the revenues from the sale of recyclable newspaper and the cost savings at the landfill exceed the cost of operating such a collection system.

The City of Racine has been involved in newspaper recycling since 1974. Bundled newspapers are collected during the regular collection period and placed in racks on the collection vehicles. When these racks are filled, the newspapers are deposited at drop-off points along the refuse collection route. A separate vehicle then gathers them and transports them to the processing station where they are loaded on a semi-trailer, and then sold to a private contractor. The cost of this operation in 1985 was about $16,700. The revenue from the sale of the newspaper and the savings in landfill costs together approximated $42,600 in 1985. This program has demonstrated that revenues from such operations can exceed costs, and this margin may be expected to improve in the future as disposal costs at landfills increase.

In the City of Madison, a citywide program to collect bundled newspaper was initiated in 1971. The newspapers are collected during the regular collection period and transported to the processing station by the collection vehicles, which are equipped with racks. Semi-trailers are then loaded for the purpose of delivering the newspapers to a private contractor in Chicago, Illinois. The cost of this operation in 1985 was about $34,000. The revenue from the sale of the newspaper and the savings in landfill costs together approximated $43,000 in 1985.

The principal advantages of a separate collection system for recyclable materials are the increased level of participation in the program, lower landfill costs, and the potential for higher revenues from the sale of the materials. The chief disadvantages are the initial equipment cost and the increased operation costs.

Because of the potential low cost, the demonstrated feasibility, and the ease of implementation, a separate collection system was considered as a viable component in the development of alternative solid waste management plans for Kenosha County.

## Storage--Conventional Solid Waste

Storage of solid waste can be defined as the temporary holding of the material in containers either prior to collection or following collection at a transfer or processing station. The primary purpose of the storage function is to accumulate a sufficient quantity of solid waste for economical collection and transport. Storage of sewage treatment plant sludge is discussed separately in the next section, since the storage of conventional solid waste and of sewage sludge are not interrelated.

To choose the best storage containers for a collection system, the effects on the users, public health, and collection efficiency must be considered. Proper containers can save collection costs and energy use, increase the speed of collection, and potentially reduce a labor requirement. There are several types of storage methods. The most common type of storage container for residential waste is the 20- to 32-gallon, galvanized metal or plastic garbage can. These containers in 1985 cost from $15 to $28, are lightweight, are not readily cracked or rusted through, and have tight-fitting lids. Containers larger than 32 gallons in size are usually not acceptable. The advantage of cans over bags is that they are animal-proof if kept in good condition. Compared to bulk containers, the cans have the advantage of not needing special mechanized equipment for collection. Use of many smaller cans at each stop increases the handling time required to load the refuse into the truck, while the use of larger or heavier cans increases the weight the residents and the collection crew must lift.

Plastic and paper bags are used both as can liners and as substitutes for rigid containers. Bag systems provide ease of collection through easier handling and do not require lid removal or set-back motion. Studies show that the use of bags can save up to 35 percent of the collection cost. This savings is partially offset by the cost of the bags--about $0.10 each in 1985. Bags, if properly used, also provide aesthetic benefits and are generally more convenient to the generator. The use of plastic or paper bags will slightly increase the amounts of those materials in the solid waste stream; however, the bags also increase the heat content of the solid waste. The disadvantages of bags include susceptibility to animal-caused damage, and the potential for breakage when used for certain heavy and sharp objects.

A third type of storage container used for residential solid wastes is the mobile cart, which is becoming more popular in many urban areas because of the potential efficiency and cost savings. Carts are not presently used in Kenosha County. The carts, which have a capacity of about 80 to 90 gallons, have the advantage of being a larger capacity, uniform storage container which can result in more efficient collection. In addition, the cart reduces the heavy physical labor associated with lifting containers under a manual system. These carts are generally wheeled to the curb by residents and picked up mechanically by specially equipped trucks. The disadvantage of these containers is that special equipment is required to lift them. Also, start-up costs are high. The carts cost about $55 per unit in 1985. However, communities that have implemented the system report substantial cost savings after the start-up costs are recovered. Consideration must be given to the width of alleys if a mobile system is to be considered.

In areas of concentrated multifamily residences and for certain commercial and industrial establishments, two- to four-cubic-yard metal containers--often called "green boxes"--may be used for storage of solid wastes. Larger units of up to 40 cubic yards in size can be used for storage at larger commercial or industrial establishments and at construction or demolition sites. These containers also can be used in low-density residential areas as an intermediate or transfer station in the collection system, and, if placed at key locations, as drop-off centers for segregated or combined household wastes. A typical two-cubic-yard container cost about $300 in 1985. A 20-cubic-yard container cost about $3,000. These containers can be loaded and unloaded mechanically with special trucks equipped with a hoisting mechanism. In multifamily areas, several apartment buildings may use the same container. In some cases, these containers are unloaded onsite into a packer truck. In other cases, where the containers are larger, they are hoisted or pulled onto special trucks and hauled to the disposal or processing site for unloading. This type of container is also used at transfer stations.

The use of bulk containers and mechanized collection has long been regarded as an efficient and acceptable way of servicing apartment buildings and commercial establishments. Several of the more efficient residential solid waste systems in the United States use clustered storage and mechanized pickup, whereby more than one residence can be serviced per stop. Where there are proper storage areas and sufficient access space, and where economic analysis shows a potential cost savings, mechanized collection should be considered as a viable option.

In multifamily building areas, it is generally the most practical to use bulk containers designed for mechanized collection. Individual housing units should use properly maintained, lightweight metal or plastic cans of no more than 32 gallons in volume, weighing no more than 80 pounds when filled; plastic bags; or mobile carts when mechanized collection systems are determined practical on a local community basis.

Pre-collection storage primarily affects the design and operation of the local collection system and attendant costs. Decisions on the type of pre-collection storage can best be made at the local level. Thus, specific pre-collection storage techniques were not further considered under this study. Rather, the alternatives considered were all assumed to incorporate existing types of pre-collection storage.

Post-collection storage options at transfer stations or at processing facilities will be considered in the development of alternative solid waste management plans as part of the transfer and processing systems.

## Storage--Sewage Treatment Plant Sludge

Storage is an integral part of every wastewater solids treatment and disposal system. Short-term and sometimes long-term storage facilities are necessary for the containment of sludge during periods of inclement weather and equipment malfunction or failure, or when seasonal limitations preclude disposal of sludge. Wastewater sludge can be stored: 1) within the wastewater treatment process in grit removal basins and channels, primary sedimentation basins, aeration reactors and secondary sedimentation tanks, and wastewater stabilization ponds; 2) within the sludge treatment processes in gravity thickeners, anaerobic digesters, aerobic digesters, composting facilities, and drying beds; and 3) within facilities dedicated to storage of liquid and dewatered sludge, including holding tanks, storage lagoons, confined bins or hoppers, and unconfined stockpiles. For the purpose of this study, sludge storage is discussed only as it is practiced in dedicated storage facilities at the treatment plant or at remote sites prior to final disposal.

### Facilities Provided Primarily for Storage of Liquid Sludge:

Holding Tanks--Holding tanks are commonly used as an integral part of most sludge conditioning and stabilization processes and may be used for blending sludge and equalizing the storage capacity of the sludge processing system. For the purpose of this discussion, holding tanks are referred to as dedicated temporary storage facilities independent from wastewater and sludge processing. Such storage systems are usually small and provide only a limited amount of storage capacity. It is important to note that storage of unstabilized primary and secondary sludge in a holding tank can produce nuisance odors if no form of odor-inhibiting treatment or air cleansing system is used. The use of these facilities allows for efficient removal of sludge to transport vehicles for final disposal.

Storage Lagoons--Sludge lagoons have historically been used to store large quantities of liquid sludges, primarily at sewage treatment plant sites. Properly constructed and operated, such facilities can provide long-term storage of sludge with a minimum of environmental problems. Lagoons require large land areas but have low operation and maintenance costs, reduce sludge moisture content by evaporation, and provide flexibility in the amount and moisture content of sludge which can be stored.

### Facilities Provided Primarily for Storage of Dry Sludge:

Confined Hoppers and Bins--Confined hoppers and bins are used for storage of dried sludge with a solids content of 30 percent or more. They are generally used for periods of three weeks to six months. Sludge is conveyed to these structures following final processing and drying. Generally, a series of storage bins or hoppers is used, rather than one large unit, to provide a more flexible approach to storage and removal of stored materials.

Unconfined Stockpiles--Unconfined stockpiles are a prevalent method for long-term storage of dewatered sludge. Stockpiles located in areas with frequent and/or intense rainfall necessitate that the dried sludge be covered so that excessive moisture does not result in slumping of the material. Generally, the material is dumped in an area dedicated to either temporary or long-term storage. A three-sided structure without a permanent roof may be constructed to facilitate containment and ease of material deposition, as well as the loading of the sludge into transport vehicles.

Domed Enclosures--The Kenosha Water Utility has found the use of wooden domed enclosures, similar to structures being used for salt storage in many locations, to be a cost-effective means of storing dewatered sludge. A photograph of the Kenosha Water Utility facility is shown in Figure 8. These facilities are available in a variety of sizes up to about 116 feet in diameter, with a base wall height of up to about 50 feet, and typically are constructed on a concrete pad.

Storage of sewage treatment plant sludge prior to disposal is an important function to be evaluated in the development of a comprehensive solid waste management plan for Kenosha County. Accordingly, the above-referenced sludge storage systems will be considered as part of the sludge processing and disposal systems component of the plan.

## Collection

The collection operation can be defined to consist of the removal of solid wastes from the storage point at the place of generation. This operation begins when the collection vehicle leaves the garage, and includes all time spent on the route. The transport operation begins when the collection vehicle departs for the disposal or processing site from the last loading point. This operation includes the time spent at the disposal site and the time spent after leaving the disposal or processing site to return to the first container on the next collection route. The purpose of the collection function is to gather solid waste from the individual generators prior to transport to subsequent transfer, processing, or disposal sites.

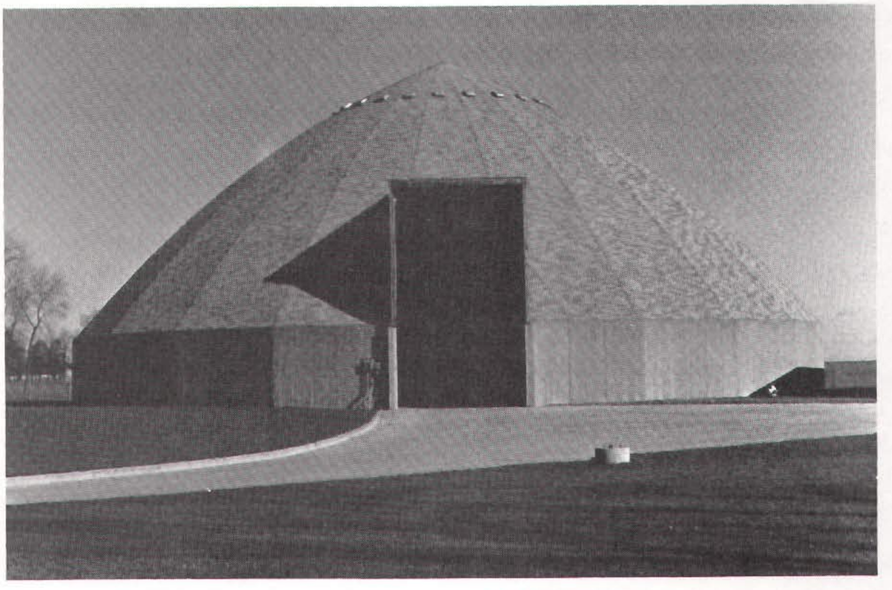
Regarding sewage treatment plant sludge, the collection function pertains only to the collection of such material from a storage area located at or near the sewage treatment plant. In Kenosha County, a combination of private and municipally operated collection services are providing this service to the private and publicly owned sewage treatment plants.

In Kenosha County, the collection and transport of solid wastes other than sewage treatment plant sludge is provided by one of three types of services: municipally operated collection and transportation services, private collection services, and individual residents, commercial establishments, and industries that haul their own wastes to disposal sites. The only municipality which provides residential solid waste collection and transportation service in Kenosha County is the City of Kenosha. Private collection and transportation contractors collect residential wastes in the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and in each of the eight townships. Some residents, commercial establishments, and industries haul their own wastes to transfer stations or landfills.

In Kenosha County it is estimated that 55 to 70 percent of the total cost of solid waste management is incurred in the collection and transportation phase.

Figure 8

WOODEN DOMED ENCLOSURE FOR
THE STORAGE OF DEWATERED SLUDGE



Source: Kenosha Water Utility and SEWRPC.

Based upon existing trends, this percentage may be expected to decrease because of the improved efficiency in collection systems and expected increases in landfill disposal costs. The existing solid waste disposal facilities and transportation patterns for the residential and commercial solid wastes generated in and around the County are shown on Map 24 in Chapter II.

Private industry provides the vast majority of the collection and transportation services for commercial and industrial wastes in Kenosha County. As shown in Table 21 in Chapter II, there are 44 licensed private collection services operating in the County. Private collection services can be arranged either on an individual contract basis with residents, commercial establishments, or industries, or through contracts with an entire municipality.

There are four aspects of the collection function which warrant careful consideration in the design of the collection system: the point of collection, the frequency of collection, crew size, and the type of collection equipment. Decisions concerning the collection system are best made locally, based on a community-by-community analysis, and individually in the case of commercial and industrial establishments. However, in order to provide insight into the relationship between the collection function and the other solid waste management functions, collection options are discussed in this section.

Point of Collection: The solid waste collection point is generally either curbside/alley or backyard. Curbside/alley collection requires the resident to place the solid waste at the curb or alley for collection and to retrieve the empty storage containers. Backyard collection does not require special placement of residential storage containers by individual occupants.

Curbside/alley has the advantage of being the most productive and efficient type of service. The collection crews are not required to carry waste containers any significant distances, and fuel usage by collection vehicles is reduced. The disadvantages of this type of service include the need for special considerations in the case of the elderly and handicapped, and the fact that full containers must remain at the curb until pickup, thus limiting routing flexibility.

Backyard collection can take several forms. Collectors may remove refuse from the backyards of premises and return any reusable containers; or collectors may transfer the contents of a household container, in the backyard, to a larger receptacle which is carried out and emptied into the vehicle. The latter eliminates the need to return the resident's container after emptying it. The chief advantage of the backyard collection system is that it is the most complete service from the resident's viewpoint. In addition, the aesthetics of curbs cluttered with containers and attendant litter is eliminated. The disadvantages of this service are significantly higher costs and the need for collectors to enter private property. Backyard pickup service offers a maximum degree of routing flexibility, but the low productivity and high costs of such pickup service frequently result in a decision to employ a more efficient collection system.

Modified versions of the backyard collection system include a set-out service and a set-back service. In set-out service, containers are carried out to the curb by collectors. Residents are responsible for returning their own empty containers. Full cans are therefore on the street only a short time, thus reducing litter. Because the containers may, for various reasons, remain at the curb for considerable periods, they should be set out with lids in place, and the lids should be replaced on the empty containers by the crew. Set-back service requires customers to bring their containers to the curb. The collection crews return the empty containers to the yard. This method has less routing flexibility than the other two methods of backyard service and is not often used.

In all container pickup methods, it is desirable that only one round trip between household backyard and vehicle be required. The use of bags can help achieve this objective, since bags eliminate the need for a return trip to the backyard.

In Kenosha County, curbside/alley pickup is the most prevalent collection method for residential solid wastes. The municipal collection service provided in the City of Kenosha, as well as those in communities using private contractors for the collection of residential solid wastes, uses curbside collection methods.

Frequency of Collection: For health and aesthetic reasons, the maximum acceptable time period between collections of residential wastes containing food wastes and other putrescible material is generally considered to be a week. Such collection is generally required to avoid the need for containers with large storage capacity or the use of individual compactors. In certain situations--such as during peak seasonal load periods--even more frequent collection may be required because of increased population and limited storage space. In other situations, where residents are amenable, less frequent collection may be possible if storage space and containers are available, or compactors are used, and special care is taken to store the solid waste properly. For large bulky materials, collection can be much less frequent--up to once every six months.

In Kenosha County, all communities have weekly collection of residential solid waste. Commercial and industrial solid wastes are collected primarily by private contractors on an as-needed basis.

Crew Size: The number of persons in a collection crew depends on the system, equipment, and type of service offered. In general, significant cost savings can be realized by using a minimum-size crew; there seldom is justification for using more than a two-man crew for curb/alley collection--and a one-man crew may suffice--or a three-man crew for backyard collection. Except for the driver's time, the crew-member time is nonproductive during disposal trips. Systems utilizing a single crew member as a driver/loader with a side-loading or front-loading vehicle have been shown to be particularly efficient for curb and alley collection routes. Single and two-man crew systems are the most predominant crew sizes used in Kenosha County.

Collection Equipment: Although some noncompaction closed body trucks are still used for solid waste collection, the vast majority of collection trucks are front-, side-, or rear-loading compactors. Each design has its advantages and disadvantages. Side loaders are universally used in one-man manual collection systems because the driver-collector must be able to reach the storage container conveniently from his cab, and must be able to load the truck at a point as close to the cab as possible to reduce walking time.

In Kenosha County, the most commonly used collection vehicles are 15- to 25-cubic-yard rear-loading compactors and 12- to 25-cubic-yard side-loading compactors. Small satellite vehicles are also used in some areas, with loads then being transferred to a larger collection vehicle. These satellite vehicles are often towed with the larger vehicle and used to do the majority of the collection, with periodic trips made to deposit the loads from the small vehicle to the larger vehicle. This requires the use of bags for the solid waste in order to make handling easier, since there is a duplication in handling the material.

When designing or modifying a collection system, decisions should not be made on the type of equipment and size of the crews until the policies regarding the level of service to be provided have been established. Only on the basis of these policies can the equipment and size of crews be selected. Other factors, such as round-trip time to the disposal site, street widths, local weight and height limits on vehicles, housing density, labor wage rates, and the amount of waste at each stop, will also have an impact on such decisions. Table 32 shows the productivity performance of 11 solid waste collection systems, and illustrates the productivity relationships between the various types of systems.

## Transfer

Transfer of solid waste refers to the transfer of wastes from small collection vehicles to larger vehicles prior to transport over extended distances to either processing centers or disposal sites. A transfer station is the location at which wastes are temporarily stored and then transferred. The purpose of transferring wastes from smaller to larger vehicles is to reduce the cost of

## Table 32

## PRODUCTIVITY PERFORMANCE IN 11 RESIDENTIAL SOLID WASTE COLLECTION SYSTEMS

| Level of Service by Point and Frequency of Collection | Type of Operation | | | Tons Collected per Crew Collection Hour | Households Served per Crew Collection Hour | People Served per Truck per Week | Costs | |
|---|---|---|---|---|---|---|---|---|
| | Crew Size | Method | Incentive | | | | Dollars per Ton Collected | Dollars per Stop |
| Curb or Alley Once-a-Week | 1 | 1 side | Task | 2.2 | 100.9 | 7,763 | 19.87 | 0.44 |
| | 1 | 1 side | 8 hours | 1.9 | 54.7 | 4,344 | 20.52 | 0.68 |
| | 2 | 1 side | Task | 2.1 | 109.6 | 7,517 | 27.36 | 0.51 |
| | 2 | 1 side | 8 hours | 3.0 | 118.2 | 9,615 | 19.49 | 0.49 |
| | 3 | 2 sides | Task | 3.8 | 99.2 | 7,060 | 24.28 | 0.89 |
| | 3 | 2 sides | 8 hours | 1.7 | 63.7 | 4,150 | 44.45 | 1.20 |
| Curb or Alley Twice-a-Week | 2 | 1 side | Task | 1.3 | 88.5 | 3,636 | 29.87 | 0.89 |
| | 2 | 1 side | Task | -- | -- | 4,607 | 43.43 | 0.68 |
| | 3 | 2 sides | Task | 3.0 | 199.5 | 6,316 | 32.03 | 1.06 |
| Backyard Once-a-Week | 2 | Tote barrel | Task | 1.2 | 71.7 | 5,130 | 42.29 | 0.73 |
| | 2 | Tote barrel | 8 hours | 1.1 | 43.8 | 3,690 | 46.40 | 1.11 |

Source: David G. Wilson, Handbook of Solid Waste Management, 1976. Costs updated to 1984 dollars by SEWRPC.

the transportation function; this is generally done by not utilizing the collection crew and equipment for transport.

In the transfer operation, the small vehicles can be private automobiles, pickup trucks, or, more commonly, collection and packer trucks. The larger vehicles normally are large-capacity trucks, although barges and railroad cars are sometimes used in special situations. The popularity of truck transfer systems has led to the development of equipment specifically suited to this purpose. Two basic types of transfer systems have developed. The first is the direct-dump system where a collection truck or individuals dump by gravity into a large open-top trailer or container. In the second basic transfer system, wastes are transferred to a container equipped to provide pressurized horizontal compaction.

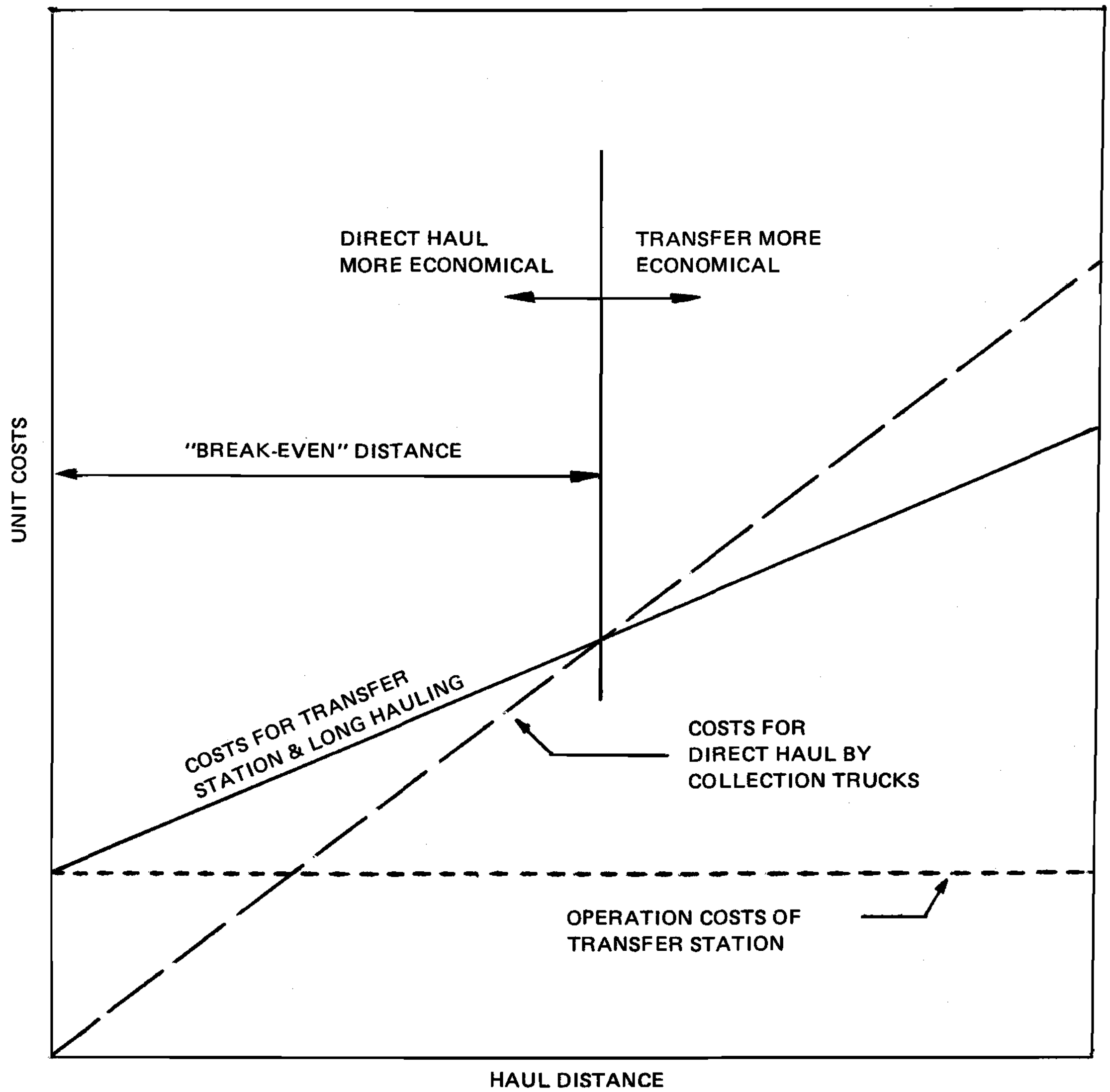
Although a transfer operation offers potential savings, the operation requires an extra materials-handling step and the construction of a transfer facility. The costs that are incurred include capital costs for land and facility construction, operation and maintenance costs for the transfer facility, and the costs for transport of the waste from the transfer station to the disposal site. Some years ago, before the development of improved equipment such as large one-man compactor trucks, it was possible to generalize on the haul distance for which the use of a transfer station would be cost-effective. However, this is no longer possible, and each system must be analyzed for each major waste generation center to determine the point at which a transfer station is more economical than direct haul. Normally, a one-way distance of between 10 and 25 miles is the break-even point. To determine the feasibility of using a transfer station, cost-effectiveness studies of alternative collection/ transport systems must be made and trade-offs determined. A generalized approach to determining the feasibility of a transfer station is shown in Figure 9. Detailed costs for specific situations are provided in Chapter VII.

The principal advantage of transferring wastes is the potential reduction in cost and fuel which can be achieved by not utilizing the collection crew and equipment for transportation. Another advantage is that the transfer station can serve as a site for volume reduction processing.

The principal disadvantages are the capital, operation, and maintenance costs associated with the transfer station, although these costs should presumably be offset by the savings in collection and transport costs.

Figure 9

GENERALIZED TRANSFER STATION COST ANALYSIS SCHEMATIC




Source: SEWRPC.

As previously noted, transfer stations are currently an important feature of solid waste management operations in Kenosha County. It is estimated that 43,900 tons, or 77 percent of the residential, bulk, and yard wastes generated in the County, are transported to one of five transfer stations operated in the County. These five stations serve as temporary disposal and consolidation points for all or most of the residential, and some commercial, refuse collected in the City of Kenosha and the Towns of Brighton, Salem, Somers, and Wheatland.

It is important to note that the recently constructed City of Kenosha transfer station was designed with sufficient capacity to handle not only all residential and some commercial refuse generated in the City, but also sewage sludge produced at the city sewage treatment plant. The transfer station is presently not used for the transfer and transport of the sludge to the Pheasant Run landfill because of the expressed desire of the landfill operator to have sludge segregated from the other solid wastes.

Because of the potential cost savings and the current widespread use of transfer stations, this technique was considered to be a viable option as a continuing component in the development of alternative solid waste management plans for Kenosha County, including the use of the City of Kenosha facility for transfer of the City's sewage treatment plant sludge.

## Transportation

Although transportation of solid waste occurs, in fact, during collection, the term is herein defined as the relatively long-distance transport of solid waste from the last point of loading to the processing or disposal site. The transport operation also includes the transport time from the disposal or processing site back to the collection route. The purpose of the transportation step is to deliver the solid waste to the processing or disposal site.

Transportation can be accomplished by rail, barge, or truck. Generally, rail haul is not competitive unless large volumes of processed waste are to be transported distances greater than 100 miles. Barging is a special case limited to a few suitable geographic locations.

The type of transport vehicle used is dependent upon the amount and type of waste to be handled. Collection vehicles can be used for transportation. The two basic types of trucks that may be used following transfer are the open-top trailer and the compacted load trailer. Another option is the transport of open or enclosed containers with compactors used to receive wastes at the transfer stations. Trucks designed with hoisting or pulling mechanisms are used to transport these containers.

As discussed in Chapter II, in Kenosha County solid wastes are transported to the transfer stations by municipal vehicles and collection equipment owned by private contractors. These vehicles are generally 12- to 30-cubic-yard, or 5- to 12-ton, packer trucks, and are either rear or side loading. Solid wastes are transported from the transfer stations to the landfill mainly by private collection services, which most commonly make use of tractor trailers with a capacity of up to 30 tons--or about 75 cubic yards.

Sludge generated at sewage treatment plants is generally transported to disposal sites in equipment owned by municipalities and private contractors. As discussed in Chapter II, over 95 percent of the sewage treatment plant sludge generated in Kenosha County is generated at the City of Kenosha wastewater treatment facility. Sludge generated at the city plant is transported in 18-cubic-yard capacity dump trucks to the Pheasant Run landfill, located in the Town of Paris. Liquid sludges generated at other sewage treatment plants in the County are transported in large--5,500-gallon capacity--tank trailers, which can transport an average load of 5,000 gallons of sludge with a solids content of 3 to 10 percent.

The economic and other considerations of the transportation system are closely related to the type of transfer and processing operation to be used. Accordingly, this study included a detailed analysis of the transportation function. The results of this analysis are considered to be an integral component of any transfer and processing functions which are found viable in the development of alternative plans.

## Processing

Processing can be defined as a physical or chemical process used to change the characteristics of solid waste to facilitate reuse or disposal. The purposes of processing are to reduce the amount of material, to improve the material's handling characteristics, or to improve the material's usefulness. The three processing techniques which are most commonly used are baling, shredding, and densifying. Incineration is sometimes classified as a processing operation and will be discussed in this section. Processing of solid waste can be conducted at the point of reuse, at the point of landfill, or at an intermediate transfer location. Sewage treatment plant sludges are processed in a number of ways which are briefly discussed in this section.

Baling: Baling is a mechanical method of reducing the volume of solid waste by high pressure compaction. Three basic types of solid waste balers are used. One type, developed on the principles used for baling scrap metal, achieves densities which are high enough to eliminate the need for baling wire. This type of baler requires pre-shredding. The second type, developed on the principles used in a "hay baler," is a horizontal, continuous push-through type of solid waste baler. Use of this system also requires pre-shredding in order to obtain a homogeneous material for the continuous feed hopper, thereby minimizing bridging or blockage in the hopper. The bales are secured by tie wires to facilitate handling. A third type of solid waste baler is based on the principles used in balers employed to bundle corrugated cartons at supermarkets and other commercial establishments. This type of baler requires no pre-processing, although tie wires are required because of the lower density obtained.

Densities of baled wastes vary from 1,000 to 1,800 pounds per cubic yard, depending on the type of baler used. The cost of baling may be expected to range from $10 to $15 per ton.

The principal advantages of baling are that the volume of the waste is reduced by up to 50 percent, and the waste is easier and less costly to handle and transport. Baling has recently become a more reliable process with the introduction of better equipment. The principal disadvantages are the initial capital investment required and the operational costs of the baling facility. Baling of wastes is generally most applicable in situations where large volumes of waste are generated but where nearby disposal sites are unavailable.

Since the emphasis of the alternatives developed for this plan will be on the reduction of the amount of waste to be landfilled, rather than on a reduction in the gross volume of waste to be disposed of, baling is not considered a viable option in the Kenosha County study area. Accordingly, it will not be considered as a component in the development of alternative solid waste management plans.

Shredding: Shredding is a generic term used for several similar size-reduction processing operations, including pulverization, milling, hammermilling, grinding, and comminution. The purpose of shredding is to reduce the volume of solid waste and turn it into a relatively homogeneous material which can be more easily handled. The most attractive feature is the bulk reduction achieved. When compacted in a landfill, shredded waste has fewer voids than unprocessed waste and the density can be increased by 25 to 50 percent. Shredding can also facilitate incineration and may be a necessary part of many resource recovery systems. The cost of shredding may be expected to range between $15 and $20 per ton.

The principal advantages of shredding are that the volume of waste when landfilled is reduced from 25 to 50 percent and the waste is easier to handle and transport. However, handling and transport is not improved to the same extent as with baled waste. Shredding also enhances the marketability of certain fractions of the solid waste stream. The principal disadvantage of shredding is the initial capital investment required for equipment and the operating costs of the shredding operation. Shredding of waste appears most applicable in areas where there may be a landfill capacity shortage and in situations where the solid waste could be recycled as a fuel.

Shredding is a necessary step in the development of a system producing refuse-derived fuel, and the process will be considered for that use in the development of alternative solid waste management plans for Kenosha County.

Densifying: A process called densifying, which is similar to shredding, can be used on a relatively small scale; up to about 10 tons per hour of waste can be processed using this system. The process converts the bulky solid wastes into a more manageable size which allows for more convenient hauling. The advantages of densifying are a reduction in the volume of the wastes, which provides for less costly hauling and landfilling, and the potential for turning the waste into energy. The product material can vary from small pellets which are used as a fuel to log-size bars which are marketed as wood substitute fireplace fuel. There is a market for this type of waste, although cost-effectiveness has not been demonstrated on a large scale. The principal disadvantages of densifying are the initial capital investment, and the lack of established markets for the products. In addition, there are limited large-scale operating systems as of this time. The quality of the product and its potential for use as a fuel can vary with the incoming waste stream. For example, if the amount of plastic in the solid waste becomes too high, the burning temperatures may exceed the desirable level. Should the product market become established, this system could become cost-effective. Review of available manufacturers' data indicates that cost-effectiveness may be achieved if the product can be marketed effectively for $30 to $50 per ton.

Because of the lack of demonstrated large-scale feasibility and market establishment, this process will not be considered in the development of alternative solid waste management plans for Kenosha County.

Incineration: Incineration is defined as the controlled burning of solid, liquid, or gaseous wastes. The main purpose of incinerating solid waste is to reduce the volume of, and the contaminants in, the solid waste material, with a secondary purpose being the production of energy. It is important to note that approximately one-third of the sludge generated in the United States is disposed of by incineration either by itself, or in combination with some other waste material. As such, solid waste management techniques which utilize incineration are applicable to residential, commercial, and industrial solid wastes as well as sewage treatment plant sludge. Certain end products of solid waste incineration require further processing or disposal. These include the particulate matter carried by the gas stream, incinerator residue, grate siftings, and process water. Bulky burnable wastes usually are not processed in an incinerator, since they either are too large to load in the combustion chamber, burn too slowly, or contain a steel frame of a dimension and shape that could foul grate operation or the residue removal systems. Other large items, such as washing machines, refrigerators, water heater tanks, stoves, and large auto parts, cannot be handled by incineration. In addition, inert materials such as foundry sand would not be incinerated. Such materials make up approximately 15 percent by volume of the Kenosha County solid waste stream at the point of collection.

Incineration can reduce the original volume of combustible wastes by up to 90 percent. In Kenosha County it is estimated that 75 percent by weight of the solid waste stream, including sewage treatment plant sludge, is combustible. Incineration still requires a landfill both to receive the ashes of the incineration process, and to receive those wastes that cannot be incinerated or recycled. Thus, incineration can provide only a partial solution to the waste disposal problem.

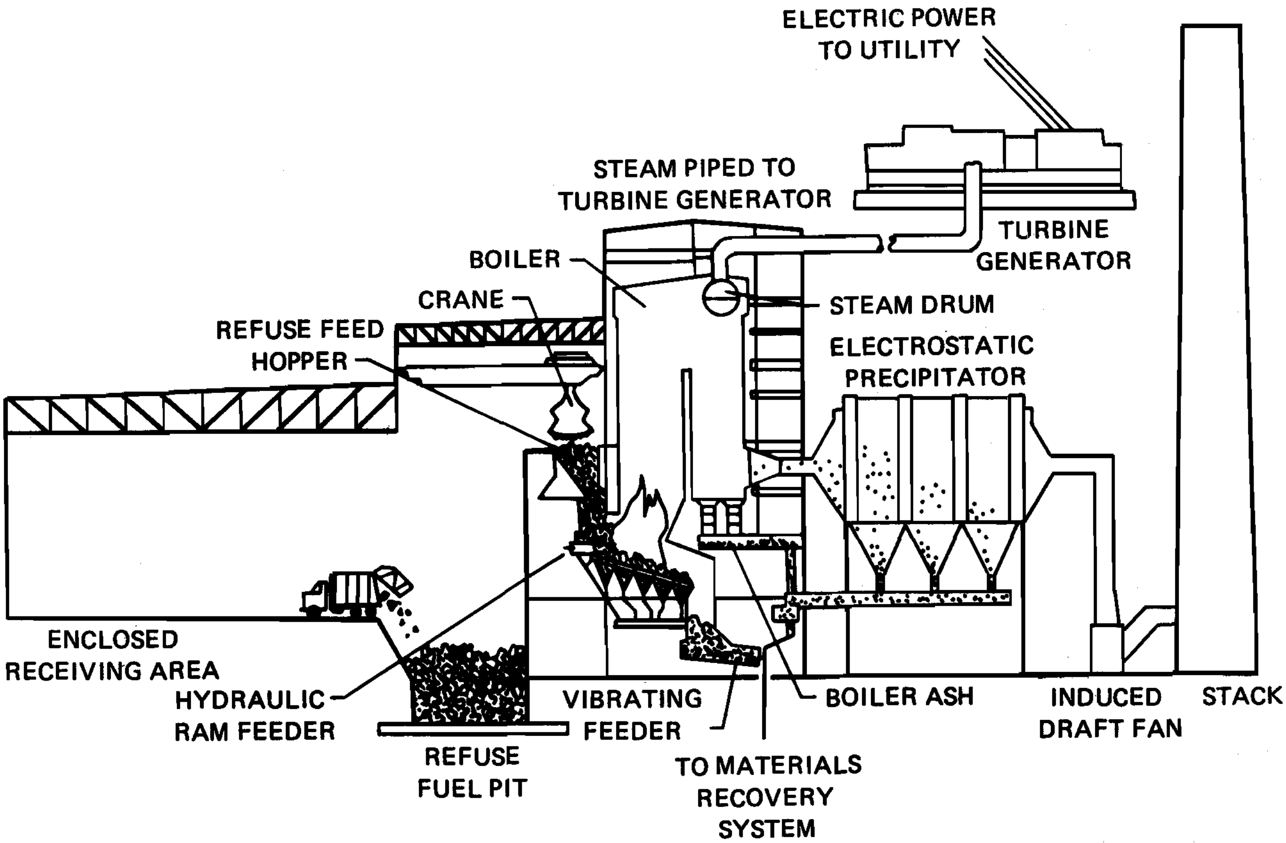
An October 1984 report to the U. S. Conference of Mayors indicated that there were 33 resource recovery incinerator plants with capacities exceeding 300 tons per day under construction or completed in the United States. The costs for incineration of solid waste vary substantially, depending upon the market available for the steam product generated and the size of the installation, but may be expected to range from $25 to $50 per ton. There are several types of incineration systems. Those that appear most applicable are the custom-designed refractory-lined furnace and boiler, smaller modular systems, and fluidized bed systems.

Because of the high lime content and pH of the sludge generated at the Kenosha Water Utility using the present processing system, the sludge is unlikely to be suitable for incineration in many types of facilities, including the multiple hearth system. That sludge, however, may be suitable for incineration in a fluidized bed incineration system. Thus, consideration of some incineration systems may also require a parallel modification of the sludge processing systems used prior to incineration.

Custom-Designed Refractory-Lined and Water-Walled Incinerators--Custom-designed incinerators are designed primarily to reduce the volume of and contaminants in waste. These furnaces are refractory-lined or water-walled, contain grates which move the waste from a feeder mechanism to a discharge device, and are sized to permit the combustion of the burning gases to be completed within the furnace in a combustion chamber enclosure. Systems can be designed for heat recovery, with the recovered heat used to produce steam for space heating, industrial processing, and power generation purposes. The most common type of new system is one in which the solid waste can be fed as a fuel directly into the furnace without prior treatment. When the wastes are handled in this fashion, the process is referred to as a mass burning process. An example of a mass burn incineration system with heat recovery is shown in Figure 10. Alternatively, the refuse can be processed in some manner, such as shredding, prior to introduction into the furnace. Heat recovery generally is accomplished either by the use of a refractory-lined furnace followed by use of a boiler which converts the waste heat from the furnace to steam or hot water, or by use of a water-walled furnace which incorporates, or is followed by,

Figure 10

SCHEMATIC DIAGRAM OF MASS BURN INCINERATION SYSTEM WITH HEAT RECOVERY




Source: SEWRPC.

use of a boiler for the conversion of heat to steam. Larger custom-designed facilities can be expected to have an initial capital cost of $50,000 to $150,000 per ton per day of capacity, with the higher costs being attributed to designs for special air quality emission limitations or special construction requirements. Thus, a 300-ton-per-day unit could cost between $15 and $45 million.

Modular Incinerators--Responding to the needs of industry to provide a means of disposing of space-occupying waste which contains a large combustible fraction, several manufacturers of incinerators have developed small, prefabricated incinerators with capacities of one to five tons of waste per hour. In recent years, modular furnaces have also been used successfully for the incineration of municipal solid waste. Although smaller in size, modular units can be combined to form a relatively large system with capacities up to 300 tons per day. Currently, there are a number of these systems under construction or in operation in the United States. They typically range in size from 50 to 300 tons of input per day, and cost from $4 to $20 million to construct.

While the modular type systems are smaller, they may serve a specific market and can be more cost-effective than the larger systems. Incineration using modular units may be attractive when smaller industrial or institutional customers are available for the energy recovered.

Fluidized Bed Incineration--There has been a growing interest in atmospheric fluidized bed incineration. A schematic diagram of such a system is shown in Figure 11. The interest in these systems can be attributed to the fact that they typically operate at higher combustion efficiencies and at lower excess air levels than do conventional systems, and can minimize air pollutant emissions. Preliminary estimates indicate that the costs of such systems may be substantially less than the costs of other types of systems, especially when located in areas where air emission controls are stringent. At the present time, there are limited operating data on these systems.

Multiple-Hearth Furnace--Multiple hearth furnaces have historically been the most widespread type of incinerator used for the combustion of sludge. A typical multiple hearth furnace is shown in Figure 12. The facilities consist of a circular steel shell surrounding a number of solid refractory hearths and a central rotating shaft to which rabble arms are attached. Capacities of such facilities range from 200 to 8,000 pounds per hour of sludge with a solids content of 20 percent. Multiple hearth furnaces that burn sludge containing 20 percent solids or less require use of a supplemental fuel to achieve and maintain optimum operating temperatures. The sludge generated by the City of Kenosha sewage treatment plant contains approximately 40 percent solids, and consequently may not require a supplemental fuel for incineration.

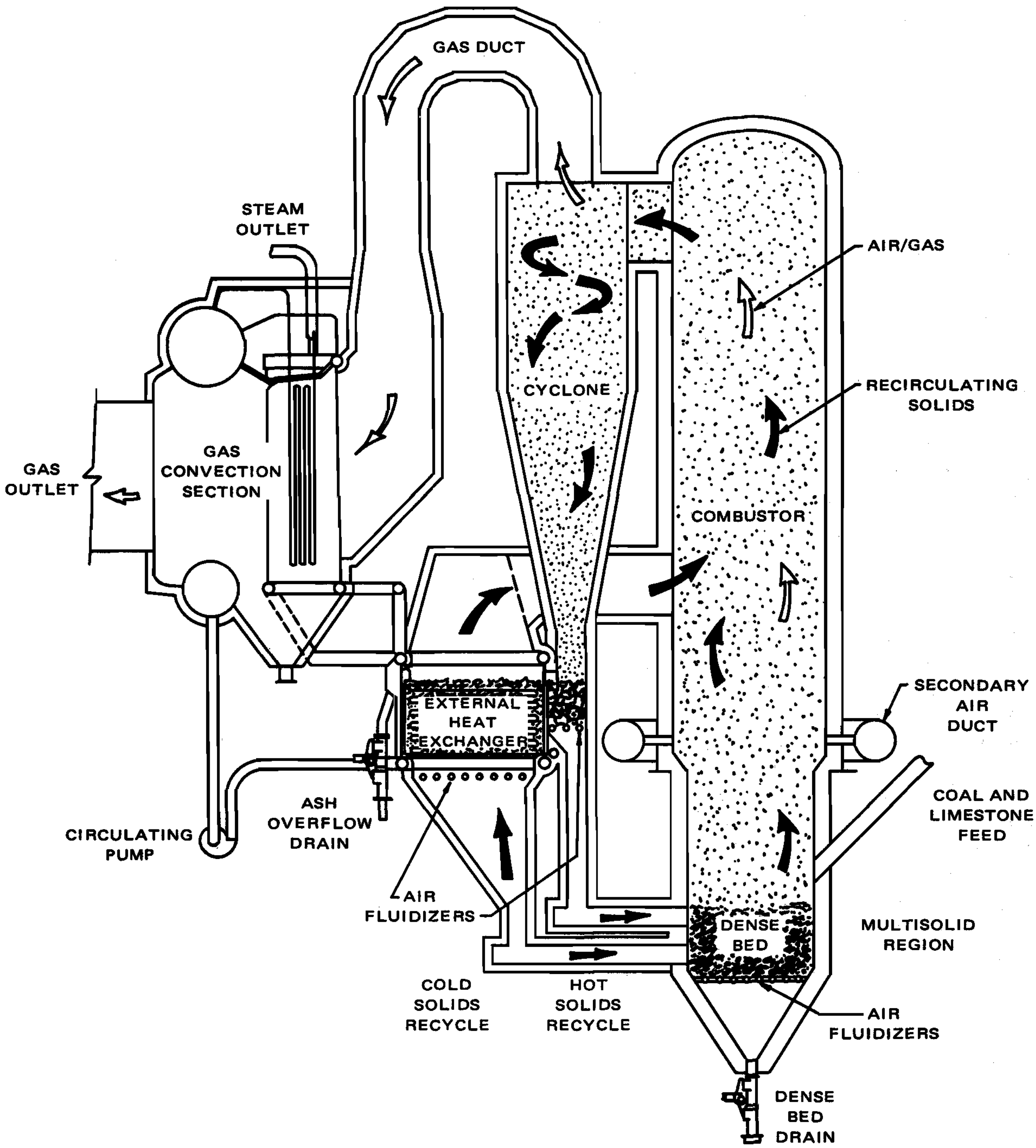
Incineration Conclusions: Incineration has the advantage of substantially reducing the volume of waste to be landfilled. As already noted, the system can be designed to recover energy and thus offset the costs of construction and operation. The main disadvantage is the high initial capital cost and the continuing high operation and maintenance costs. Incineration is considered a high technology system which requires specialized operators and equipment maintenance personnel. Furthermore, ash produced by incineration of solid wastes may contain materials which can result in it being categorized as toxic and hazardous. Should this occur, incineration may need to be restricted to residential wastes and limited quantities of commercial and industrial wastes. The ash may also need to undergo pre-treatment prior to disposal, or the ash may have to be disposed of in a licensed hazardous waste landfill. In addition, incineration systems have the potential to contribute to air quality problems. The design of the systems must therefore take into account all state and federal air quality criteria and should provide enough flexibility to allow the systems to be adaptable to changes in the criteria. Depending upon the site in question, special air emission control measures may need to be designed into the system which provide for more stringent controls than required by State and Federal law.

Because of the potential to reduce landfill needs, to recover energy from solid waste, and to reduce costs over the long term, incineration was considered as a viable option for use in Kenosha County, and will be considered in the development of alternative solid waste management plans.

Sewage Treatment Plant Processing: Sewage treatment plant sludges can be processed by a number of means prior to being disposed of. Below is a list of the primary means of processing generally considered viable:

Figure 11

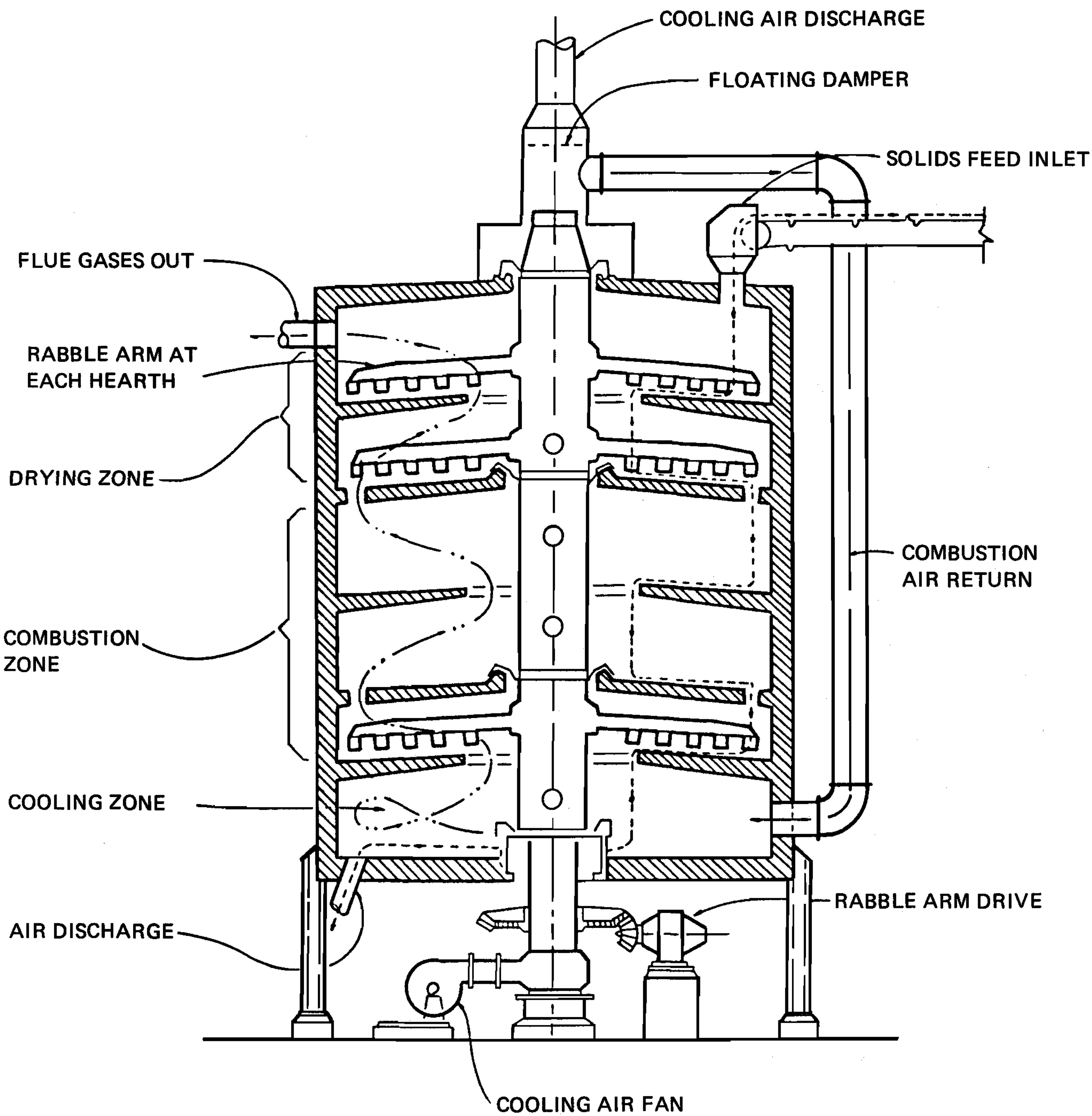
SCHEMATIC DIAGRAM OF A
FLUIDIZED BED INCINERATION SYSTEM




Source: Power Magazine, February 1985.

Figure 12

CROSS-SECTION OF A MULTIPLE HEARTH FURNACE




Source: Milwaukee Metropolitan Sewerage District.

A. Thickening
   1. Dissolved Air Flotation
   2. Centrifuge
   3. Gravity

B. Stabilization
   1. Aerobic Digestion
   2. Anaerobic Digestion
   3. Lime Stabilization

C. Dewatering
   1. Sand Bed Drying
   2. Centrifuge
   3. Vacuum Filters
   4. Filter Presses
   5. Belt Presses
   6. Lagoons

Thickening--Thickening of sludges takes place through either gravity or mechanical methods to reduce the volume of sludge requiring further processing.

Stabilization--Stabilization is the process whereby the wastewater solids are rendered less odorous and putrescible while reducing the pathogenic and volatile solid contents.

Dewatering--Dewatering involves the removal of sufficient moisture from thickened wastewater solids to form a semi-solid cake suitable for further processing or for utilization/disposal.

As discussed in Chapter II, most of the sludges generated in Kenosha County are produced at the Kenosha Water Utility sewage treatment plant, which provides for anaerobic digestion of primary sludge and thickened waste-activated sludge prior to thickening in filter presses which produce a low-water-content sludge cake. That sludge cake contains about 40 percent solids--a substantially higher solids content than is achieved at other large public sewage treatment plants in Wisconsin.

Other sewage treatment plants in the County generally stabilize sludge by digestion and dispose of the sludge in liquid form without dewatering. Limited amounts of sludge are dewatered on drying beds.

As discussed later in this chapter, the alternative evaluations conducted are based upon assumptions that the existing, or committed, onsite sewage treatment plant processing systems will be continued. The focus of the alternatives will be on offsite processing and disposal options, or extensions of the processing onsite. Only where changes in the existing onsite processing are necessary to accommodate offsite options will modifications to the onsite processing at the sewage treatment plants be considered.

## Treatment

Treatment can be defined as a biological or chemical process designed to change the character of solid waste. Treatment is used to convert solid waste to intermediate products and energy. Treatment processes include pyrolysis, composting, and bioconversion.

Pyrolysis: Pyrolysis is the destructive distillation of the organic portion of waste materials under heat and/or pressure in the absence of oxygen which results in the production of combustible oil, gas, and char, all three of which are marketable. This process has been tested and is now in use both in the United States and throughout the world. However, the technological complexities and differing economical feasibilities of operating a full-scale pyrolysis plant have resulted in fairly limited use of such facilities for the processing of solid wastes. This treatment system was considered further in the development of alternative plans for Kenosha County, particularly for sewage treatment plant sludge.

Composting: Composting is a biological degradation process by which the organic materials in solid wastes are converted into a nuisance-free, humus-like material that can be used as a soil conditioner. Composting of municipal solid waste and sewage treatment plant sludge has been practiced in Europe and the United States for many years. The technology of composting is well advanced, and there are no technological barriers to using the process. In the United States, composting plants have been established in various communities over the last 20 years. However, many of these plants have not been considered successful, and many have closed. The major problem has been the lack of a viable market for the compost produced. The composting of vegetative material is desirable in a solid waste management system that includes incineration because the moisture content of the vegetative materials contained in residential solid wastes can adversely affect the efficient incineration of other combustible wastes.

While composting of a large portion of the waste stream which is degradable is technically feasible, experience has indicated such systems to be impractical because of a lack of available markets, the need for pre-processing to remove the nondegradable products, the long time required for composting, and the nonuniformity of the product. Consequently, only composting of the vegetative material such as lawn clippings and leaves will be considered further in this study.

Composting systems have historically not been widely used to process sludge in the Region or in the United States because of public resistance, and since more economical disposal techniques are available. However, as the state-of-the-art has improved and the costs of other disposal methods, such as landfilling, have increased, renewed interest has been shown in the composting of sludge. Composting systems applicable to sewage treatment plant sludge fall into three categories: static pile, windrow, and mechanical enclosed systems. The static pile and windrow systems have been used extensively in composting sewage sludge because of their lower cost and demonstrated performance. Enclosed systems require the construction of a specially designed mechanical vessel for composting the material. The main advantages of a closed mechanical system are that it requires a minimal amount of land area and achieves complete odor control. Its disadvantages are the high capital cost and inherently complex mechanical nature. The pile and windrow systems are more applicable in Kenosha County for the type and quantities of sludge being evaluated, and will be considered further in the development of alternative plans. Consequently, the closed mechanical system method will not be considered further. The pile and windrow systems are discussed below.

Static Pile System--This process begins with mixing dewatered sludge with bulking particles, such as wood chips, which gives the sludge structural integrity for pile construction and porosity for air circulation. This mixture is typically prepared at a volumetric ratio of one part sludge to two or three parts wood chips. The mixture is then formed into large piles of trapezoidal cross-sections, 10 to 15 feet high. Air is drawn through the pile with blowers and perforated pipe installed in a layer of wood chips beneath the static pile. Following a composting period of approximately 30 days, the static pile is broken down, and the mixture of compost and wood chips is moved to another site and cured for an additional 30 days. The mixture is then screened to separate chips from compost. After screening, compost is available for use as a soil amendment, and reclaimed wood chips are recycled for the next processing round.

Windrow System--In this system, uncomposted dewatered sludge is mixed with a sufficient quantity of previously composted and dried material to achieve a starting solids content of approximately 40 percent. After mixing, the fresh compost is formed into windrows with a trapezoidal shape and dimensions of five feet high, 12 feet wide at the base, and four feet wide at the top. Lengths of the windrows can vary. Unlike the static pile which, as its name implies, remains undisturbed for the entire composting period, these windrows are regularly mixed. This serves to renew the surface, promote surface drying, and ensure that all of the compost is exposed to the elevated temperatures inside the windrow. As with the static pile process, finished compost is cured for an additional 30 days following a composting period of 25 to 30 days. After curing, a portion is recycled to the beginning of the process as makeup. The remaining compost is then available for use as a soil amendment.

Bioconversion: Bioconversion is a process whereby solid wastes categorized primarily as grass clippings, leaves, and other vegetative debris, and sewage sludge--either along with or mixed in heterogeneous combinations--undergo anaerobic (without oxygen) decomposition. The process reduces the volume of the raw materials and yields methane gas. Bioconversion is considered to be a technically feasible disposal technique. The results of evaluations carried out to determine the economic benefits of the use of bioconversion systems in lieu of other solid waste disposal systems have been mixed. For example, a recently completed study conducted in Milwaukee County evaluated the available technology and costs of converting yard wastes into methane by bioconversion. The technical results of the study indicated that yard wastes are readily digestible and that the by-products of the process include pipeline quality methane gas. In addition, the bioconversion process reduced the volume of the decomposed material between 60 and 80 percent. Volume reductions can reduce transportation and disposal costs. The economic analysis conducted as part of the study indicated that small satellite conversion units with a capacity of 15 tons per day were not economically feasible to operate, with a cost per ton more than double that of a 75-ton-per-day facility. In addition, the evaluation indicated that year-round operation of the system was the most cost-effective way to run a facility.

The costs associated with use of this system generally range from $50 to $80 per ton. There appear to be more cost-effective, less capital-intensive methods available to reduce the amount of "yard" wastes or sewage sludge in the Kenosha County solid waste stream. Consequently, this alternative will not be considered further.

Fertilizer-Soil Conditioner Production: The production of an organic fertilizer-soil conditioner that utilizes dewatered sludge as a base and which would be distributed in bagged or bulk form is another option to be considered.

Such a product--Milorganite--is produced at the Milwaukee Metropolitan Sewerage District Jones Island sewage treatment plant. The Kenosha Water Utility has underway experiments with a similar product--Ken-Soil--which contains a mixture of dewatered sludge, vermiculite, and peat moss. That mixture neutralizes the high alkalinity pH of the sludge. Small-scale experiments are presently underway at Gateway Technical Institute in Kenosha to evaluate the fertilizer-soil conditioner value of this product. As noted above, the practicality and cost of this option are dependent upon the market value of the product. Because of the local interest, this alternative is considered viable and will be considered further.

## Resource Recovery

Resource recovery may be defined as the extraction of economically usable materials or energy from waste materials. In implementing a resource recovery system, both the markets and the technologies available must be carefully considered. Resource recovery systems include landfill methane recovery, steam production by incineration, refuse-derived fuel (RDF) production, waste material exchange systems, and land application of sewage treatment plant sludge.

Landfill Methane Recovery: Landfill methane recovery is a process in which methane gas is recovered at the landfill. The gas may be burned onsite or transported to power plants. The advancement in the technology of operating such a system was recently demonstrated in southeastern Wisconsin. During 1985, the operator of two large landfills--the Metro landfill located in the City of Franklin, Milwaukee County, and the Omega Hills landfill located in the Village of Germantown, Washington County--announced plans to develop methane recovery systems at these two landfills. These systems, which are now operational, provide for recovery and burning of methane gas from the landfills, with the heat energy developed being used to generate electricity. There are no large, existing landfills in Kenosha County that have adequate amounts of decomposed waste to result in the generation of methane gas at a fairly constant rate in sufficient quantities for this system to be feasible. Consequently, a landfill methane recovery system would not be viable in Kenosha County and will not be discussed further.

Steam Production by Incineration: It has been estimated that the combustible residential, commercial, and industrial solid wastes generated in Kenosha County have a heat value of 4,500 British thermal units (BTU's) per pound when preceded by separation of fractions which are not amenable to combustion, such as bulky material, construction debris, and wet vegetative materials. Steam production by incineration is another resource recovery process. Assuming combustion of 40 percent of the residential and commercial solid waste generated in the County, about 23,000 pounds of steam could be generated per hour, resulting in an equivalent in heat value of about 3,700 gallons of No. 2 fuel oil, or about 535,000 cubic feet of natural gas per day. Assuming a value of $5.50 per 1,000 pounds of steam, this would result in a potential income of about $800,000 per year which could be used to offset the production cost. In addition, there would be a reduction in landfilling and transportation costs of about $750,000 per year which could also be used to offset the incineration facility cost. The potential energy production could be higher should a higher percentage of the County's solid waste, including sewage treatment plant sludge, be incinerated, and assuming customers are available for the energy produced.

The production of steam and electricity from solid waste incinerators is a proven technology which, with efficient equipment and increasing energy costs, is currently receiving increased attention. This process is considered a viable option and is considered further in the development of alternative solid waste management plans for Kenosha County.

Refuse-Derived Fuel: The production of refuse-derived fuel is another resource recovery option. This option entails several shredding and materials separation steps to produce the fuel. There are possible markets for such fuel in Kenosha County, but they are limited. The Wisconsin Electric Power Company is a potential market for RDF. However, past experience in southeastern Wisconsin has shown that specially designed boilers would be required rather than modifications to existing systems, and this would entail major capital expenditures.

The City of Madison operates a resource recovery program which includes a high-technology energy recovery system utilizing mixed municipal wastes. The plant, which began operation in 1979, presently processes up to 60 percent of the City's residential waste into RDF. Madison Gas & Electric, a private utility, has co-fired mixtures of up to 20 percent, by BTU, of RDF with coal for electric power generation with acceptable results. The Oscar Mayer, Inc., plant in Madison has also successfully used a co-fired mixture of up to 30 percent by BTU value of RDF with coal. The total cost of the Madison facility, including the processing plants, RDF receiving station, and boiler modifications, was $5.1 million. The system has a design capacity of between 400 and 500 tons per day and is currently operating at 250 to 350 tons per day. Operation and maintenance costs were about $1,500,000 in 1985.

In 1985, approximately 70,000 tons of solid waste was collected in the City of Madison. Of this total, approximately 60,000 tons were transported to the RDF processing facility, with about 57,000 tons determined to be processible into RDF. A total of 18,200 tons of RDF were produced and sold to the Madison Gas & Electric utility and the Oscar Mayer plant, which generated a revenue of $350,000, or about $19.30 per ton of RDF. The remainder of the solid waste was either landfilled or recycled. The total net cost for solid waste disposal in the City of Madison in 1985 was about $2.3 million, or about $32.50 per ton. This includes a credit from the sale of RDF. The net cost of disposal substantially exceeds the cost of landfilling, which is presently about $10 per ton. However, operating the facility at full capacity and an improved market for the RDF could make the present system more competitive with landfilling.

High-level resource recovery systems with materials separation and refuse-derived fuel products require suitable markets. Based on consideration of the factors involved, the production of refuse-derived fuel was considered a feasible option warranting further investigation in the Kenosha County study.

Waste Exchange Systems: Another form of resource recovery is the use of a waste exchange system, in which the wastes of one firm's operation are offered to another firm that can use the waste as a raw material. In theory, both seller and buyer can benefit and the exchanged wastes do not have to be disposed of in landfills. Two types of waste exchange programs are in use: information exchange and material exchange.

An information exchange program consists of a library listing--called a waste exchange information center--where offers of waste materials are forwarded to a central clearinghouse and the resulting information is periodically redistributed to a subscription list of potential customers. Businesses inquiring about wastes are linked to the offering firm, at which time the waste exchange information center withdraws from the negotiations. Information-type waste exchanges typically have small staffs and low costs, and are run by nonprofit trade, business, or governmental groups.

Material waste exchanges are more elaborate and costly operations. The exchange acts as a waste broker, buying, analyzing, modifying, and marketing wastes. Seven of the 22 waste exchanges in operation in the United States in 1985 were material-type exchanges. The 18 exchanges in operation in Europe and Australia were all information exchanges. There were no waste exchanges of any type in operation in the State of Wisconsin in 1985. The Midwest Industrial Waste Exchange (MIWE), located in St. Louis, was in the process of broadening its information base. MIWE currently concentrates on midwestern waste listings, and is reported to be interested in involving more Wisconsin industries. The Illinois Material Exchange Service publishes a list of wanted industrial waste materials and the industries which have the materials available. The mailing list for Wisconsin has been growing steadily, and presently more than 600 of these publications are mailed to Wisconsin industries six times annually.

Land Application of Sewage Treatment Plant Sludge: Land application of sewage treatment plant sludge is a recognized effective method for disposal. In Wisconsin, agricultural land is most often used for disposal, with the sludge acting as both a fertilizer and a soil conditioner. Transportation, handling, and application costs can make land application more expensive than some other disposal methods, such as landfilling. Furthermore, land application of sewage sludge can encounter public opposition, and can result in contamination of surface- and groundwaters, and food chain contamination. Sewage sludge is applied to agricultural lands most often by injecting it beneath the soil surface or applying it to the surface and plowing it into the soil.

Most of the sewage treatment plant sludge generated in Kenosha County is disposed of by landfilling. However, the increasing costs of landfill disposal make land application a viable alternative for Kenosha County.

## Disposal

Sanitary landfilling is an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards and nuisances. A sanitary landfill is a needed component in any solid waste management system for environmentally safe disposal of solid wastes. It is important to note that landfilling is the disposal method for 95 percent of the sewage treatment plant sludge generated in Kenosha County. The type of landfill and the design requirements are chiefly related to the physical environmental setting of the site and the amount of waste to be disposed of. The principal concern in the design is groundwater protection. Groundwater or infiltrating surface water moving through solid waste can produce leachate, a solution containing dissolved and finely suspended solid matter and microbial waste products. Leachate may leave the fill at the ground surface as a spring or percolate through the soil and rock that underlie and surround the waste. The composition of leachate is important in determining its potential effects on the quality of nearby surface water and groundwater. Contaminants carried in leachate are dependent on solid waste composition and on the simultaneously occurring physical, chemical, and biological activities within the fill.

There are four basic landfill types presently feasible for application in the State of Wisconsin that relate to the manner in which the generated leachate is managed. They are natural attenuation, lined, zone of saturation, and shallow lift landfills. A schematic diagram of each type is shown in Figure 13.

Natural Attenuation Landfill: Natural attenuation is a process whereby the leachate emanating from the landfill site is naturally treated as it migrates through underlying soils. A natural attenuation site depends upon natural in-place soils to provide for environmentally secure disposal. Natural attenuation sites are located in areas with relatively impermeable soils such as clays, silts, clay tills, and sandy silts. A minimum groundwater separation distance of 10 to 20 feet from the bottom of the landfill is needed for such landfills. Leachate collection is not generally practiced at natural attenuation sites, since the underlying soils are relied upon for treatment. However, backup leachate collection systems may be installed where clay soils are particularly tight and it is expected that leachate production will surpass the percolation possible through the base grade.

A natural attenuation site will normally be the least costly option and will require the least amount of long-term care and maintenance after filling. The specific criteria that need to be considered in the development of a natural attenuation site include: the soil type, the quantity of refuse to be disposed of, the time frame in which the quantity of refuse is to be disposed of, the type of solid waste, the depth of solid waste deposits, the depth to groundwater, and the groundwater flow system. Recently, regulatory policies on the siting of landfills have resulted in the use of such landfills only in unusual situations with only the most favorable site conditions. This type of landfill is not considered by the Wisconsin Department of Natural Resources to be suitable for the disposal of large volumes of municipal waste materials.

Lined Landfill: If soil conditions are such that natural attenuation of the leachate will not take place, a clay or other artificial liner may be constructed to minimize the downward vertical migration of the leachate. This liner is designed to allow the leachate to be collected in an underdrain system and transported to a sewage treatment plant for disposal. By stopping the downward migration of leachate, adverse impacts on the underlying groundwater systems can be avoided; and by collecting the leachate and conveying it to a sewage treatment plant for treatment prior to disposal, adverse impacts on surface water can be avoided.

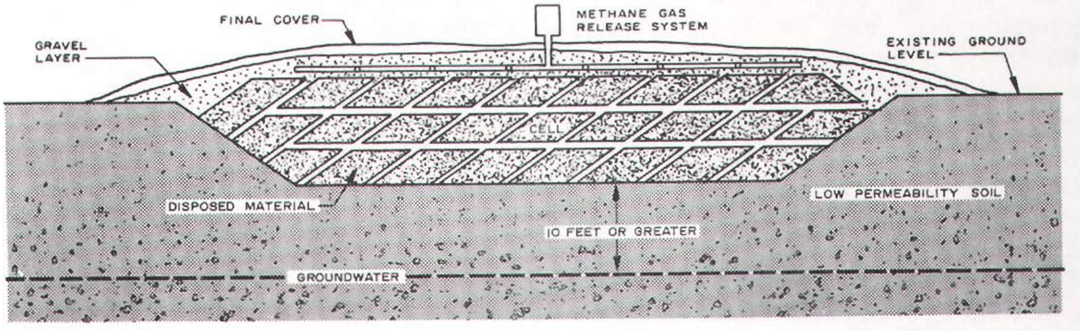
Clay-lined sites are generally located in areas with at least some heavy soils such as clay silts, clay tills, and sandy silts. However, sites with sandier granular soils may also be used if offsite materials are hauled in for liner and final cover material. A minimum separation distance of 10 feet to the high groundwater is generally needed. Significant earthwork and construction control are required in the development of clay liners, and long-term care and maintenance of the landfill site after filling is generally required.

A variation of the lined site is the "retarder" lined site. A retarder is a blended soil layer which retards but does not totally block the downward migration of leachate. The objective of the retarder is to attenuate the more hazardous constituents of the leachate by selecting proper soils for the construction of the retarder and by maintaining a permeability which allows the less harmful constituents to migrate through the retarder. A retarder site must be located and designed so that the underlying groundwater system and

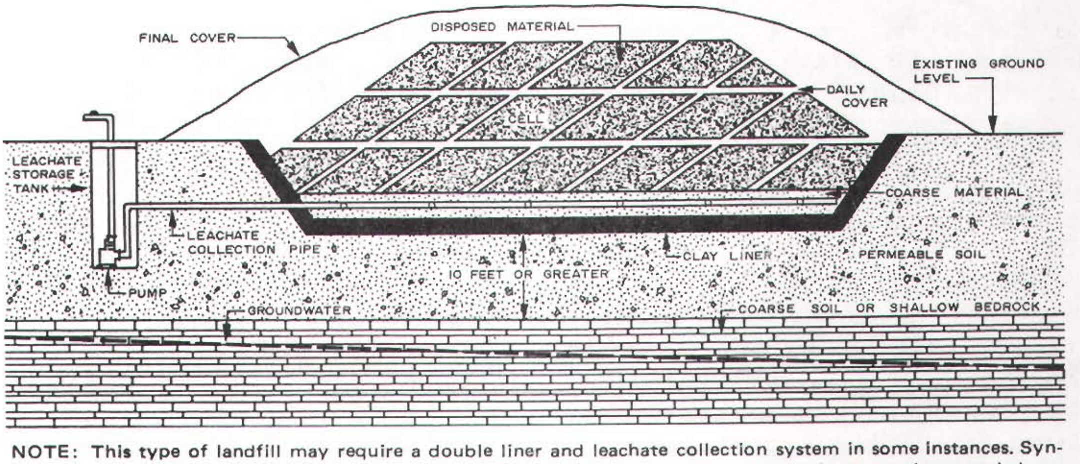
Figure 13

## TYPES OF LANDFILLS UTILIZED IN THE STATE OF WISCONSIN

### NATURAL ATTENUATION LANDFILL

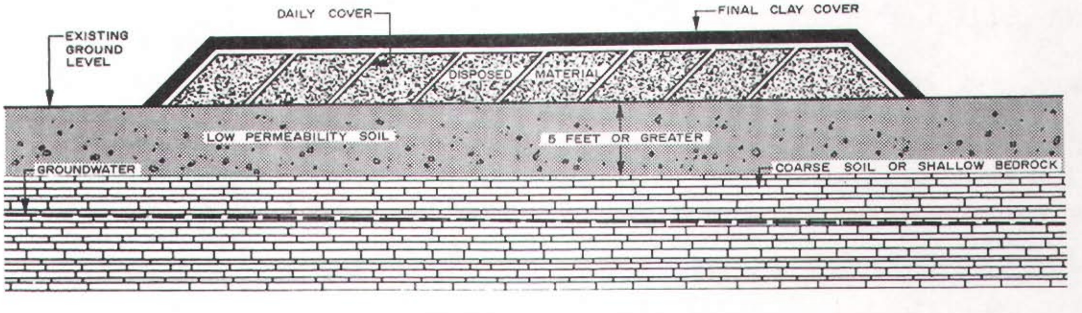



### CLAY-LINED LANDFILL

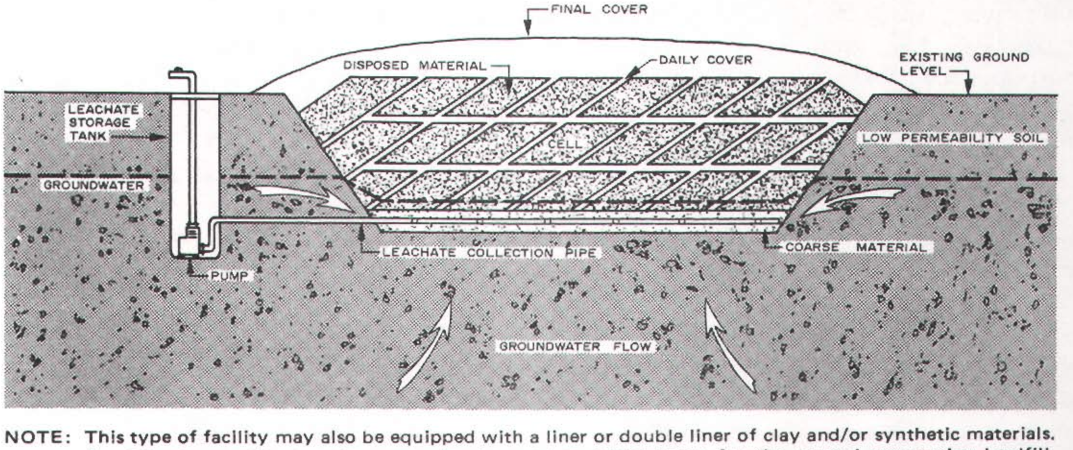



NOTE: This type of landfill may require a double liner and leachate collection system in some instances. Synthetic lining material may also be used. A methane gas release system may also be used as noted above for the natural attenuation landfill.

### SHALLOW LIFT LANDFILL




### ZONE OF SATURATION LANDFILL




NOTE: This type of facility may also be equipped with a liner or double liner of clay and/or synthetic materials. A methane gas release system may also be used as noted above for the natural attenuation landfill.

Source: SEWRPC.

soil can be relied upon for the natural dilution and further attenuation of the less hazardous constituents in the leachate migrating through the retarder. The advantages of the retarder over the liner are that it decreases the amount of leachate that must be ultimately collected and removed from the landfill site and that it relies on natural phenomena for the attenuation of the leachate. Large retarder-type landfills are not generally feasible because a significant thickness of retarder and favorable groundwater conditions are required to attenuate the quantities of leachate associated with larger landfills. Retarder landfills appear to be more appropriate in areas where leachate treatment facilities such as sewage treatment plants are located at long haul distances, or are at--or exceeding--plant capacity. The retarder is similar in construction to the clay liner; however, the retarder is composed of soils that have a smaller fraction of clay. Evaluations of clay minerology, compaction, permeability, and other factors are essential for the retarder concept to work.

In some instances, two linings and two leachate collection systems may be needed. The clay lining may be supplemented with synthetic materials. In Wisconsin, large municipal landfills are required by the Wisconsin Department of Natural Resources to be either clay lined or of a zone of saturation design.

Zone of Saturation Landfill: A zone of saturation landfill site is developed through the excavation of clay soils below the water table. The clay soils chosen for such a site are of such a low permeability that during excavation the rate of infiltration does not exceed the rate of evaporation, and there is no net gain of accumulated water within the excavation. After the site has been excavated, a leachate collection system is constructed at the base of the landfill. During and after active filling operations, some groundwater will migrate into the site to make contact with the refuse and will subsequently form leachate. Percolation from precipitation will also enter to form leachate. Because of the inward migration of groundwater, the leachate quality becomes somewhat diluted. Leachate strength and volume, however, are similar to the strength and volume of leachate from clay-lined landfills. This is withdrawn by the leachate collection system.

A zone of saturation landfill site may be expected to generate higher quantities of leachate because of the groundwater component of infiltration. The inward infiltration of groundwater prevents the outward migration of leachate, and a properly developed zone of saturation site will result in no discharge of leachate to the groundwater system. This inward migration of groundwater will somewhat dilute the leachate. Locating a zone of saturation site adjacent to or in a groundwater discharge area may yield one of the most environmentally desirable landfill facilities. While the operational costs and development costs of such a landfill site may be comparable to those of natural attenuation sites, the long-term care and maintenance costs of such a facility following filling are relatively high. The nature of the groundwater system may require continuing removal of leachate from such a facility long after filling has ceased.

These landfills may have one or two clay liners and leachate collection systems, depending upon the subsurface conditions and the type of material to be landfilled. In some cases a synthetic lining material is used in conjunction with the clay; however, synthetics have not yet been used in conjunction with zone of saturation landfills in Wisconsin.

Shallow Lift Landfill: A variation of the natural attenuation landfill applicable for small communities is the shallow lift landfill. This type involves the construction of one lift of refuse, six to eight feet in thickness, over a clayey type soil that may be five or more feet thick. This type of landfill construction has been limited to the unglaciated areas of southwest and western Wisconsin. Underlying the clay soil may be bedrock, shallow groundwater, or other unsuitable soil or groundwater conditions. The impact on the groundwater is considered to be minimized because of the low refuse depth. Operating a shallow lift landfill site requires the placement of final cover on each cell as each cell is completed. Therefore, the waste is "sandwiched" in clay materials which virtually eliminates infiltration during operation and significantly decreases infiltration after abandonment. Shallow lift landfill sites are usually suitable only for small communities since they require significant acreage per unit volume of waste deposited because of the shallow depth of refuse. Considerable earthwork may be required in the development of a shallow lift landfill because of the need to place final cover upon each cell, and for additional base grade preparation such as removal of topsoil, addition of clay materials, and grading. The primary advantage of the shallow lift landfill is that it allows the development of a waste disposal facility within otherwise marginally suitable areas.

Other Disposal Considerations: Leachate removal from any of the above-noted engineered sites is a major consideration in landfill planning and development. The leachate can be disposed of by processing in a sewage treatment plant either without or following pre-treatment. This method of disposal requires detailed studies comparing the estimated quantity and character of the leachate to the amount of wastewater treated and the capacity of the sewage treatment plant. Unless the plant wastewater flow is very large in comparison to the leachate quantity, holding or storage tanks may be considered at the plant to allow the leachate to be fed into the plant at an acceptably slow rate.

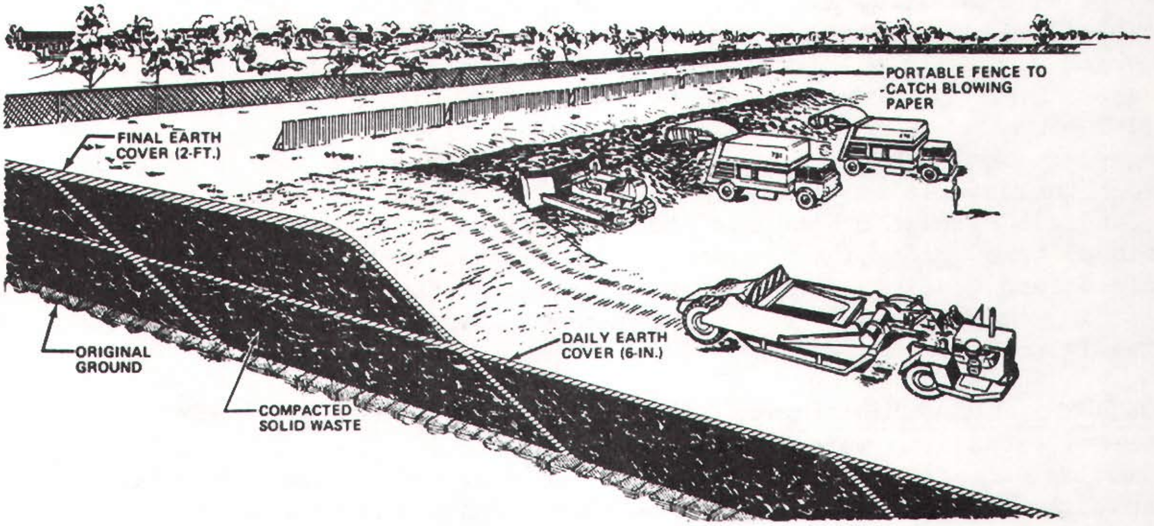
An additional consideration in landfill planning and development is the need to control gases which accumulate within the landfill. Decomposition of landfilled refuse results in the production of a mixture of gases, including primarily carbon dioxide, methane, nitrogen, and, on occasion, hydrogen sulfide. Generation of carbon dioxide is of concern because it is water soluble and can be absorbed by landfill leachate, thereby decreasing the pH and increasing the corrosiveness of the leachate. Methane, which is virtually insoluble, can move by diffusion up from the decomposing refuse into the atmosphere, or laterally into adjacent areas. Concentrations of methane in the atmosphere of between 5 and 15 percent are explosive. Gas migration can be controlled through the use of impermeable liners, construction of trenches to intercept and vent the migrating gases, and installation of collector pipes, fans, and venting systems. These gases can be collected and burned to generate energy, or collected, cleaned, and used as a substitute for, or as a supplement to, natural or propane gas.

Operational Methods: The principal operational methods used for landfilling may be classified as: 1) area, 2) trench, as shown in Figure 14, and 3) depression.

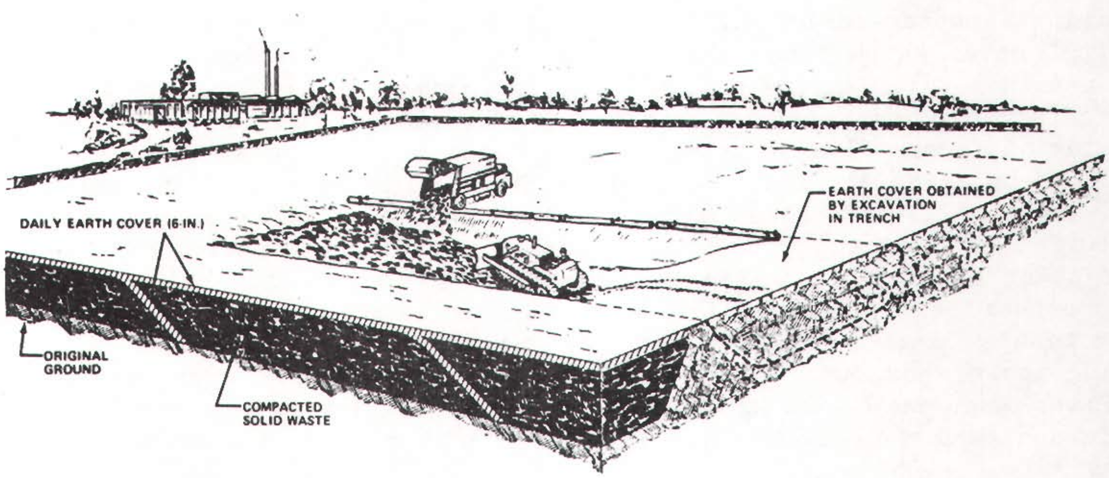
The area method consists of unloading and spreading the wastes in narrow strips on the surface of the land in a series of layers. Each layer is compacted as the filling progresses. At the end of each working day, daily cover is placed

## Figure 14

## METHODS OF LANDFILL OPERATION




IN THE AREA METHOD OF SANITARY LANDFILLING, A BULLDOZER SPREADS AND COMPACTS THE WASTE ON THE NATURAL SURFACE OF THE GROUND, AND A SCRAPER IS USED TO HAUL THE COVER MATERIAL AT THE END OF THE DAY'S OPERATION




IN THE TRENCH METHOD OF SANITARY LANDFILLING, THE COLLECTION TRUCK DEPOSITS ITS LOAD INTO A TRENCH WHERE A BULLDOZER SPREADS AND COMPACTS IT. AT THE END OF THE DAY THE TRENCH IS EXTENDED, AND THE EXCAVATED SOILS ARE USED AS DAILY COVER MATERIAL

Source: U. S. Environmental Protection Agency and SEWRPC.

over the completed fill. The cover material must be hauled in by truck or earth-moving equipment from adjacent land or from borrow-pit areas. Because of the potential costs and problems associated with obtaining suitable cover material, the application of this method should be preceded by a detailed engineering feasibility study. This method is favorable for sites proposed to accommodate high volumes of wastes.

The ramp method of operation is a variation of the area method in which earth cover is excavated immediately in front of the active working face of the landfill. In this way, a small excavation is made for a portion of the next day's waste. This technique allows for more efficient use of the disposal site when a single lift is constructed than the area method does because cover does not have to be imported from other areas.

The trench method of landfilling is ideally suited to areas where an adequate depth of cover material is available at the site and the groundwater table is low. To start the process, a portion of the trench is dug and the excavated material is stockpiled to form an embankment behind the first trench. Wastes are then placed in the trench, spread into thin layers, and compacted. The active fill area should be large enough to avoid costly delays for collection vehicles waiting to unload. Cover material is obtained by excavating an adjacent trench or continuing the trench that is being filled. This method is quite adaptable to varying but relatively low quantities of wastes.

The depression method is often used effectively for landfilling operations at locations where natural or artificial depressions exist. Dry borrow pits and other depressions are commonly used for this purpose. The techniques used to place and compact solid wastes in depression landfills vary with the geometry of the site, the characteristics of the cover material, the hydrology and geology of the site, and the access to the site.

The cost of landfilling varies widely with the type and size of landfill. In Kenosha and the surrounding counties, the costs vary from $12 to $27 per ton.

The advantage of landfilling is that it is a low-level, proven technology for the ultimate safe disposal of solid wastes. Landfilling is a method of disposal which is flexible in that nearly all solid wastes can be landfilled with little or no processing. Generally, landfilling is lower in cost than other, higher technology methods of solid waste management. The disadvantages of landfilling are the use of land for disposal, the lack of adequate sites for new landfill development, the potential for groundwater contamination, and the fact that the resource recovery potential in solid waste is not utilized or realized.

Regardless of the other options incorporated into the solid waste management system, landfilling was considered as one component of every alternative plan developed for Kenosha County under the study.

## ALTERNATIVE SOLID WASTE MANAGEMENT SYSTEMS

This section of the report describes alternative solid waste management plans to be considered further for Kenosha County. The selection of these alternatives was based on consideration of the existing solid waste management systems operating in the County, state regulations governing solid waste management, the solid waste management objectives established under the study, and the evaluation of the techniques contained in the previous section. For the purpose of this discussion, alternatives for residential, commercial, and industrial wastes are discussed separately from alternatives for sewage treatment plant sludge. More detailed descriptions and analyses of each of the alternatives set forth below, including both monetary and environmental costs, are provided in Chapter VII.

The following techniques were found to be potentially viable for the management of residential, commercial, and industrial solid wastes in Kenosha County and were incorporated into the alternative plans.

Source Separation
- Pre-collection separation with recycling centers.

Storage
- System similar to existing practices incorporating cans, bags, and bulk containers.

Collection
- System similar to existing practices relying principally on municipal and private collection operations.

Transfer
- Transfer from collection trucks to larger capacity trucks or bulk containers.

Transportation
- Collection vehicles.
- Large-capacity trucks.

Processing
- Shredding.
- Incineration.

Resource Recovery
- Steam production.
- Electric power production.
- Refuse-derived fuel production.

Disposal
- Sanitary landfill.

The alternative solid waste management system plans pertaining to residential, commercial, and industrial wastes considered worthy of further analyses under the study are presented below. Each of the alternative system plans is evaluated in detail in Chapter VII.

1. Continued use of the existing solid waste management system, including all existing functions. This alternative includes provisions for the improvement of existing facilities not now in compliance with current state solid waste management regulations, and the initiation of a countywide recycling program as required by State law.

2. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems; and

   - Disposal at one existing major commercial general-use landfill.

3. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems; and

   - Disposal at two existing major commercial general-use landfills.

4. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems;

   - One incinerator designed for steam generation; and

   - Disposal at two existing major commercial general-use landfills.

5. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems;

   - One incinerator designed for electric power generation; and

   - Disposal at two major commercial general-use landfills.

6. A system similar to Alternative 4 but including two incinerators designed for steam generation.

7. A system similar to Alternative 5 but including two incinerators designed for electric power generation.

8. A system consisting of the following functions:

   - Storage, collection, and transfer using techniques similar to those used by existing systems; and

   - Shredding and processing of a portion of the solid waste into refuse-derived fuel for marketing and/or incineration at a dedicated system designed for RDF.

In addition, consideration will be given to combining a high level of recycling with those alternatives which would appear most favorable. This recycling option could include the separate collection of newsprint, composting, and increased use of community recycling systems.

The techniques found potentially viable for the management of sewage treatment plant sludge were:

Transportation
- System similar to existing practices relying principally on municipal and private transportation operations.

Processing
- Incineration.
- Composting.

Resource Recovery
- Steam and electric power production.
- Land spreading on agricultural lands.

Disposal
- Sanitary landfill.

The alternative solid waste management system plans for sewage treatment plant sludge considered worthy of further analyses under the study are presented below. Each of the alternative system plans is evaluated in detail in Chapter VII.

1. Continued use of the existing sewage treatment plant sludge management system, including all existing functions.

2. A system consisting of the following functions:
   - Transportation using techniques similar to those used by the existing systems; and
   - Disposal at one existing major commercial general-use landfill.

3. A system similar to Alternative 3, but with incineration of the unprocessed sewage treatment plant sludge.

4. A system consisting of the following functions:
   - Transportation using techniques similar to those used by the existing systems;
   - Processing of sewage treatment plant sludge using a composting system; and
   - Disposal at one existing major commercial general-use landfill, primarily as a backup system.

5. A system consisting of the following functions:
   - Transportation using techniques similar to those used by the existing systems;
   - Land spreading of sewage treatment plant sludge on agricultural lands; and
   - Disposal at one existing major commercial general-use landfill, primarily as a backup system.

6. A system consisting of the following functions:
   - Transportation using techniques similar to those used by the existing systems;
   - Production of a fertilizer-soil conditioner product using dewatered sludge as a base; and
   - Disposal at one existing major commercial general-use landfill.

# Chapter VI

# INVENTORY AND GENERAL EVALUATION OF IMPLEMENTATION METHODS

## INTRODUCTION

A wide range of implementation measures are available to public agencies in Wisconsin for carrying out a solid waste management system plan. This chapter discusses the institutional and legal mechanisms and organizational and cooperative arrangements relevant to plan implementation, and presents options for financing, and for operational management and staffing. The discussion emphasizes implementation strategies for a countywide program, identifies the advantages and disadvantages of the various measures, and identifies those implementation measures which have good potential for application in Kenosha County.

## BASIC CONCEPTS AND PRINCIPLES RELATING TO PLAN IMPLEMENTATION

Before identifying specific plan implementation measures, it is useful to consider certain basic concepts and principles that bear on the sound implementation of a solid waste management plan. These include the use of the existing institutional structure to the maximum extent possible; plan adoption and support by member units of government to ensure successful plan implementation; and coordination and cooperation among the many units and agencies of government involved.

The solid waste management plan for Kenosha County is intended to emphasize, to the maximum extent possible, implementation measures based upon, and related to, the existing governmental structure, existing governmental programs, and existing legislation. Accordingly, the initial step in the plan implementation process is the formal adoption of the recommended solid waste management plan by the designated management agencies and other affected units and agencies of government. Such adoption signifies intergovernmental understanding of, and agreement on, the recommendations contained in the plan. Furthermore, such formal action should serve as notice to other governmental units and agency staffs to begin the process of integrating the plan recommendations with other ongoing programs. In the absence of such formal action, neither the staffs of the agencies and units of government nor the general public at large can know what the formal position of the unit and agencies of government concerned may be with respect to this important matter.

One of the basic concepts supported by the Technical Advisory Committee for the Kenosha County solid waste management plan was the promotion of a cooperative approach to the solid waste management problems of the County by all of the various units and agencies of government concerned with solid waste management within the County. In the absence of a new countywide unit of government responsible for all aspects of solid waste management, a great deal of intergovernmental coordination and cooperation will be necessary to implement the recommended plan effectively and efficiently.

The following review and analysis pertains to source separation, transfer, processing, and disposal. It is assumed that the storage, collection, and transportation functions will continue to be carried out by the local communities, individual generators, and private contractors. Thus, implementation measures for storage, collection, and transportation are not explicitly considered herein.

## INSTITUTIONAL AND LEGAL MECHANISMS

The most common institutional arrangement for solid waste management in Kenosha County is contractual agreements between private industry-landfill operators or solid waste collection firms and those responsible for solid waste disposal--local units of government, industrial and commercial establishments, and individuals. Under these agreements, the private sector assumes responsibility for the proper siting, design, and operation of the landfill facilities required for waste disposal, or, in the case of collection firms, responsibility for maintaining the collection and transportation equipment and staff. The contractual agreements are made, in some cases, between local units of government and private contractors and, in other cases, directly between individual industrial and commercial establishments and institutions and the contractors.

Under Wisconsin law, counties, cities, villages, towns, and special institutional districts have the authority to manage solid waste alone or in cooperation with one another. The private sector, including both individuals and organizations, also has authority to carry out solid waste management activities. Because of the many and varied agencies which may be involved in solid waste management within the County, it is important to identify those agencies having the legal authority and financial capability to most effectively implement the solid waste management plan. Accordingly, those agencies whose actions will have a significant effect either directly or indirectly upon the successful implementation of the solid waste management plan, and whose full cooperation in plan implementation will be important, if not absolutely essential, are listed and discussed below.

### County

County government has been granted the largest measure of organizational authority subject to the constitution and general laws of the State. With the passage of Chapter 30, Laws of 1971, counties have been granted the optional authority to plan, organize, finance, and implement programs to effect the storage, collection, transportation, processing, recycling, or final disposition of solid waste. Section 59.07 of the Wisconsin Statutes provides authority for counties to create a solid waste management board and to retain a solid waste manager to operate a county system. The solid waste management board is authorized to:

1. Develop plans for a solid waste management system;

2. Collect, transport, dispose of, destroy, or transform wastes within the county or joint county area, including, without restriction because of enumeration: garbage, ash, or incinerator residue; municipal, domestic, agricultural, industrial, and commercial rubbish; and waste or refuse material, including explosives, pathological waste, chemical waste, and herbicide and pesticide wastes;

3. Acquire lands by purchase, lease, donation, or eminent domain within the county for use in the solid waste management system;

4. Authorize employees or agents to enter upon lands to conduct reasonable and necessary investigations and tests to determine the suitability of sites for solid waste management activities whenever permission is obtained from the property owner;

5. Acquire by purchase, lease, donation, or eminent domain such easements, or other limited interests in lands, as are desired or needed to assure compatible land use in the environs of any site that is part of the solid waste disposal system;

6. Establish operations and methods of waste management as are deemed appropriate. Waste burial operations shall be in accordance with sanitary landfill methods and the sites shall, insofar as practicable, be restored and made suitable for attractive recreational or productive use upon completion of waste disposal operations;

7. Acquire necessary equipment, or use equipment and facilities of the county highway agency, and construct, equip, and operate incinerators or other structures to be used in the solid waste management system;

8. Adopt and enforce ordinances necessary for the conduct of the solid waste management system and provide forfeitures for violations;

9. Contract with private collectors, transporters, or municipalities to receive and dispose of waste;

10. Engage in, sponsor, or co-sponsor research and demonstration projects intended to improve the techniques of solid waste management, or to increase the extent of reuse or recycling of materials and resources included within the waste;

11. Accept funds derived from state or federal grant or assistance programs and enter into necessary contracts or agreements;

12. Appropriate funds and levy taxes to provide funds for acquisition or lease of sites, easements, and necessary facilities and equipment, and for all other costs required for the solid waste management system. However, no town, city, or village which operates its own waste collection and/or disposal facility, or property therein, shall be subject to any tax levied hereunder to cover the cost of operation of these functions. Such appropriations may be treated as a revolving capital fund to be reimbursed from proceeds of the system;

13. Make payments to any municipality in which county disposal sites or facilities are located to cover the reasonable costs of services rendered to such sites or facilities;

14. Charge or assess reasonable fees approximately commensurate with the costs of services rendered to persons using the services of the county solid waste management system. Fees may include a reasonable charge for depreciation which shall create a reserve for future capital outlays for

waste disposal facilities or equipment. All assessments for liquid waste shall be by volume;

15. Create districts with different types of solid waste collection or disposal services provided within them, and different regulations and cost allocations within each service district. Costs allocated to such service districts may be provided by a general tax upon the property of the respective districts, or by allocation of charges to the cities, villages, or towns whose territory is included within such districts; and

16. Utilize or dispose of, by sale or otherwise, any and all products or by-products of the solid waste management system.

The alternative to creating such a county solid waste management board, if the County becomes involved in solid waste management, is to carry out the management actions through one of the standing committees of the County Board, or through one of the established county commissions.

Actions or authorities exercised by a county or its solid waste management board generally do not require the approval of municipalities using such services. While county government has thus been given broad authority in Wisconsin to manage solid wastes, any city, village, or town may opt out of a county solid waste program by simply operating its own collection and disposal facility unless the optional waste streamflow control powers granted to the county by the Statutes are exercised.

Solid waste streamflow control powers are available to the County as well as to the cities, villages, and towns which have a resident population of greater than 10,000 persons, based upon amendments to Chapter 144 of the Wisconsin Statutes. The County or a qualifying municipality can use flow control to direct by ordinance solid waste produced within its geographic limits either to a designated recycling center or to a resource recovery center, such as an incinerator producing steam or electricity from solid waste. The County must indicate which wastes are to be covered by the flow control, both by the type of waste and by the geographic area to which the ordinance applies. It is important to note that under Chapter 144.794(4)(b) of the Wisconsin Statutes, Kenosha County may not adopt an initial intent resolution to establish a waste flow control ordinance which covers solid waste in a municipality if that municipality has already adopted such an initial intent resolution. Furthermore, if Kenosha County were to adopt an initial intent resolution to establish a waste flow control ordinance, it would not be valid in a municipality that adopted a resolution of refusal to participate in a county waste flow control program within six weeks after adoption of the County's initial intent resolution, and then adopted an initial intent resolution to establish waste flow control in that community within three months following adoption of the county initial intent resolution. Certain wastes are exempt from flow control, including:

1. Commercial or industrial waste which is privately processed and reused;

2. Waste separated by the generator for sale, reuse, or recycling;

3. Single-family waste disposed of onsite;

4. Commercial or industrial waste disposed of in a facility owned by the generator;

5. Sewage or industrial sludge;

6. Waste processed by a recycling or resource recovery facility which existed on or before January 1, 1984, or for which a feasibility report or permit application was received by the Wisconsin Department of Natural Resources by January 1, 1984;

7. Solid waste from a town which has entered into an agreement with a city or village for the resource recovery or recycling of its wastes, if the city or village has a flow control ordinance; and

8. Solid waste which any municipality determines is not suitable for recycling or recovery.

The County or a municipality proposing flow control must determine that the use of such control is in the public interest, based upon a set of criteria specified in the law. These criteria include:

1. That the required use will result in the reuse or recovery of material from solid waste;

2. That the required use will lessen the demand for solid waste disposal facilities;

3. That the required use will conserve natural resources or energy;

4. That the required use is necessary to obtain the type and quantity of solid waste needed to make the facility economically feasible;

5. That alternatives to the required use which may be used to obtain the necessary types and quantity of solid waste have been compiled, analyzed, and considered;

6. That the required use is consistent with planning efforts of the county or municipality;

7. That the required use is consistent with any current solid waste management plan;

8. That the operation of the facility is technically feasible and will not result in significant adverse environmental impacts;

9. That the required use will be responsive to concerns expressed at the public hearing;

10. That the construction and operation of the proposed facility will comply with Chapter 144 of the State Statutes and that all necessary permits, licenses, and approvals required by the Department of Natural Resources will be obtained; and

11. That the proposed effective period of the flow control ordinance is reasonable.

A public hearing must be held by the municipality prior to making any determination that the required use is in the public interest.

It should be noted that to date, this solid waste streamflow control power has not been utilized by any county or municipality in the State. However, several municipalities in the State have adopted initial intent resolutions, the first step in establishing flow control over the waste stream. Two communities are now in the process of preparing a comprehensive project facility description report for Wisconsin Department of Natural Resources review and approval. Preparation of this report is the second step in the process to adopt a flow control ordinance. The feature of the law which provides for compensation to affected facilities has been a significant deterrent to its use. The provision requires counties or municipalities that utilize flow control to compensate owners of solid waste facilities for any adverse impacts from the imposition of a required use order. Landfill owners are eligible for compensation only if the landfill is an approved facility as defined by Section 144.441(2)(a) of the State Statutes. All affected solid waste facilities are eligible for compensation, and Section 144.794(14) of the Statutes provides a specific formula for compensating owners of solid waste disposal facilities and collection services. The components of the formula vary for landfill owners and collection firms, and thus compensation needs to be evaluated on a case-by-case basis using the rules established in the Statute.

## Cities and Villages

Cities and villages possess adequate authority to implement solid waste management plans. Cities and villages are authorized under Sections 66.049, 62.225, and 61.345 of the Wisconsin Statutes to deal with the collection and disposal of solid waste and the institution of recycling or resource recovery facilities.

It is often difficult for local units of government to locate landfill sites within their own geographic area of jurisdiction. This is particularly true in Kenosha County because of the lack of environmentally suitable and politically acceptable tracts of land. Furthermore, site selection and construction and operation of a landfill require a substantial capital expenditure, and call for a long-term financial and legal commitment by the municipality.

Local units of government can, however, effectively site other types of solid waste management facilities, particularly collection and transportation facilities and recycling operations. Resource recovery systems such as incineration with energy recovery can also be effectively carried out by local units of government; however, some of the concerns regarding the siting of landfills will also be applicable for the siting of these facilities.

## Metropolitan Sewerage District

A county board may authorize a metropolitan sewerage district to exercise all of the solid waste management powers granted to the county board under Section 59.07 of the Wisconsin Statutes except the power to acquire land by eminent domain. County board approval is not required for the management of solid wastes contained in or produced as a by-product of district sewage treatment activities. There are no metropolitan sewerage districts in Kenosha County.

## Intergovernmental Agreements

Local governments may also provide for solid waste management through intergovernmental agreements under Section 66.30 of the Wisconsin Statutes. These joint agreements are clearly limited to those joint powers which the local governmental units can legally perform individually.

## Joint Sewerage Commission

Solid waste disposal services may also be provided by a joint sewerage commission formed by two or more cities, villages, town sanitary districts, or town utility districts under Section 144.07 of the Wisconsin Statutes. No such commissions exist in Kenosha County.

## Private Sector

The private sector, including both individuals and companies, has the implied authority to carry out solid waste management activities. There are many private concerns involved in collecting, processing, storing, and disposing of solid waste, and there are many industries that handle and dispose of the wastes generated by their industrial processes. While there is no specific legislative delegation of authority to private entities, they are certainly not prohibited from handling solid waste, and, as previously noted, such entities have played a large part in managing solid wastes generated in Kenosha County.

## Centralized Solid Waste Management Agency

To better provide for solid waste management, some states have considered legislation providing for the creation of centralized solid waste management authorities at the state or multicounty regional level. Such legislation assumes that a central agency can more efficiently plan, organize, finance, and implement solid waste management programs. In Wisconsin, such a strong centralized authority--Solid Waste Recycling Authority (WSWRA)--was established by the Legislature with the enactment of Chapter 305, Laws of 1973. The WSWRA was a unique, quasi-governmental corporation charged with maximizing resource recovery by planning for and implementing systems for the recovery of energy and material resources from solid wastes. The WSWRA was mandated to develop regional recycling facilities to acquire, process, and recover solid waste throughout Wisconsin. The WSWRA had the ability to control the flow of solid waste and to issue bonds to finance projects. In addition, this authority had excellent leadership. However, as of 1983, no recycling project had been put in place, indicating the difficulty in establishing large recycling projects. The authority was dissolved by the Legislature in 1983. While the use of regional or statewide authorities appears to be an institutional option, this option will not be considered further in the Kenosha County plan, which is intended to be conducted within the framework of the existing legal and institutional structure. As noted above, under Wisconsin law, counties, cities, villages, towns, and special institutional districts have the authority to manage solid waste alone or in cooperation with one another. These arrangements apparently have been judged adequate for carrying out any county plan recommendations by the Wisconsin Department of Natural Resources, which has emphasized local implementing agencies for conventional solid waste management by promoting the county as the geographic scope of planning activities.

## Summary

As discussed above, all local governmental units in Kenosha County have been granted authority by the State to manage solid wastes. All of the above-noted institutional and legal arrangements are presently used for solid waste management within Kenosha County with two exceptions: 1) The County has no metropolitan sewerage districts; and 2) the County has no joint sewerage commission arrangements. Thus, nearly all of the institutional approaches may be considered to be viable means of implementing a solid waste management plan for Kenosha County.

# ORGANIZATIONAL AND COOPERATIVE ARRANGEMENTS

Solid waste management services are most frequently provided under one of four basic arrangements:

1. As public services, usually by a governmental department. Under this arrangement, services are provided by counties or municipalities with public employees and publicly owned equipment.

2. By private firms under contract to a governmental unit. Under this arrangement, the contractor retains the labor and owns the equipment involved, and must meet performance criteria set forth in the contract governing the provision of the services.

3. By private firms in open competition, with little, if any, governmental regulation. Under this approach, the private contractor makes arrangements for the provision of services directly with the households, businesses, and industries generating the solid wastes.

4. By private firms operating under exclusive franchises by which each is licensed to operate alone in a given area. This option is generally applicable only to the collection function and is considered viable in Kenosha County only for use as a collection arrangement.

Numerous variations of these four basic types of public and private solid waste management operations are possible. Table 33 lists eight organizational alternatives with the advantages and disadvantages, as well as other selected information on each alternative. Those alternatives considered practicable for use in Kenosha County are noted. The alternatives are discussed below.

## Privately Owned and Operated Solid Waste Management Systems

Under this alternative, a particular solid waste management system component would be owned and operated on a private commercial basis. Generally, the operator would contract for services with the local units of government. The principal advantage of this system is that the local units of government do not incur a large capital expenditure for development and operation of the solid waste management facilities. The principal disadvantage is that the local communities have less control over the costs and operational methods used. In addition, planning for systems operated by private industry is unlikely to be an open process in which local officials and citizens can participate to ensure that both the existing and probable future waste management needs of the

## Table 33

## SELECTED INFORMATION ON ALTERNATIVE SOLID WASTE MANAGEMENT ORGANIZATIONAL ARRANGEMENTS

| Solid Waste Management Organizational Arrangements | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | Decision Policy and Decision-Makers | Methods for Distribution of Costs | Daily Management | Conclusions Regarding Application in Kenosha County |
|---|---|---|---|---|---|---|
| Privately Owned and Operated Systems | -No large capital expenditure by local government for development and operation of solid waste management facilities<br>-Users do not pay for service through increased taxes<br>-Local government does not face uncertainties of new technologies and fluctuating markets for recyclable goods<br>-Potential for improved cost effectiveness<br>-Private contractor contributes to tax base | -Decisions by contractor based primarily on financial considerations<br>-Limited control by local units of government over solid waste management fees and services in the community<br>-Does not provide for countywide long-range planning | Private contractor and negotiations with generators | Individual user fees and contracts with municipalities | Private contractor totally responsible for management | Viable alternative |
| Individual Municipally Owned and Privately Operated Systems | -Provides for a high level of autonomy and control by the local community in the development and operation of the solid waste management system | -Requires large capital expenditure by local unit of government for development and operation of the solid waste management system<br>-Does not provide for countywide long-range planning<br>-Local governments face the uncertainty of new technology and fluctuating markets for recyclable goods<br>-Potential for high cost due to small scale | Board, commission, or agency with policy-making and review authority representing the municipality | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to policy-making unit by participating municipality and individual users and then passed on to private contractor; or municipality and individual users make payments directly to private contractor | Private contractor responsible for day-to-day management subject to approval and periodic review by policy-making unit | Viable alternative for major system components such as a landfill or incinerator for the largest municipalities only. Could be viable for transfer stations or recycling centers for any municipality |
| Individual Municipally Owned and Operated Systems | -Provides for total control of all aspects of solid waste management in the community | -Requires large capital expenditure by local unit of government for development and operation of the solid waste system<br>-Does not provide for countywide long-range planning<br>-Local governments would face the uncertainties of new technology and fluctuating markets for recyclable goods<br>-Potential for inefficiency and high cost due to small scale | Board, commission, or agency with policy-making and review authority representing the municipality | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation or any combination of these<br>-Payments made to policy-making unit by participating municipality and individual users to cover capital and/or operating costs | Personnel hired by policy-making unit with delegated authority to manage system subject to approval and periodic review of policy-making unit | Viable alternative for major system components such as a landfill or incinerator for the largest municipalities only. Could be viable for transfer stations or recycling centers for any municipality |
| Multimunicipally Owned Systems Operated by Private Contractors | -Large capital expenditure for development and operation of the solid waste system would be shared by cooperating communities<br>-Provides for a significant amount of local autonomy and control of the system by the local units of government<br>-Potential for improved cost-effectiveness over the individual municipal systems | -Requires a high level of cooperation between the participating communities<br>-Requires large capital investment for local units of government<br>-May not provide for countywide long-range planning<br>-Local governments would face the uncertainty of new technology and fluctuating markets for recyclable goods | Board, commission, or agency with policy-making and review authority representing all participating municipalities | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to policy-making unit by participating municipalities and individual users and then passed on to private contractor; or participating municipalities and individual users make payments directly to private contractor | Private contractor responsible for day-to-day management subject to approval and periodic review of policy-making unit | Viable alternative |

## Table 33 (continued)

| Solid Waste Management Organizational Arrangements | Advantages of Application in Kenosha County | Disadvantages of Application in Kenosha County | Decision Policy and Decision-Makers | Methods for Distribution of Costs | Daily Management | Conclusions Regarding Application in Kenosha County |
|---|---|---|---|---|---|---|
| Multimunicipally Owned and Operated Systems | -Provides for total control of all aspects of solid waste management in the cooperating communities<br>-Improved cost-effectiveness over individually owned and operated municipal solid waste management systems | -Requires large capital expenditure by the local units of government for development and operation of the solid waste management system<br>-May not provide for countywide long-range planning<br>-Local cooperating communities face the uncertainty of new technology and fluctuating markets for recyclable goods<br>-Requires a high level of cooperation between the participating communities | Board, commission, or agency with policy-making and review authority representing all participating municipalities | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to policy-making unit by participating municipalities and individual users to cover capital and/or operating costs | Personnel hired by policy-making unit with delegated authority to manage system subject to approval and periodic review of policy-making unit | Viable alternative |
| County Owned Systems Operated by Private Contractors | -Large capital expenditure for development and operation of solid waste management facility would be shared by county residents<br>-Provides for implementation of long-range countywide planning<br>-Provides for a significant amount of control by the County over the solid waste management system and its operation<br>-Potential for increased cost-effectiveness and efficiency because of increased size and scope of the system | -Requires high level of intercommunity cooperation and coordination<br>-Requires large capital expenditure by county government<br>-County would face the uncertainty of new technology and fluctuating markets for recyclable goods | County board committee or county department or board with policy-making and review authority | -Changes based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to County by participating municipalities and individual users and then passed on to private contractor; or participating municipalities and individual users make payments directly to private contractor | Private contractor responsible for day-to-day management subject to approval and periodic review of policy-making unit | Viable alternative |
| County Owned and Operated Systems | -Large capital expenditure for development and operation of the solid waste management system would be shared by county residents<br>-Provides for implementation of long-range countywide planning<br>-Provides for total control of the solid waste management system by the County<br>-Potential for increased cost-effectiveness and efficiency because of increased size and scope of the system | -Requires high level of intercommunity cooperation and coordination<br>-Requires that the County face the uncertainty of new technology and fluctuating markets for recyclable goods<br>-Requires that the County be involved with day-to-day operation of the facility<br>-Requires large expenditure by county government for capital and operation | County board committee or county department or board with policy-making and review authority | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to the County by participating municipalities and individual users | Hired administrator or manager or member of county department or board responsible for day-to-day management subject to approval and periodic review of policy-making unit | Viable alternative |
| Multicounty Solid Waste Management System | -Large capital expenditures for development and operation of the solid waste management system would be shared by residents of more than one county<br>-Provide for regionalized long-range solid waste management planning<br>-Increased cost-effectiveness and operating efficiency | -Requires very high level of intercommunity cooperation and coordination<br>-Requires large capital expenditure by county government<br>-Reduces the amount of control local communities have on the system | Intercounty board committee or intercounty department or board with policy-making and review authority | -Charges based on service, waste quantity (weight or volume), waste type, population, equalized assessed valuation, or any combination of these<br>-Payments made to participating counties by participating municipalities and individual users | Hired administrator or manager or member of intercounty department or board responsible for day-to-day management subject to approval and periodic review of policy-making unit | Viable alternative |

Source: SEWRPC.

community are met most effectively and efficiently. Such a system is a viable alternative for further consideration in Kenosha County for all of the solid waste management system components.

## Individual Municipally Owned Systems Operated by a Private Contractor

Under this alternative, each local unit of government would own solid waste management facilities designed and operated solely to meet local needs. The facilities would be operated by a private contractor who would contract for services with the local unit of government as a cooperating agency. The principal advantage of such a system is that the local units of government have control over the development and operation of the solid waste management system component serving their communities. Such systems may, however, require large capital outlays by local units of government, and high unit and total operating costs owing to the lack of economies of scale. In addition, such a highly localized system of solid waste management is not likely to provide a coordinated, long-range solution to the solid waste management problems in Kenosha County. Moreover, the development of solid waste facilities is sufficiently complex that it is unlikely that each community would be successful in providing for its own needs at an acceptable cost in the long term.

Such a system is a viable alternative for further consideration by the City of Kenosha for major new system components such as landfills or incinerators. This system also is a viable alternative for further consideration by any community for system components such as recycling centers or transfer stations.

## Individual Municipally Owned and Operated Solid Waste Management System

Under this alternative, the individual municipalities would own and operate the required solid waste management facilities. The principal advantage of such a system is that the local unit of government has full control of the local solid waste management system. However, this alternative would necessitate a large capital outlay by each local unit of government owing to the lack of economies of scale. In addition, such a system may not function as an integrated system throughout the County.

Such a system is a viable alternative for further consideration by the City of Kenosha for major new system components such as landfills or incinerators. This system also is a viable alternative for further consideration by any community for system components such as recycling centers and transfer stations.

## Multi-municipally Owned System Operated by a Private Contractor

Under this alternative, two or more local units of government would jointly own the required solid waste management facilities. The facilities would be operated by a private contractor who would generally contract to provide services to the cooperating governments. The principal advantage of this system is that it provides for a high degree of local municipal control over the development of facilities and services, while the daily operation and overall management of the system is performed by a private contractor. Furthermore, implementation of such a system ensures that a single municipality is not burdened with a large capital outlay for development and operation of the system. Even the shared costs, however, are likely to be high. The principal disadvantage of this system is that it may not provide for a fully coordinated approach to solid waste management in Kenosha County. Furthermore, implementation of such a system could result in a loss of the economies of scale since a number of such systems may be formed within the County, with the potential for large capital outlays and unnecessary duplication of effort. These disadvantages could, however, be overcome by the coordination afforded in a countywide planning effort. Such a system is a viable alternative for further consideration in Kenosha County for all of the solid waste management system components.

## Multi-municipally Owned and Operated Solid Waste Management System

Under this alternative, two or more local units of government would cooperate in the joint ownership and operation of the required solid waste management facilities. The principal advantage of this system is that the solid waste management needs of the communities involved would be adequately addressed, and the operation of the system would be under the control of the cooperating local units of government. The principal disadvantage of such a system is that the communities may be required to make large capital outlays for development of the solid waste management system. Also, implementation of such a system may not provide a comprehensive, long-range solution for solid waste management. Such a system is a viable alternative for further consideration in Kenosha County for all of the solid waste management system components.

## County-Owned System Operated by a Private Contractor

Under this alternative, the County would own the required solid waste management facilities, with the facilities being operated by a private contractor who would contract to provide services with the local units of government, as cooperating agencies. The principal advantage of this system is that it provides for economies of scale through development of those facilities needed on a countywide basis. Development of these facilities would be based on a long-range plan, and the needs of the entire County could be met with a minimum of duplicated effort and expense. This alternative would provide for some degree of county control while utilizing the expertise and incentive of private operation. The principal disadvantage is that a large capital outlay would have to be borne by the County. The system would have to be flexible enough to provide reliable service for all the varied amounts and types of solid waste generated in the County. Such a system is a viable alternative for further consideration in Kenosha County for all of the solid waste management system components.

## County-Owned and -Operated Solid Waste Management System

Under this alternative, the County would own and operate the required solid waste management facilities and system. The principal advantage of this system is that the County is in full control of all aspects of solid waste management and is able to implement a long-range, comprehensive plan. Furthermore, the greatest economies of scale could be achieved through implementation of this system. The principal disadvantage of this alternative is the capital and operation and maintenance costs that would accrue to the County. Such a system would have to be flexible enough to provide reliable service for all the varied amounts and types of solid waste generated in the County. Such a system is a viable alternative for further consideration in Kenosha County for all of the solid waste management system components.

## Multicounty Solid Waste Management System

Under this alternative, two or more counties would jointly own the required solid waste management facilities. Under such an organizational arrangement, either the cooperating counties would operate the facilities, or the counties would retain a private contractor for operation. The principal advantage of this system is that an areawide approach would provide the greatest economies of scale. Furthermore, the capital outlays would be shared by a broad base. The principal disadvantage is that a high level of stable, long-term coordination and cooperation among the participating counties would be required. Without such cooperation, the diversified needs for solid waste disposal by the communities concerned may not be met.

At the present time, the Wisconsin counties bordering Kenosha County are proceeding with the implementation of county-oriented solid waste management plans. Because of the current emphasis by the Wisconsin Department of Natural Resources on solid waste management planning at the county level, it may be concluded that any study should concentrate on the needs of Kenosha County alone. However, such an approach may lead to a less than cost-effective, long-term solution, particularly with respect to special solid waste management needs such as the disposal of toxic and hazardous wastes. Thus, as the management plan is developed, a system which serves an area larger than the County in some or all aspects may need to be considered.

# ALTERNATIVE FINANCING MECHANISMS

A practical plan for financing a solid waste management system is dependent on the type of management organization utilized, since each type of organization has certain legal financing options associated with its structure. The financing needs for solid waste management can be broken down into two categories, capital financing and operation and maintenance financing. Methods of financing presently utilized in Kenosha County are discussed in Chapter II. The methods of financing used by 16 countywide solid waste management systems operating in the State of Wisconsin are shown in Table 34. It should be noted that none of the counties listed presently operate an incinerator disposal system. Alternative mechanisms which can be considered for financing solid waste management systems are discussed below.

## Capital Cost Financing

The development of solid waste management systems often requires large capital outlays. Local units of government and private industry may not have sufficient capital on hand to develop the system without borrowing. The cost of interest over the lifetime of a loan can be a very substantial expense. Thus, it is necessary to look for financing techniques that minimize this cost.

Local units of government have the following alternatives available to them for financing capital expenditures for solid waste management systems: pay-as-you-go, reserve fund financing, loans from the state trust funds, general obligation bonds, special assessment bonds, general obligation-local improvement bonds, public improvement bonds, revenue bonds, promissory notes, bond anticipation notes, contractors' certificates, grants, and leasing. In actual practice, pay-as-you-go, reserve funds, general obligation bonds, and promissory notes are most often used.

## Table 34

## CAPITAL AND OPERATIONS COST MECHANISMS UTILIZED TO FINANCE COUNTYWIDE SOLID WASTE MANAGEMENT LANDFILL SYSTEMS: 1985

| County | Capital Costs | Operation and Maintenance Costs |
|---|---|---|
| Brown | General obligation bonds and general revenues | User fee of $8 per ton |
| Dane | General obligation bonds<br>General revenues plus a promissory note | User fee of $10 per ton<br>User fee of $10 per ton |
| Eau Claire | General obligation bonds | User fee of $8.05 per ton, plus $11.45 per ton on tax role |
| Fond du Lac | General revenues | User fee of $15 per ton |
| Green | Wisconsin State Trust Fund | Local governments are billed a percentage of the total operating costs based on estimated annual tonnage |
| Juneau | General revenues | User fee of $10 per ton |
| La Crosse | General obligation bonds | User fee of $8.50 per ton |
| Lincoln | City of Merrill provided initial capital funds from revenue sharing account. An improvement account and machinery account have been established to cover future capital costs. Dollars for these accounts are provided by revenues generated by landfill operation | City of Merrill pays $4.75 per capita for town residents, $7.16 per capita for city residents |
| Marathon | Promissory note (repaid by general revenues) | User fee of $14 per ton |
| Marquette | General revenues | -- |
| Monroe | General revenues | 55 percent of the operations budget is acquired through user fees charged to residents, and 45 percent is acquired through user fees charged to commercial and industrial sources |
| Oneida | General revenues | User fee of $17.50 per ton |
| Outagamie | Enterprise fund (same principle as municipal revenue bonds with dollars borrowed and repaid by the revenues generated by the landfill operation) | User fee of $10.50 per ton for county users, $15 per ton for noncounty users |
| Sauk | General revenues | Waste generator factor--municipalities are charged according to the amount of waste generated. Estimates of waste produced per employee are used to calculate commercial and industrial user fee |
| Shawano | General revenues | Not available |
| Winnebago | Promissory note (repaid by general revenues) | User fee of $10 per ton for county users, $22 per ton for noncounty users |

Source: Wisconsin Department of Natural Resources and SEWRPC.

The pay-as-you-go system normally is the least costly means of financing capital expenditures. It requires sufficient revenues to pay all bills for capital expenditures as they come due. This alternative may not be practical for very large systems. However, it can be used to fund parts of a total system.

A variation of the pay-as-you-go system is a reserve fund maintained for future expenditures. This reserve fund would be invested until it is needed. Building up a reserve fund avoids having to pay future interest costs for borrowed money; however, it does involve the use of money collected from taxpayers or users which will be used to support future facilities that those contributors may not use.

The state educational funds, set up by Section 25.01 of the Wisconsin Statutes, include four different funds--the common school fund, the normal school fund, the university fund, and the agricultural college fund. This trust fund will loan money to village, city, or county governments for any projects for which the municipality has borrowing authority. Loans from the state educational fund are general obligations of the community. There is a maximum limit of 20 years and $350,000 for a loan from the state educational fund, and there is approximately $15 to $16 million available per year.

Another form of long-term borrowing is the general obligation bond. Counties, cities, and villages can issue general obligation bonds for the financing of solid waste disposal systems. General obligation bonds pledge the faith of the community for repayment of the bonds. The bonds are rated on the credit rating of the entire community and not the individual project. No general public vote is needed by the local government electorate on the issuing of a general obligation bond unless a petition requesting such a vote of at least 10 percent of the voting public is presented to the local unit of government. The amount of money borrowed under a general obligation bond is limited by the debt limit of the county, city, or village, with the current limit at 5 percent of equalized property value. General obligation bonds are usually suitable for situations in which a minimum of $500,000 is to be borrowed.

Special assessment bonds can be issued by all local units of government for any project that is to be financed by a special assessment on local property.

Counties, cities, villages, and towns can also issue general obligation-local improvement bonds. Again, these bonds are sold in anticipation of revenues from special assessments. In towns, the voters must give their approval in a referendum to the issuance of general obligation-local improvement bonds.

Public improvement bonds can be issued by all local municipalities to finance public works projects. These bonds must be repaid within 20 years.

Revenue bonds can be issued by towns, villages, and cities for solid waste collection and disposal facilities, with the revenue to be derived from the facility constructed. Revenue bonds are mortgage bonds for periods of less than 40 years. Because the revenue bond is to be repaid by the revenue of the project to be financed, a detailed financial and technical assessment of the project must be carried out to market revenue bonds. Revenue bonds generally have higher interest rates than do general obligation bonds. These bonds are generally used for projects requiring larger capital expenditures in the range of $1 million or more. These bonds are not subject to the community's debt limit or to referendum approval.

For short-term borrowing, municipalities can issue promissory notes or bond anticipation notes for the acquisition of land or for public works projects, and are a general obligation of the municipality. Promissory notes are issued for periods of up to 10 years. Bond anticipation notes are for periods of five years or less and represent municipal borrowing up to the period when the bonds are sold.

In short-term situations, contractors' certificates can be used to raise money in anticipation of uncollected special assessments. Contractors' certificates represent liens against the property with special assessments.

Grants from state or federal agencies are another source of capital. At this time, no state grants are available for financing capital expenditures for solid waste management. However, grants are available for solid waste management planning, feasibility studies, and special demonstration projects for solid waste disposal systems under the Wisconsin Fund.

A primary source of financing for community utilities and facilities is the Community Development Block Grant (CDBG) program. On an annual basis, the City of Kenosha receives entitlement funding appropriations that are determined by population, poverty levels, overcrowded housing, and the age of the housing stock. The entitlement CDBG program is administered by the U. S. Department of Housing and Urban Development. The objective of this program is to develop viable urban communities with decent housing and suitable living environments and to expand economic opportunities, principally in low- and moderate-income areas. Funds may be used for a wide range of activities directed toward neighborhood revitalization and economic development, including neighborhood conservation, urban planning, continuing urban renewal projects, and social services. In addition, funds may be used to finance local development corporations, to finance commercial or industrial building construction, and to rehabilitate privately owned properties.

The Wisconsin Department of Development (DOD) administers the Small Cities Community Development Block Grant program for the U. S. Department of Housing and Urban Development. Eligible applicants under the program are limited to general-purpose local units of government, including towns, villages, cities, and counties that are not an entitlement city under the program or a part of an eligible urban county. All local governments in Kenosha County except the City of Kenosha are eligible to apply. In order to receive funding, local units of government must compete against other municipalities in the State for the funds through an annual grant competition for public works and housing grant applications, and at any time for economic development grant applications administered by the DOD. A quantitative scoring system is utilized by the DOD in evaluating the applications. Factors such as need, relationship of the proposed project to existing local economic development policies, and the economic development impact of the proposed project are assessed by the DOD in evaluating an application.

The U. S. Department of Commerce, Economic Development Administration (EDA), provides grants to eligible local units of government for projects in support of public works and other facilities developments which result in the creation of new permanent jobs. EDA funds are available for public works projects for up to 50 percent of eligible project costs. All local units of government in Kenosha County, as well as Kenosha County itself, are statistically eligible to apply for these funds. It should be noted that federal regulations prohibit the use of EDA funds for public works projects which result in the installation of equipment that generates electricity for public or private use.

The leasing of land or equipment can be an effective alternative to raising money for capital expenditures. Leasing is a relatively simple method of acquiring needed facilities. Leasing, however, may have high interest or service charges.

Private industry has the following options for financing capital improvements: pay-as-you-go, bank loans, corporate bonds, corporate stock, industrial revenue bonds, grants, and leasing. As described earlier, pay-as-you-go requires sufficient revenue to pay capital expenditures as they come due.

Bank loans are commonly used to raise capital for private industry and individuals. Normally, a bank will require detailed analysis of the financial and technical feasibility of the proposed project before proceeding with a loan.

Corporate bonds are frequently used by large businesses to raise capital. These bonds pay interest to the purchaser and the bond is repaid on the redemption date. Corporate bonds are often thought of only for large corporations; however, small corporations will often also issue bonds which are normally sold mainly within the community of the corporation.

Corporate stock is a share of a corporation which can be sold to raise capital. Stock owners own the corporation and have the right to vote on major company policy decisions and to vote for the board of directors. The company is never expected to repay purchasers of its stock their purchase price. The value of the stock is in the dividends it earns and the value it has due to the value of the corporation.

As is the case with municipalities, private industry can sometimes obtain grants for the construction of solid waste disposal facilities. However, at the current time no state or federal grants for sanitary landfills are available for private industry.

The U. S. Department of Commerce, Small Business Administration, Section 503--certified development company program can be used by private industry to finance capital improvements. Certified development companies are organized under provisions set forth by the U. S. Department of Commerce, Small Business Administration, to provide long-term, fixed-assets financing for the acquisition of land; building construction, expansion, and renovation; and the purchase of equipment. Loans are usually available for up to 25 years at below-market interest rates.

The U. S. Department of Commerce, Economic Development Administration, through its business development program, provides loan guarantees to banks that are making loans to businesses for expansion projects. Direct loans to businesses are also available through the business development program.

Industrial development revenue bonding is a method of public financing used to assist private industry in the construction, enlargement, or equipping of business and industrial firms. Industrial development revenue bonds are issued by a local unit of government and serve to build the community's industrial base, broaden the property tax base, and potentially provide additional employment opportunities. Industrial development revenue bonds are attractive in the bond market because purchasers of the bond are not required to pay taxes on the interest earned by the bond purchased. Industrial development revenue bonds are not general obligations of the issuing local unit of government. The local unit of government issuing industrial revenue bonds is simply in partnership with the business or industry. These bonds are made available on a first-come, first-served basis. The amount of money available statewide in 1985 was based on a $150 per capita limit and totaled $545,000,000.

A city designated as eligible by the U. S. Department of Housing and Urban Development can apply for an urban development action grant, which the city can then lend to a private business or developer for projects involving job creation and rehabilitation and/or construction of public, commercial, industrial, and residential structures. Currently, the City of Kenosha is the only city in Kenosha County that is eligible for this program.

The Wisconsin Housing and Economic Development Administration (WHEDA) provides low-interest financing to businesses and individuals with current annual sales of $35 million or less through its small enterprise economic development (SEED) program. SEED money can be used for the purchase, expansion, and improvement of land, plants, and equipment, and for depreciable research and development expenditures, so long as such projects result in the creation and maintenance of permanent jobs. Eligible projects include manufacturing establishments and storage and distribution facilities for manufactured projects; national or regional headquarters; retail establishments located in Urban Development Action Grant projects or tax incremental financing districts; research and development facilities; recreation and tourism facilities; and facilities involving the production of raw agricultural commodities. The SEED program is most useful to firms purchasing existing facilities, to firms located in municipalities that do not offer industrial development revenue programs, to firms that require fixed-rate, long-term capital, and to credit worthy firms that cannot find a buyer for their bonds.

Along with the preceding methods for raising capital, private industry can lease items, thereby avoiding raising the capital to purchase the items. Leasing is a highly flexible method of acquiring goods, but is usually associated with high interest or service charge costs.

## Operation and Maintenance Cost Financing

Operation and maintenance costs, as well as capital costs, must be financed. Governments in Wisconsin have a larger range of options for generating revenues for the operation and maintenance of solid waste management systems than for generating funds for capital expenditures, including user fees, property taxes, special assessments, sales taxes, recycling, and waste management funds.

For solid waste management systems operated by private industries, the options for raising revenue for the operation and maintenance of the systems are limited to user fees, billing local units of government, recycling, and waste management funds.

User fees can be based upon the amount of waste disposed of in a landfill or other facility, with the charge for disposal based on the tonnage or volume of waste disposed of. Some landfills will charge user fees based on the difficulty in handling the material. User fees have the advantage of being a very equitable system since payment is based upon use. However, user-fee systems have administrative costs which can be substantial, such as, at landfills, the cost of the scale and the scale operator.

Revenues for solid waste management systems are often generated through taxes. Although private industry cannot levy taxes, private companies that provide solid waste management disposal services for a local unit of government can bill the government and have the town, village, city, or county pass on the cost of solid waste management through a local tax. Three types of taxes that are available in Wisconsin for generating revenue for solid waste management are property taxes, special assessments, and sales taxes. Property taxes are relatively easy to administer, but, with regard to equitability, there is no direct relationship between the value of the property and the amount of solid waste management service received by a property. In fact, in some communities, businesses and industries do not receive any tax-supported solid waste management services despite the fact that they pay property taxes. One additional disadvantage is that there is a limit on the amount of property tax that local units of government can levy. As previously discussed, towns cannot have a property tax in excess of 1 percent of total assessed valuation. For villages, the limit is 2 percent of equalized assessed valuation; and for cities the limit is 3.5 percent of equalized assessed valuation.

Another type of revenue-generating tax is the special assessment. The Wisconsin Statutes allow any town, village, or city to make special assessments against property for the value of service received. Special assessments have an advantage in that they can be more equitable than other taxes, with the assessment equal to the level of service provided. One disadvantage of special assessments is that the administrative costs are higher than for general property taxes. With a special assessment, each property must have a specific assessment related to the level of service. Counties cannot levy special assessments; however, it would be possible for a county to bill each community for solid waste services, with each community then developing a special assessment for the property within its jurisdiction.

A third type of local tax available in Wisconsin is the sales tax. Section 77.71 of the Wisconsin Statutes allows counties to levy a sales tax of up to 0.5 percent of gross retail sales, with the tax going back to the towns, villages, and cities. This tax would be collected and distributed by the State, and therefore would have relatively low administrative costs for the local jurisdictions.

A well-developed recycling program can reduce the amount of waste that goes into the landfill and provide revenue. However, many resource recovery programs are not profitable. On the other hand, source separation programs can be profitable, as they rely to a great extent on voluntary labor. However, the potential revenues generally are used for operation improvements and for support of the community groups providing the labor.

Another source of revenue is the waste management fund. Legislation enacted in 1978 provides for a state waste management fund. This fund can provide money for the long-term care of solid waste landfills throughout Wisconsin, as well as payment for the clean-up of damage from an incident at a landfill licensed under the new state regulations. However, these funds are not used for the establishment of new landfills. All landfills are required to contribute to the waste management fund, but only landfills licensed under the new state regulations are eligible to receive money from the fund.

It appears that user fees, property taxes, and private industry billing of local units of government are viable options for use in raising revenue for operation and maintenance. The use of a sales tax does not appear to be locally acceptable, while the use of recycling revenues would have only limited benefits since the profits generated from recycling operations may generally be expected to be small, and some revenues may be directed toward other civic projects by the volunteer groups operating the center. The waste management fund is used to provide compensation in the event of an incident at an existing or abandoned landfill that causes environmental damage, and does not provide funds for the establishment of new sanitary landfill facilities.

## OPERATIONAL MANAGEMENT AND STAFFING

Operational management and staffing is an important element of any solid waste management system. As already noted, solid waste management can be organized and operated by the county, private contractor, municipalities, or several cooperating municipalities. Various options exist for carrying on day-to-day solid waste management operations, and for assigning policy-making responsibilities.

Day-to-day management may be assigned to public employees at different levels of government, or to a private contractor, or can be left entirely in the hands of private operators who then negotiate with individuals or local units of government to provide services. Supervisory responsibility and daily administration may be assigned to a solid waste manager, a department of engineering or public works, a private firm, or a sanitary district staff. Shared staff within a county or between cooperating municipalities should also be investigated.

Overall management of the system must be assigned to a policy-making body. Options include a county solid waste management board, the county board itself, sanitary districts, or governing bodies of cities, villages, or towns. Intergovernmental arrangements would require specific assignment of duties and powers between the participating entities.

Potential personnel needs for varying levels of solid waste management service must be considered. A particularly significant decision is whether to use government employee staffing or private firm contracting. Consideration should be given to staff size, experience, training or educational attainment requirements, supervisory needs, and staff location. The number of employees needed to operate a countywide system is dependent upon the type of facilities provided. Table 35 provides an indication of the level of effort needed, listing the employees involved in 15 county landfill operations around the State. Incineration operations may be expected to require from 5 to 40 employees, depending on the size of the operation, the amount of solid waste processed, and the hours of operation.

## Table 35

### EMPLOYEES INVOLVED IN DAILY OPERATIONS OF SELECTED COUNTYWIDE LANDFILLS: 1985

| County | Capacity in Million Cubic Yards Unless Noted | Number of Equipment Operators | Number of Scale Operators | Number of Manager-Supervisors | Number of Clerks |
|---|---|---|---|---|---|
| Brown (two landfills) | 2.7 | 2 | 1 | -- | -- |
| | 2.1 | 2 | 1 | -- | -- |
| Dane (two landfills) | 2.1 | 2 | 1 | 1 | -- |
| | 3.8 | 1 | 1 | 1 | 1 |
| Eau Claire | 1.5 | 3 | 1 | 1 | -- |
| La Crosse | 880,000 tons | 1 | 1 | 1 | -- |
| Marathon | 2.2 | 3 | 1 | 1 | 1 |
| Oneida | 0.9 | 2 | 1 | -- | -- |
| Sauk | -- | 2 | -- | 1 | -- |
| Winnebago | -- | 5 | 1 | 1 | -- |
| Fond du Lac | 750,000 tons | 1 county employee, 2 private contractors | -- | -- | -- |
| Green | -- | 3 employees[a] | -- | -- | -- |
| Juneau | 0.6 | 2 employees | 1 | 1 | 1 part-time |
| Lincoln | 350,000 tons | 2 employees[a] | -- | -- | -- |
| Monroe | -- | 1 employee[a] | -- | -- | -- |
| Outagamie | 200,000 tons per year | 2 employees | 1 | 1 | 1 |
| Shawano | -- | 1 employee | -- | -- | -- |

[a]Job assignments not identified.

Source: Wisconsin Department of Natural Resources and SEWRPC.

The management of a solid waste facility involves the following responsibilities:

1. Hiring personnel to operate the waste management system in accordance with appropriate personnel procedures.

2. Negotiating and drafting contracts and agreements.

3. Designing, constructing, maintaining, and operating facilities and services.

4. Selecting and investigating sites and facilities.

5. Purchasing equipment and facilities.

6. Fulfilling state solid waste management approval and licensing requirements.

7. Drafting and enforcing any ordinances and regulations.

8. Preparing budgets.

9. Recommending establishment of service districts.

10. Calculating fees to be assessed to municipalities, businesses, persons, or service districts and recommending methods of fee collection.

11. Collecting fees and establishing billing procedures.

12. Providing payments for services rendered (municipal services, consulting work).

13. Conducting, sponsoring, or directing research.

14. Developing programs for using federal or state grants-in-aid or other assistance programs.

15. Keeping records and accounting.

16. Keeping the public informed.

17. Supplying facts, reports, information, and continuing education as requested and needed by policy-makers.

## SUMMARY

Kenosha County and the local units of government within the County have been granted authority by the State to manage solid wastes. In addition, the private sector has an important role in solid waste management in Kenosha County. There are several alternative institutional arrangements which may be viable for application in the County. These are exclusive reliance on privately owned systems, on systems owned by more than one local unit of government, and on county-owned systems. In the case of systems owned by local units of government, both the public and private operation options may be viable.

There are also numerous options available for financing the capital cost of solid waste management systems. The type of such financing selected will be dependent upon the type of solid waste management system selected. With regard to operation and maintenance costs, it appears that several methods of financing are also viable for use in Kenosha County, including user fees, property taxes, private billing of industry and local units of government, and the use of the waste management fund. Operational management and staffing is an important consideration in the evaluation of alternative systems. Various options exist for carrying out the day-to-day solid waste management operations. Day-to-day management may be assigned to public employees at different levels of government or to a private contractor, or can be left entirely in the hands of private operators who then negotiate with individuals or local units of government to provide services.

# Chapter VII

# EVALUATION OF SOLID WASTE MANAGEMENT ALTERNATIVES AND PRELIMINARY SELECTION OF RECOMMENDED ALTERNATIVE

## INTRODUCTION

The essence of planning is the generation and assessment of alternative means of achieving agreed-upon objectives. The demographic information presented in preceding chapters of this report, together with the solid waste management objectives also presented in preceding chapters, provide the basis for the development and analysis of alternative solid waste management plans for Kenosha County. In Chapter V, the available solid waste management techniques were described and screened with regard to applicability to Kenosha County. Eight alternative solid waste management plans, consisting of various combinations of applicable techniques for residential, commercial, and industrial solid wastes, were determined to warrant more detailed evaluation. Also, three additional management alternatives pertaining to residential, commercial, and industrial solid wastes, which for the purpose of this evaluation have been termed accessory alternatives, were determined to warrant consideration as well. In addition, five alternative management plans consisting of applicable techniques for municipal sewage treatment plant sludge were determined to warrant further consideration. This chapter presents the results of these evaluations.

This chapter is divided into six sections. The first section describes the social, economic, technical, and regulatory factors which must be considered in a comparative evaluation of the alternatives. The second section provides a comparative evaluation of the alternatives for the management of residential, commercial, and nonhazardous industrial solid wastes. The third section sets forth a comparative evaluation for the management of municipal sewage treatment plant sludge. The fourth section addresses the management of special solid wastes which must be handled separately from the main solid waste stream, including hazardous wastes, septic tank wastes, and sewage holding tank wastes. The fifth section sets forth the conclusions of the alternatives considered. Based upon these conclusions, the final section sets forth a preliminary recommended plan for the disposal of residential, commercial, and industrial solid wastes and municipal sewage treatment plant sludge generated in Kenosha County. As noted in Chapter V, all of the alternatives considered are concerned with the post-collection solid waste management functions, since the pre-collection storage and collection functions are expected to continue to be performed by municipal public works departments and by private contractors.

## CONSIDERATIONS IN EVALUATION OF ALTERNATIVES

This chapter provides estimates of the capital and operating costs of each of the eight alternative plans and three accessory alternatives for residential,

## Table 36

### AVERAGE ANNUAL SOLID WASTE QUANTITIES AND COMPOSITION TO BE CONSIDERED IN THE ALTERNATIVE PLANS: 2010

| Component | Residential | | Commercial | | Industrial | | Construction and Demolition, Bulk Trees and Brush | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Waste Generated (tons) | Percentage by Weight | Waste Generated (tons) | Percentage by Weight | Waste Generated (tons) | Percentage by Weight | Waste Generated (tons) | Percentage by Weight | Waste Generated (tons) | Percentage by Weight |
| Paper | 29,610 | 47 | 15,120 | 56 | 16,100 | 35 | - - | - - | 60,830 | 41 |
| Foundry Sand | - - | - - | - - | - - | 5,060 | 11 | - - | - - | 5,060 | 3 |
| Metal | 4,410 | 7 | 2,430 | 9 | 6,440 | 14 | - - | - - | 13,280 | 9 |
| Food | 7,560 | 12 | 2,700 | 10 | 3,220 | 7 | - - | - - | 13,480 | 9 |
| Plastic | 3,780 | 6 | 1,620 | 6 | 1,380 | 3 | - - | - - | 6,780 | 5 |
| Yard | 6,300 | 10 | - - | - - | - - | - - | - - | - - | 6,300 | 4 |
| Construction and Demolition Debris | - - | - - | - - | - - | - - | - - | 7,800 | 60 | 7,800 | 5 |
| Glass | 4,410 | 7 | 1,620 | 6 | 3,220 | 7 | - - | - - | 9,250 | 6 |
| Wood | 1,260 | 2 | - - | - - | 4,600 | 10 | - - | - - | 5,860 | 4 |
| Textiles | 2,520 | 4 | - - | - - | 460 | 1 | - - | - - | 2,980 | 2 |
| Trees and Brush | - - | - - | - - | - - | - - | - - | 2,730 | 21 | 2,730 | 2 |
| Bulk | - - | - - | - - | - - | - - | - - | 2,730 | 19 | 2,470 | 2 |
| Unclassified and Miscellaneous | 3,150 | 5 | 3,510 | 13 | 5,520 | 12 | - - | - - | 12,180 | 8 |
| Total | 63,000 | 100 | 27,000 | 100 | 46,000 | 100 | 13,000 | 100 | 149,000[a] | 100 |

[a]These quantities do not include 900 tons of residential wastes, 6,600 tons of commercial wastes, 110,000 tons of industrial wastes, 5,000 tons of construction and demolition debris, and 900 tons of trees, brush, and bulk materials which are currently estimated to be recycled, reused, and incinerated at existing facilities.

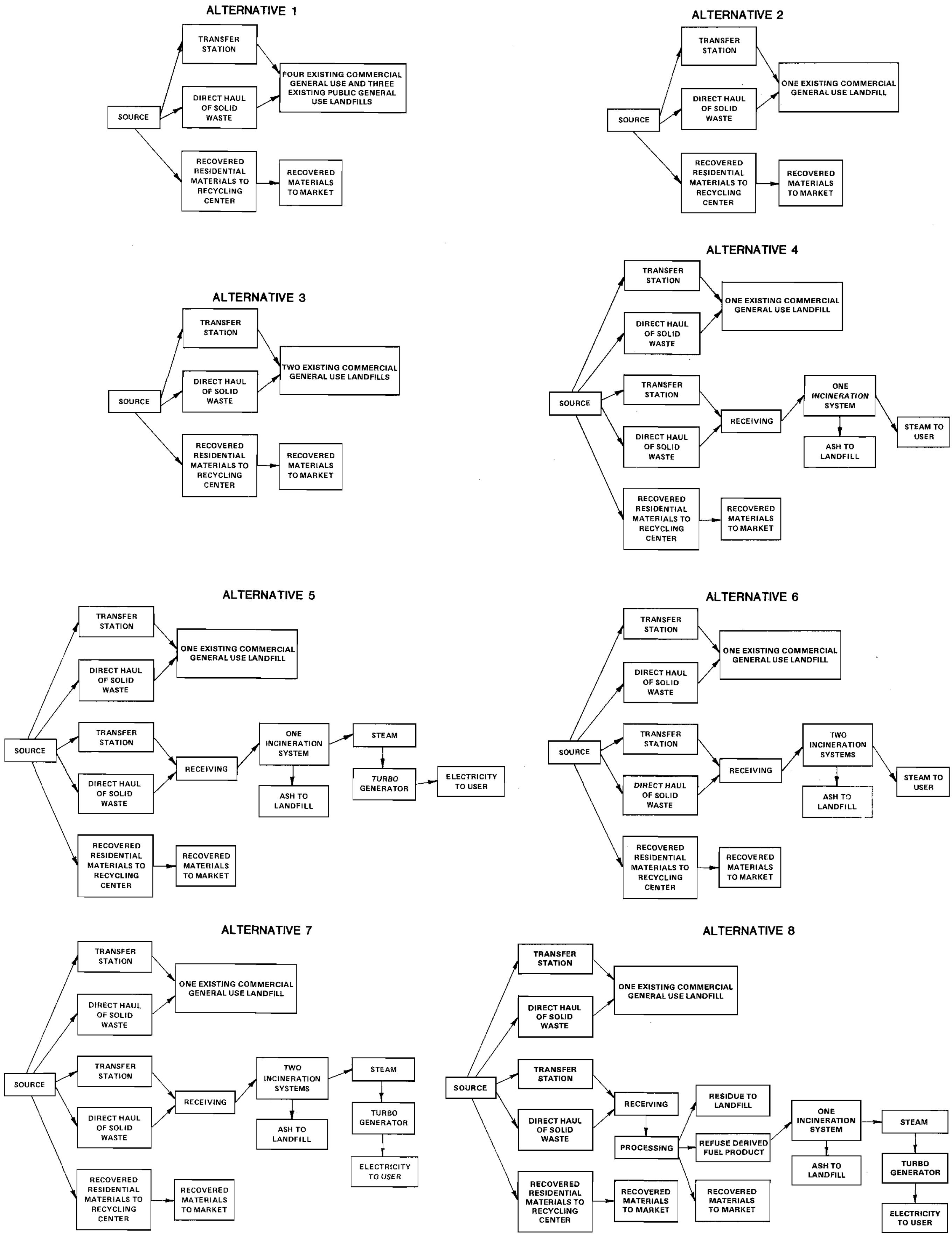
Source: SEWRPC.

commercial, and industrial solid wastes; and the five alternative plans pertaining to municipal sewage treatment plant sludge. The costs of land acquisition, engineering, interest during construction, and construction, as well as of operation and maintenance, are estimated for each alternative as applicable. While these costs are an important consideration, it must be recognized that the selection of a recommended solid waste management plan from among the alternatives considered cannot be based upon economic considerations alone, but must also consider other factors such as, importantly, potential environmental impacts.

Each of the alternatives which address the residential, commercial, and industrial solid wastes is designed to accommodate the total solid waste stream expected to be generated in Kenosha County through the year 2010, excluding that waste that is presently recycled, and excluding special wastes such as hazardous wastes, fly ash, sewage sludge, and septic and sewage holding tank wastes. The solid waste quantities and characteristics used in the design and evaluation of the alternative plans are set forth in Table 36, and the alternatives are graphically summarized in Figure 15. The total quantity of residential, commercial, and industrial solid wastes which the alternatives are intended to manage is estimated to be 142,000 tons per year, or about 400 tons per day, representing the approximate average amount of solid waste expected over the plan period of 1990 through the year 2010. This quantity does not include approximately 900 tons of residential wastes, 6,600 tons of commercial wastes, 110,000 tons of industrial wastes, 5,000 tons of construction and demolition debris, 700 tons of trees and brush, and 200 tons of bulk materials, all of which are currently estimated to be recycled, incinerated in privately owned small-scale incinerators, or disposed of annually at places other than licensed landfills, such as at areas needing "clean fill."

## Figure 15

## SCHEMATIC DIAGRAM OF SELECTED SOLID WASTE MANAGEMENT ALTERNATIVES



An important component of all the alternatives is a residential solid waste recycling program, as required by amendments to Chapter 144 of the Wisconsin Statutes. Based on the criteria presented in Chapter II, six recycling centers are required, including two facilities in the City of Kenosha; one in the Town of Pleasant Prairie; and one each at the existing landfills operated in the Village of Twin Lakes, and the Towns of Bristol and Randall. There are additional recycling efforts currently taking place in the County. These efforts, which are not required under Chapter 144 of the Wisconsin Statutes, include the operation of a recycling center at the Waste Management of Wisconsin, Pheasant Run Landfill in the Town of Paris, as well as a recycling program in the Town of Somers. This component also includes two new recycling facilities in the Villages of Paddock Lake and Silver Lake. These recycling facilities and efforts will be considered further and are included as a component under each alternative solid waste management plan evaluated.

Assuming a moderate level of participation by the public, approximately 3,000 tons per year, or about 2 percent of the residential solid wastes generated, would be recycled at the 10 recycling operations, in addition to the 900 tons per year that is presently recycled. Most of the recyclable residential solid wastes deposited at these centers, consisting primarily of newsprint, glass, aluminum, and plastic, would be transported to the centers by individual residents.

Landfilling of various quantities of solid wastes is a critical component of each of the alternatives evaluated. There are three small municipal landfills currently operating in the Village of Twin Lakes and the Towns of Bristol and Randall, respectively. The Village of Twin Lakes and the Town of Randall have signed closure agreements with the Wisconsin Department of Natural Resources (DNR) to abandon these facilities by 1999. Further, proposed regulations being promulgated by the U. S. Environmental Protection Agency are likely to impose more stringent regulations on these operating landfills. These regulations could include, but are not limited to, the establishment of a groundwater monitoring network and the use of synthetic materials to seal the facility following closure. These regulations will result in costly changes for operation of the landfills concerned, and may be expected to make the continued operation of these facilities uneconomical. Such regulations are anticipated to become effective early in the implementation period of this plan.

For the above-referenced reasons, these three municipally owned and operated landfill sites are assumed to be operated for the entire plan period only under the first alternative--which envisions the continued use of the existing solid waste management system. The remaining alternatives assume that these sites will not be used to dispose of significant quantities of solid wastes, and that they will likely cease operation during the early stages of the plan period.

The small municipal landfills operating in the Towns of Bristol and Randall are currently used to dispose of the majority of the solid wastes generated in their respective municipalities. Consequently, once these landfills are abandoned, an alternative disposal system--such as a centrally located transfer station which would provide temporary storage of solid wastes--will be required for the disposal of the solid wastes generated there. Therefore, for the purposes of all but the first alternative, it has been assumed that a centrally located transfer station will be constructed in the early stages of the plan period in the Towns of Bristol and Randall.

The small municipal landfill operating in the Village of Twin Lakes, however, is used only for the disposal of limited amounts of solid waste. The majority of the solid wastes generated in the Village is currently transported to the Waste Management of Wisconsin, Pheasant Run landfill. Therefore, since closure of this landfill will have a minimal influence on the future solid waste disposal needs of the Village of Twin Lakes, and because the Village could make use of the transfer station to be constructed in the Town of Randall, for the purposes of the solid waste management alternatives presented herein, a centrally located transfer station has not been proposed to replace the existing municipal landfill in the Village of Twin Lakes.

The amount of ash to be disposed of in each of the alternatives dealing with incineration is an important consideration. In general, the incineration systems may all be expected to reduce the tonnage of solid waste by about 75 percent, leaving about 25 percent, on a dry-weight basis, as ash, and about 30 to 35 percent on a wet-weight basis if quenching operations are used. In terms of volume reduction, the ash generated would represent approximately 15 percent of the volume of solid waste prior to incineration.

Each of the alternatives that address municipal sewage treatment plant sludge is designed to accommodate an annual average of 6,500 tons--on a dry-weight basis--during the plan period. Approximately 6,200 tons, or 95 percent, would be generated by the City of Kenosha sewage treatment plant, with the remainder generated by the eight other publicly owned facilities operating within the County. The municipal sewage treatment plant quantities and characteristics used in the design and evaluation of the alternative plans are set forth in Table 37, and the alternatives are graphically summarized in Figure 16.

## ALTERNATIVES PERTAINING TO RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOLID WASTES

The principal features and costs of the eight alternative plans dealing with residential, commercial, and industrial solid wastes are summarized in Table 38. Each alternative is described below. The unit-cost and other detailed data utilized in the development of these alternative cost estimates are provided in Appendix E. A more detailed tabulation of the costs of each solid waste alternative is included in Appendix F. All costs are expressed in constant 1987 dollars.

### Alternative Plan 1: Continued Use of Existing Solid Waste Management Systems

Under Alternative Plan 1, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 1 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing transfer stations located in the County which serve municipalities in the study area, followed by transport to a landfill; 2) continued transport of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling, using four existing commercial general-use landfills and three small municipally owned and operated landfills located within and adjacent to the County. The existing solid waste management system is described in Chapter II and graphically summarized on Map 24 in Chapter II.

## Table 37

### QUANTITIES AND CHARACTERISTICS OF MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE GENERATED IN KENOSHA COUNTY ASSUMED FOR ALTERNATIVES ANALYSIS: 1990-2010

| Municipal Sewage Treatment Plant | Sludge Generated (dry tons per year) | | Total Solids (percent) | Total Nitrogen (percent) | Ammonia Nitrogen (percent) | Total Phosphorus (percent) | Cadmium (mg/kg) | Chromium (mg/kg) | Lead (mg/kg) | Mercury (mg/kg) | pH (standard units) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1986 | 2010 | | | | | | | | | |
| City of Kenosha | 6,000[a] | 6,500[a] | 38.5 | 3.75 | 0.08 | 1.67 | 6.0 | 626 | 316 | 0.48 | 12.2 |
| Town of Pleasant Prairie Sewer Utility District D | 91 | 96 | 3.5 | 2.30 | 0.59 | 0.26 | 5.88 | 29.4 | 50.0 | 3.53 | 6.9 |
| Town of Pleasant Prairie Sanitary District No. 73-1 | 4 | 5 | 6.5 | 3.45 | 0.01 | 6.9 | 9.1 | 29.1 | 133 | 4.60 | 6.9 |
| Town of Salem Sewer Utility District No. 1 | 11 | 12 | 1.7 | 10.00 | 1.47 | 2.94 | 17.6 | 23.5 | 58.8 | 58.80 | 7.0 |
| Town of Salem Sewer Utility District No. 2 | 13 | 14 | 5.6 | 3.90 | 1.20 | 3.57 | 10.7 | 39.3 | 25.0 | 1.07 | 7.5 |
| Town of Bristol Utility Districts Nos. 1 and 1A | 35 | 37 | 2.5 | 7.20 | 0.31 | 1.40 | 4.0 | 640 | 1,360 | 4.80 | 6.2 |
| Village of Paddock Lake | 21 | 23 | 5.0 | 0.22 | 0.09 | 1.60 | 6.20 | 22.0 | 92.0 | 2.00 | 6.0 |
| Village of Silver Lake | 21 | 22 | 1.8 | 6.30 | 0.20 | 3.5 | 56.24 (ppm) | 0.01 (ppm) | 135.40 (ppm) | 0.01 (ppm) | 8.1 |
| Village of Twin Lakes | 45 | 48 | 10.0 | 3.98 | 0.56 | 2.98 | 15.0 | 73.9 | 85.9 | 2.32 | 7.1 |
| Total | 6,241 | 6,757 | -- | -- | -- | -- | -- | -- | -- | -- | -- |

[a]The above-noted sludge quantities for the City of Kenosha were based upon inventory data collected in 1985 and upon 1984 full year operations, during which about 6,000 dry tons of sludge were generated. During 1986, about 4,900 dry tons of sludge were generated. However, for evaluation of the alternatives, the higher quantities noted in the table were used in order to be conservative and account for potential increases due to existing and future industrial facility uses which may, over the plan period, result in loadings similar to those experienced in 1984.

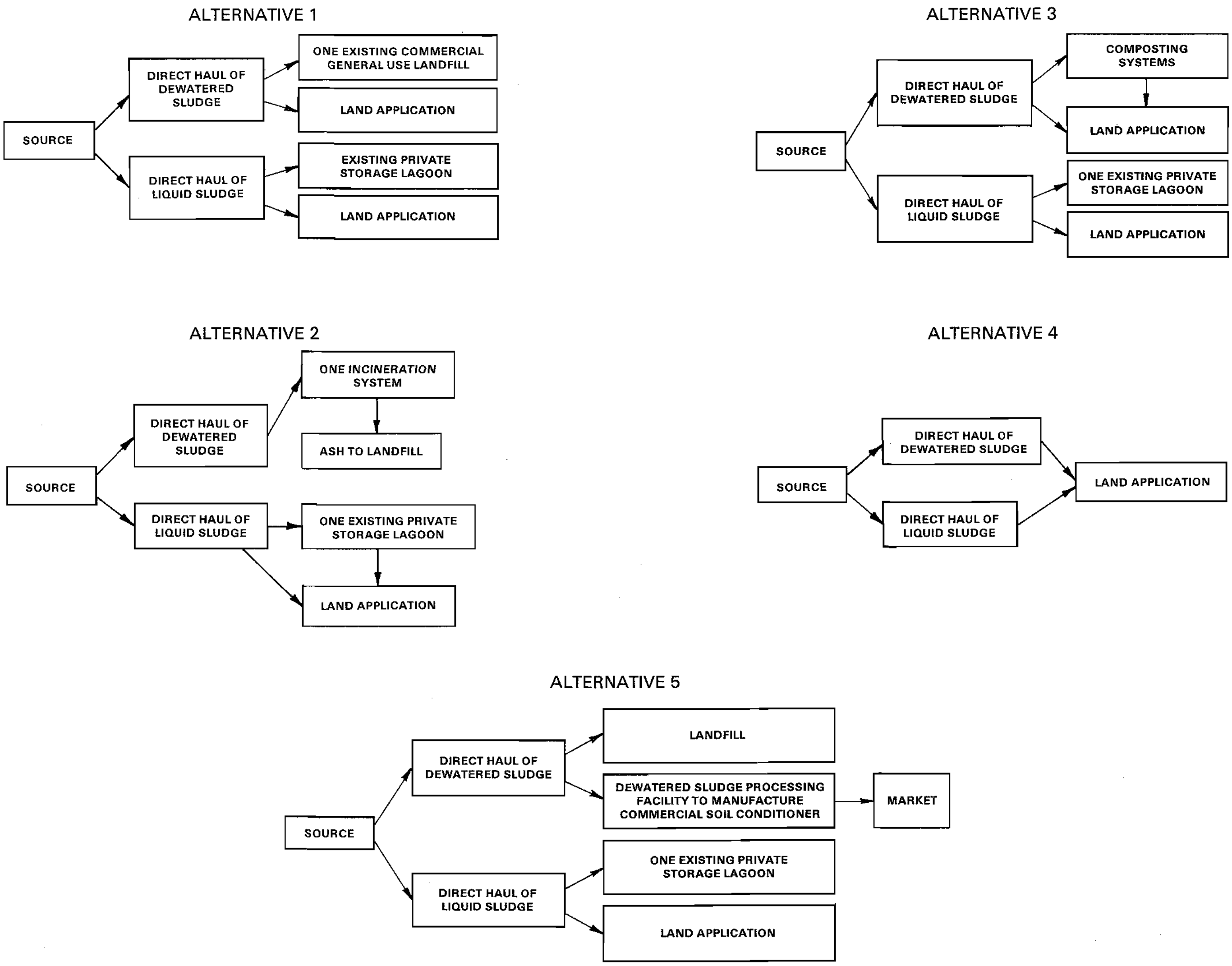
Source: SEWRPC.

The post-collection solid waste transportation system in the study area would, under this alternative, be similar to the existing system described in Chapter II. Most residential solid wastes would continue to be transported to one of the five transfer stations in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to a landfill. Residential solid wastes not transported to one of the five transfer stations would be transported directly to one of the landfills by private collection vehicles. Commercial and industrial solid wastes would be transported primarily by private contractors directly to one of the landfills. Of the total quantity of unrecycled solid waste generated, about 46,000 tons, or about 31 percent on an average annual basis, would be transferred, with the remaining 93,000 tons, or 65 percent, being hauled directly to a landfill.

A countywide residential solid waste recycling program would be established for the study area under this alternative, consisting of 10 recycling centers. Of the six recycling facilities required under Chapter 144 of the Wisconsin Statutes, two would be located in the City of Kenosha; one in the Town of Pleasant Prairie; and three at the municipally owned and operated landfills located in the Village of Twin Lakes and the Towns of Bristol and Randall. Additionally, the recycling component would include two existing facilities, one located at the Waste Management of Wisconsin, Inc., Pheasant Run landfill

## Figure 16

## SCHEMATIC DIAGRAM OF SELECTED MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE MANAGEMENT ALTERNATIVES




Source: SEWRPC.

in the Town of Paris and one located in the Town of Somers. This component also includes the establishment of two new additional facilities in the Villages of Paddock Lake and Silver Lake, respectively. Thus, under this alternative, a total of 10 residential recycling facilities would be established and operated throughout the plan period. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 139,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area, would be disposed of primarily at landfills, in particular four existing commercial general-use landfills,

# Table 38

## PRINCIPAL FEATURES AND COSTS OF SOLID WASTE MANAGEMENT ALTERNATIVES FOR KENOSHA COUNTY: 1990-2010

| Residential, Commercial, and Industrial Wastes | | Cost Estimates 1990-2010[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Annual Costs and Revenues | | | | | | | |
| Alternative | Principal Components | Initial Capital Cost | Annual Amortized Capital Cost[b] | Transport and Transfer | Landfill Disposal[c] | New Facilities Operation and Maintenance | Average Annual Revenue[d] | Total Average Annual Cost | Unit Cost (dollars per ton) | Total Present Worth of Capital and Operation and Maintenance[b] |
| 1. Continued use of existing solid waste management systems | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes at four existing commercial general-use landfills and at three existing public general-use landfills | $ 380,000 | $ 33,000 | $836,000 | $2,085,000[e] | $ 185,000 | $ -- | $3,139,000 | $22.10[e] | $36,023,000 |
| 2. Disposal of solid wastes at a single existing commercial general-use landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes at one existing commercial general-use landfill | 350,000 | 30,000 | 899,000 | 2,085,000 | 185,000 | -- | 3,199,000 | 22.53 | 36,770,000 |
| 3. Disposal of solid wastes at two existing commercial general-use landfills | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes at two existing commercial general-use landfills | 350,000 | 30,000 | 857,000 | 2,085,000 | 185,000 | -- | 3,157,000 | 22.23 | 36,287,000 |
| 4. Processing of a portion of the solid wastes at one new incinerator with a capacity of 250 tons per day and designed for steam production, with disposal of unincinerated and unrecycled solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at one new incinerator designed for steam production<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | 19,461,000 | 1,693,000 | 733,000 | 1,602,000 | 1,579,000[f] | 1,285,000 | 4,322,000 | 30.43 | 49,678,000 |
| 5. Processing of a portion of the solid wastes at one new incinerator with a capacity of 250 tons per day and designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at a new incinerator designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | 19,026,000 | 1,655,000 | 733,000 | 1,602,000 | 1,649,000[f] | 673,000 | 4,966,000 | 34.97 | 57,080,000 |

## Table 38 (continued)

| Residential, Commercial, and Industrial Wastes: Alternative | Residential, Commercial, and Industrial Wastes: Principal Components | Cost Estimates 1990-2010[a]: Initial Capital Cost | Annual Costs and Revenues: Annual Amortized Capital Cost[b] | Annual Costs and Revenues: Transport and Transfer | Annual Costs and Revenues: Landfill Disposal[c] | Annual Costs and Revenues: New Facilities Operation and Maintenance | Annual Costs and Revenues: Average Annual Revenue[d] | Annual Costs and Revenues: Total Average Annual Cost | Unit Cost (dollars per ton) | Total Present Worth of Capital and Operation and Maintenance[b] |
|---|---|---|---|---|---|---|---|---|---|---|
| 6. Processing of a portion of the solid wastes at two new incinerators designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at two new incinerators designed for steam production<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | $29,112,000 | $2,533,000 | $609,000 | $1,602,000 | $2,455,000[f] | $1,285,000 | $5,914,000 | $41.65 | $67,977,000 |
| 7. Processing of a portion of the solid wastes at two new incinerators designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at two new incinerators designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | 33,072,000 | 2,877,000 | 609,000 | 1,602,000 | 2,423,000[f] | 673,000 | 6,838,000 | 48.15 | 78,598,000 |
| 8. Processing of a portion of the solid wastes into refuse-derived fuel, incineration at one incinerator designed for electric power generation, and disposal of unincinerated and unrecycled solid wastes, refuse-derived fuel residue, and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Processing of solid wastes into refuse-derived fuel<br><br>Incineration of refuse-derived fuel at one new incinerator designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes, refuse-derived fuel residue, and incinerator ash at one existing commercial general-use landfill | 20,531,000 | 1,786,000 | 703,000 | 1,712,000 | 1,559,000[f] | 1,100,000 | 4,660,000 | 32.94 | 53,450,000 |

[a]Based on 1987 costs.

[b]Economic analysis and amortization rates based upon an annual interest rate of 6 percent, and a 20-year amortization period.

[c]Landfill disposal costs are based on an average cost of $15 per ton. This cost includes both operation and maintenance costs at the landfills, as well as capital costs needed for expansion and upgrading of the facilities at the major large commercial general-use landfills. The capital cost is included in the annual cost since the expenditures are expected to be made incrementally over the life of the facility.

[d]Revenues are generated from the sale of steam or electricity produced at the incinerator facilities.

[e]Landfill costs estimated at $15 per ton—the same as for the other alternatives. Using costs presently experienced at landfill sites within the study area—$10 per ton—results in a total cost of $2,464,000 and a unit cost of $17.18 per ton.

[f]This cost does not include the costs of the transport and disposal of incinerator residue. Those costs are included separately under the transportation and landfill disposal costs.

Source: SEWRPC.

including: the Waste Management of Wisconsin, Pheasant Run landfill located in the Town of Paris; the Land Reclamation, Ltd., landfill located in the Town of Mt. Pleasant, Racine County; the Browning and Ferris landfill located in the Town of Benton, Lake County, Illinois; and the Greidanus Enterprises landfill located in the Town of Darien, Walworth County. In addition, unrecycled solid wastes generated in the study area would be disposed of at three small existing municipally owned and operated landfills, including the Town of Bristol, the Town of Randall, and the Village of Twin Lakes landfills.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 1 is $380,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $3,106,000. The total average annual cost of capital and operation and maintenance is $3,139,000, or about $22 per ton of solid waste.

## Alternative Plan 2: Disposal at a Single Existing Commercial General-Use Landfill

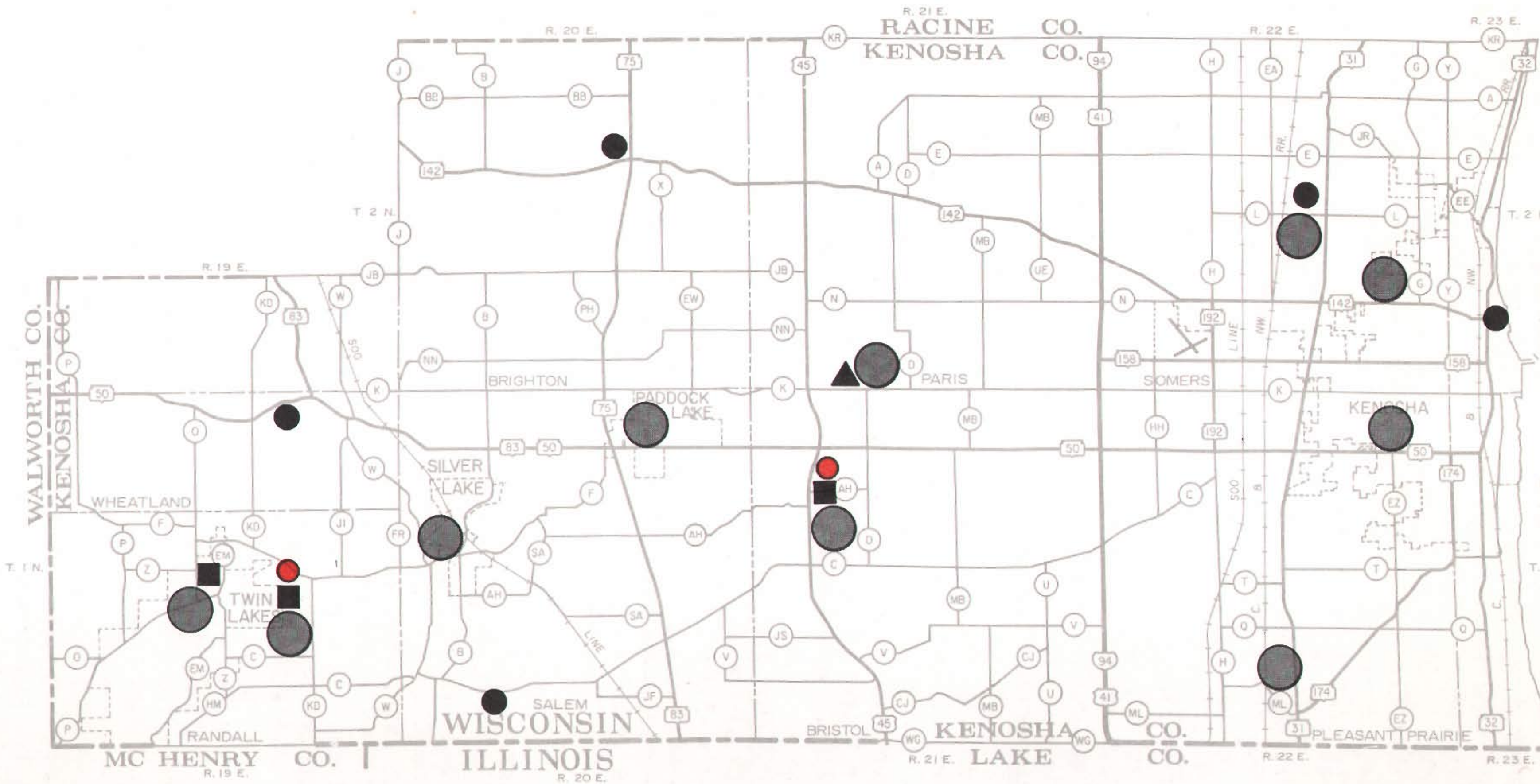
Under Alternative Plan 2, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 2 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing or two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to a landfill; 2) continued transport of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling using primarily one existing commercial general-use landfill located within the County. In addition, this alternative assumes that the three small existing municipal landfills would be abandoned early in the plan period and replaced by two transfer stations--one serving the Town of Randall and one serving the Town of Bristol. The locations of the primary landfill and transfer stations proposed under Alternative Plan 2, together with the generalized locations of the recycling centers and the public general-use landfills to be abandoned early in the plan period, are shown on Map 35.

The post-collection solid waste transportation system in the study area would, under this alternative, be similar to the existing system described for Alternative Plan 1. Most residential solid wastes would continue to be transported by collection vehicles in the City of Kenosha and primarily by residents using private vehicles in the other areas to one of the five existing and two proposed transfer stations located in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to a landfill. Residential solid wastes not transported to transfer stations would be transported by collection vehicles directly to the landfill. Commercial and industrial solid wastes would be transported primarily by private contractors to a landfill. Of the total quantity of unrecycled solid wastes generated, about 47,000 tons, or 34 percent on an average annual basis, would be transferred, with the remaining 92,000 tons, or 66 percent, being hauled directly to the landfill.

A countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes,

## Map 35

### ALTERNATIVE 2: DISPOSAL OF SOLID WASTES AT A SINGLE EXISTING COMMERCIAL GENERAL-USE LANDFILL




LEGEND

- COMMERCIAL GENERAL-USE LANDFILL (1)
- EXISTING TRANSFER STATION (5)
- GENERALIZED LOCATION OF RECYCLING STATIONS (10)
- PUBLIC GENERIAL-USE LANDFILLS TO BE ABANDONED DURING THE PLAN PERIOD (3)
- TRANSFER STATIONS TO BE CONSTRUCTED EARLY IN PLAN PERIOD (2)

GRAPHIC SCALE

0 — 2 MILES

0 4000 8000 12000 FEET

Source: SEWRPC.

would be located as described under Alternative Plan 1. The landfills operated in the Village of Twin Lakes and the Towns of Bristol and Randall are anticipated to be abandoned in the early stages of the plan period and replaced with two transfer stations located in the Towns of Bristol and Randall. It is envisioned for this and the remaining alternatives that the recycling facilities operated at these landfills will continue to operate throughout the plan period as an adjunct to the two new transfer stations in the Towns of Bristol and Randall, and that a recycling operation would be continued for the Village of Twin Lakes. Thus, under this alternative, a total of 10 recycling centers would be established and operated throughout the plan period. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 139,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area, would be disposed of at the Pheasant Run landfill, a commercial general-use facility currently owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 2 is $350,000, with an average annual operation and maintenance cost, including landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $3,169,000. The total average annual cost of capital and operation and maintenance is $3,199,000, or about $23 per ton of solid waste.

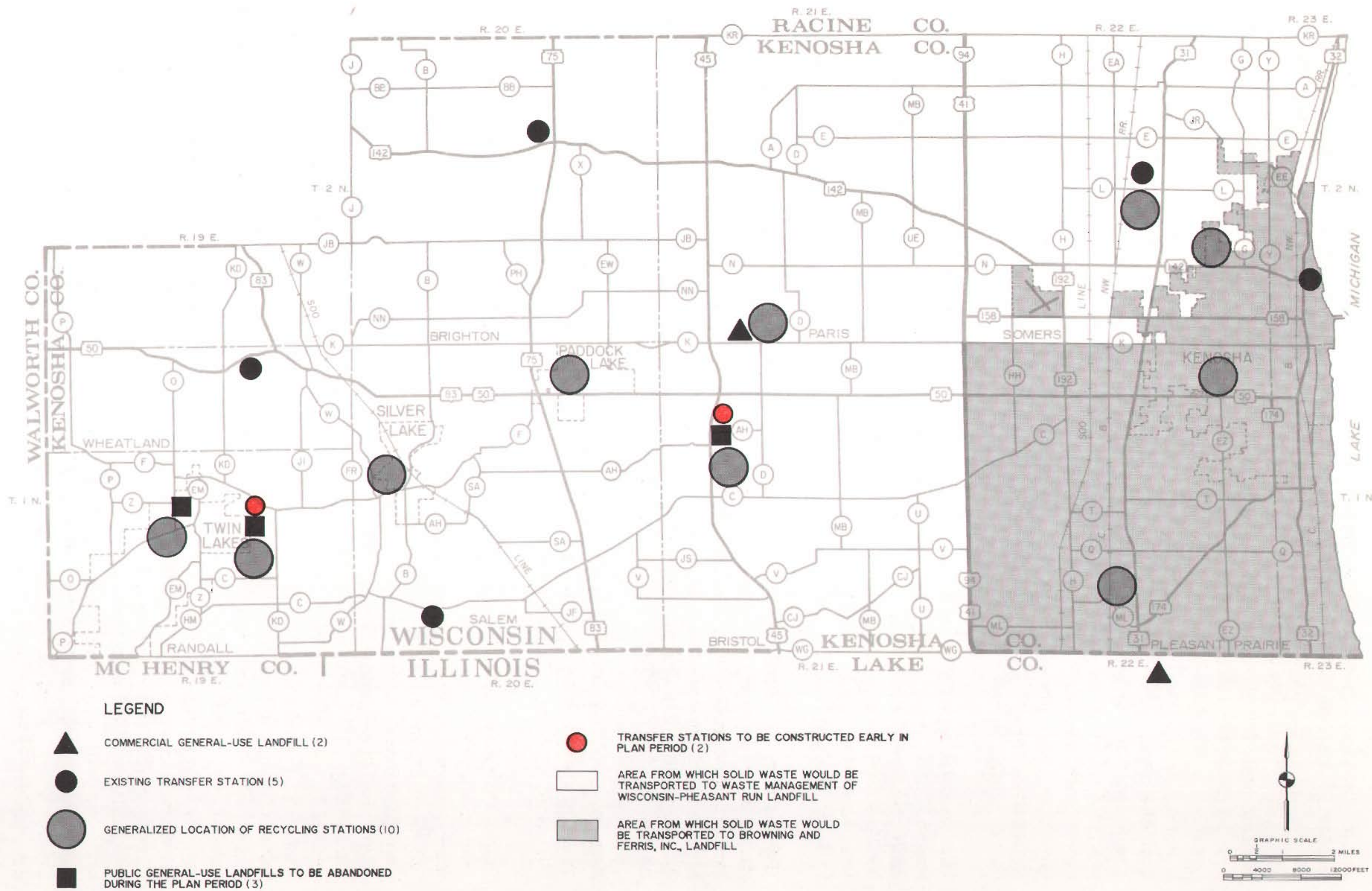
## Alternative Plan 3: Disposal at Two Existing Commercial General-Use Landfills

Under Alternative Plan 3, solid wastes generated in the study area would be recycled or landfilled. The principal components of the solid waste management system under Alternative Plan 3 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to a landfill; 2) continued transport of the remaining unrecycled solid wastes directly to a landfill; 3) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 4) disposal of all unrecycled solid wastes by landfilling, using primarily two existing commercial general-use landfills, one of which is located in the County. In addition, this alternative assumes that the three small existing municipal landfills would be abandoned early in the plan period and replaced by two transfer stations--one serving the Town of Randall and one serving the Town of Bristol. The location of the landfill and transfer stations under Alternative Plan 3, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 36.

The post-collection solid waste transportation system in the study area would, under this alternative, be the same as described for the existing system with the exception of the location of the disposal sites. Most residential solid wastes would continue to be transported by collection vehicle or residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. Solid wastes received at these stations would then be transported in large-capacity vehicles to one of the landfills. Residential

## Map 36

## ALTERNATIVE 3: DISPOSAL OF SOLID WASTES AT TWO EXISTING COMMERCIAL GENERAL-USE LANDFILLS




Source: SEWRPC.

solid wastes not transported to transfer stations would be transported directly to one of the landfills. Commercial and industrial solid wastes would be transported primarily by private contractors to one of the landfills. Of the total quantity of unrecycled solid wastes generated, about 47,000 tons, or 34 percent on an average annual basis, would be transferred, with the remaining 92,000 tons, or 66 percent, being hauled directly to a landfill.

A countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 139,000 tons per year, or 98 percent of the average annual solid waste load generated in the study area, would be disposed of at two commercial general-use landfills, including the Pheasant Run landfill owned and operated by Waste Management of Wisconsin, Inc., and located in the Town of Paris; and the Browning and Ferris, Inc., landfill located in the Town of Benton, Lake County, Illinois.

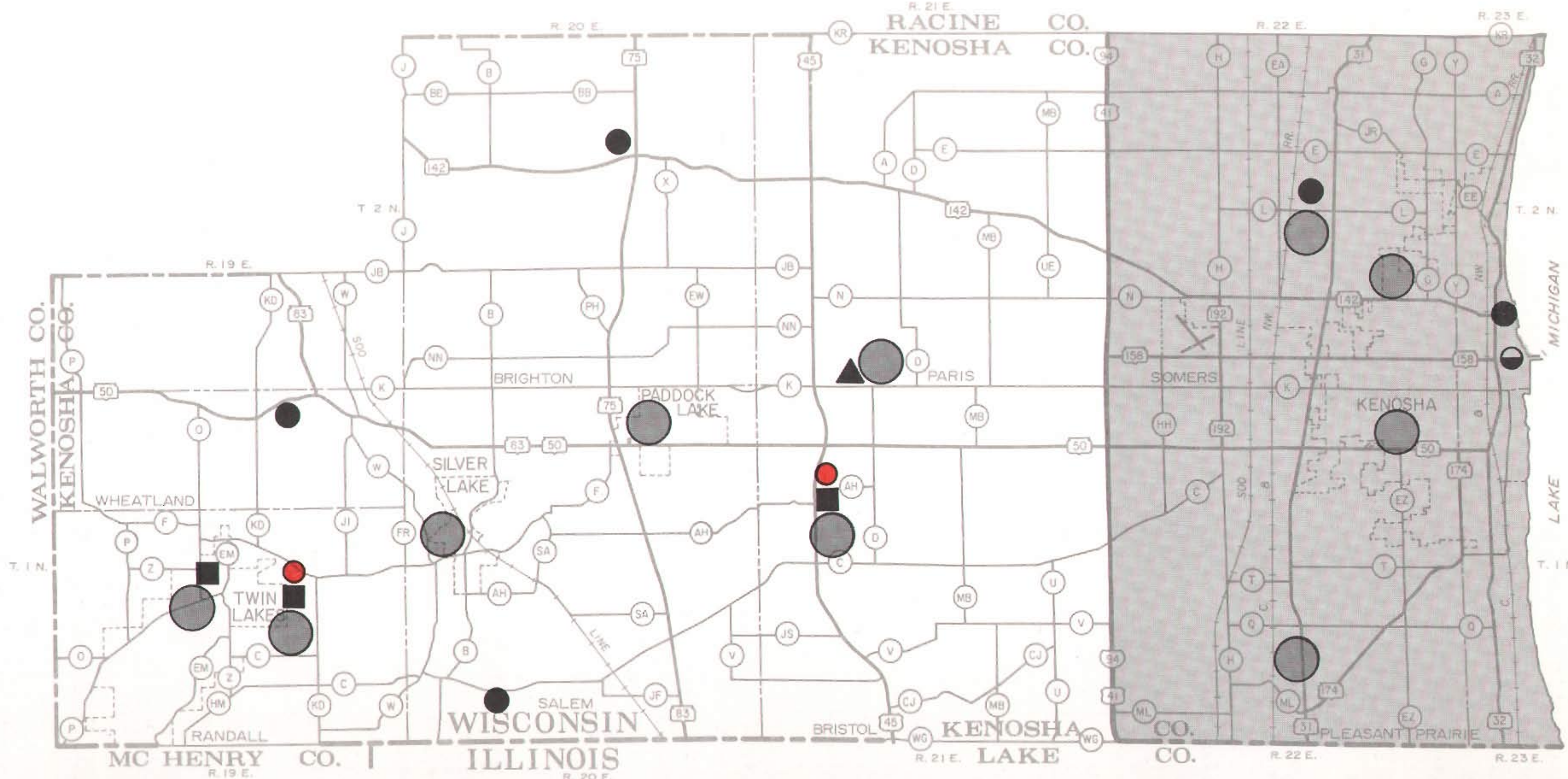
The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 3 is $350,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $3,127,000. The total average annual cost of capital and operation and maintenance is $3,157,000, or about $22 per ton of solid waste.

## Alternative Plan 4: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Steam Production, with Disposal at One Existing Commercial General-Use Landfill

Under Alternative Plan 4, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 4 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to the incinerator or to a landfill; 2) continued transport of the remaining unrecycled solid wastes directly to the incinerator or to a landfill; 3) processing of a portion of the solid wastes at a new incinerator designed to burn solid wastes for steam production; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using one existing commercial general-use landfill located in the County. In addition, this alternative assumes that the three small existing municipal landfills would be abandoned early in the plan period and replaced by two transfer stations--one serving the Town of Randall and one serving the Town of Bristol. The locations of the landfill, transfer stations, and incinerator under Alternative Plan 4, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 37.

## Map 37

### ALTERNATIVES 4 AND 5: PROCESSING OF A PORTION OF THE SOLID WASTES AT AN INCINERATOR, WITH DISPOSAL AT ONE EXISTING COMMERCIAL GENERAL-USE LANDFILL




LEGEND

- COMMERCIAL GENERAL-USE LANDFILL (1)
- INCINERATOR (1)
- EXISTING TRANSFER STATION (5)
- GENERALIZED LOCATION OF RECYCLING STATIONS (10)
- PUBLIC GENERAL-USE LANDFILLS TO BE ABANDONED DURING THE PLAN PERIOD (3)
- TRANSFER STATIONS TO BE CONSTRUCTED EARLY IN PLAN PERIOD (2)
- AREA FROM WHICH SOLID WASTE WOULD BE TRANSPORTED TO WASTE MANAGEMENT OF WISCONSIN-PHEASANT RUN LANDFILL
- AREA FROM WHICH A PORTION OF THE SOLID WASTE WOULD BE TRANSPORTED TO AN INCINERATOR

GRAPHIC SCALE

0 1 2 MILES

0 4000 8000 12000 FEET

Source: SEWRPC.

The post-collection solid waste transportation system in the study area would, under this alternative, be similar to the existing system except for the location of the disposal sites. Some residential solid wastes would continue to be transported by collection vehicles or residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. Depending upon the final location of the incinerator, the City of Kenosha transfer station would, under this alternative, be used only on a limited basis for transfer. The majority of the solid wastes generated in the City of Kenosha and the Towns of Pleasant Prairie and Somers would be hauled directly to the incinerator site under this alternative. Of the total quantity of unrecycled solid wastes generated, about 12,000 tons, or 9 percent on an average annual basis, would be transferred, with the remaining 127,000 tons, or 91 percent, being hauled directly to the incinerator or to a landfill.

Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, a modular incineration system with a capacity of 250 tons per day was proposed. A total of 56,000 tons per year, or about 39 percent of the average annual solid waste load, would be incinerated. The system would have capacity to produce 1.1 million to 1.2 million pounds of steam per day at a pressure of 200 to 300 pounds per square inch (psi). This alternative includes the costs of extending steam conveyance lines to one of several potential energy users in or adjacent to the central business district of the City of Kenosha. For the purpose of this evaluation, it was assumed that the facility would be located at the City of Kenosha transfer station site. Approximately 17,000 tons of ash would be generated by this facility per year, which would be disposed of at an approved landfill.

Under this alternative, a countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 83,000 tons per year, or 58 percent of the average annual solid waste load generated in the study area, would be disposed of at the Pheasant Run landfill, a commercial general-use facility owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 4 is $19,461,000, with an average annual net operation and maintenance cost, including all landfilling costs, of $2,629,000, and including an estimated credit of $1,285,000 derived from annual steam sale revenues. The total average annual cost of capital and operation and maintenance is $4,322,000, or about $30 per ton of solid waste.

### Alternative Plan 5: Processing of a Portion of the Solid Wastes at a Single Incinerator Designed for Electric Power Generation, with Disposal at One Existing Commercial General-Use Landfill

Under Alternative Plan 5, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 5 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to the incinerator or to a landfill; 2) continued transport of the remaining unrecycled solid wastes directly to the incinerator or to a landfill; 3) processing of a portion of the solid wastes at a new incineration system designed to burn solid waste for electric power generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily one existing commercial general-use landfill located in the County. In addition, this alternative assumes that the three small existing municipal landfills would be abandoned early in the plan period and replaced by two transfer stations--one serving the Town of Randall and one serving the Town of Bristol. The locations of the landfill, transfer stations, and incinerator under Alternative Plan 5, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are also shown on Map 37.

The post-collection solid waste transportation system in the study area would, under this alternative, vary from the existing system with regard to the disposal site locations. Some residential solid wastes would continue to be transported by collection vehicles or by residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. Depending upon the final location of the incinerator, the City of Kenosha transfer station would, under this alternative, be used only on a limited basis for transfer. The majority of the solid wastes generated in the City of Kenosha and the Towns of Pleasant Prairie and Somers would be hauled directly to the incinerator site under this alternative. Of the total quantity of unrecycled solid wastes generated, about 12,000 tons, or 9 percent on an average annual basis, would be transferred, with the remaining 127,000 tons, or 91 percent, being hauled directly the incinerator or to a landfill.

Based upon a review of the potential uses of the electric energy produced, as well as of the seasonal distribution of the waste generated, a modular incineration system with a capacity of 250 tons per day was proposed. A total of 56,000 tons per year, or about 39 percent of the average annual solid waste load, would be incinerated. The system would have the capacity to produce 1.1 million to 1.2 million pounds of steam per day at a pressure of 500 to 600 psi. The steam would be used for operating a turbine to generate between 60,000 and 63,000 kilowatts per day of electricity, of which 54,000 to 56,000 kilowatts per day would be available for sale. For the purpose of this evaluation, it was assumed that the facility would be located at the City of Kenosha transfer station. Approximately 17,000 tons of ash would be generated by this facility per year, which would be disposed of at an approved landfill.

Under this alternative, a countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 83,000 tons per year, or 58 percent of the average annual solid waste load generated in the study area, would be disposed of at the Pheasant Run landfill, a commercial general-use facility owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 5 is $19,026,000, with an average annual net operation and maintenance cost, including landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $3,311,000, and including an estimated credit of $673,000 derived from annual electricity sale revenues. The total average annual cost of capital and operation and maintenance is $4,966,000, or about $35 per ton of solid waste.

## Alternative Plan 6: Processing of a Portion of the Solid Wastes at Two Separate Incinerators Designed for Steam Production, with Disposal at One Existing Commercial General-Use Landfill

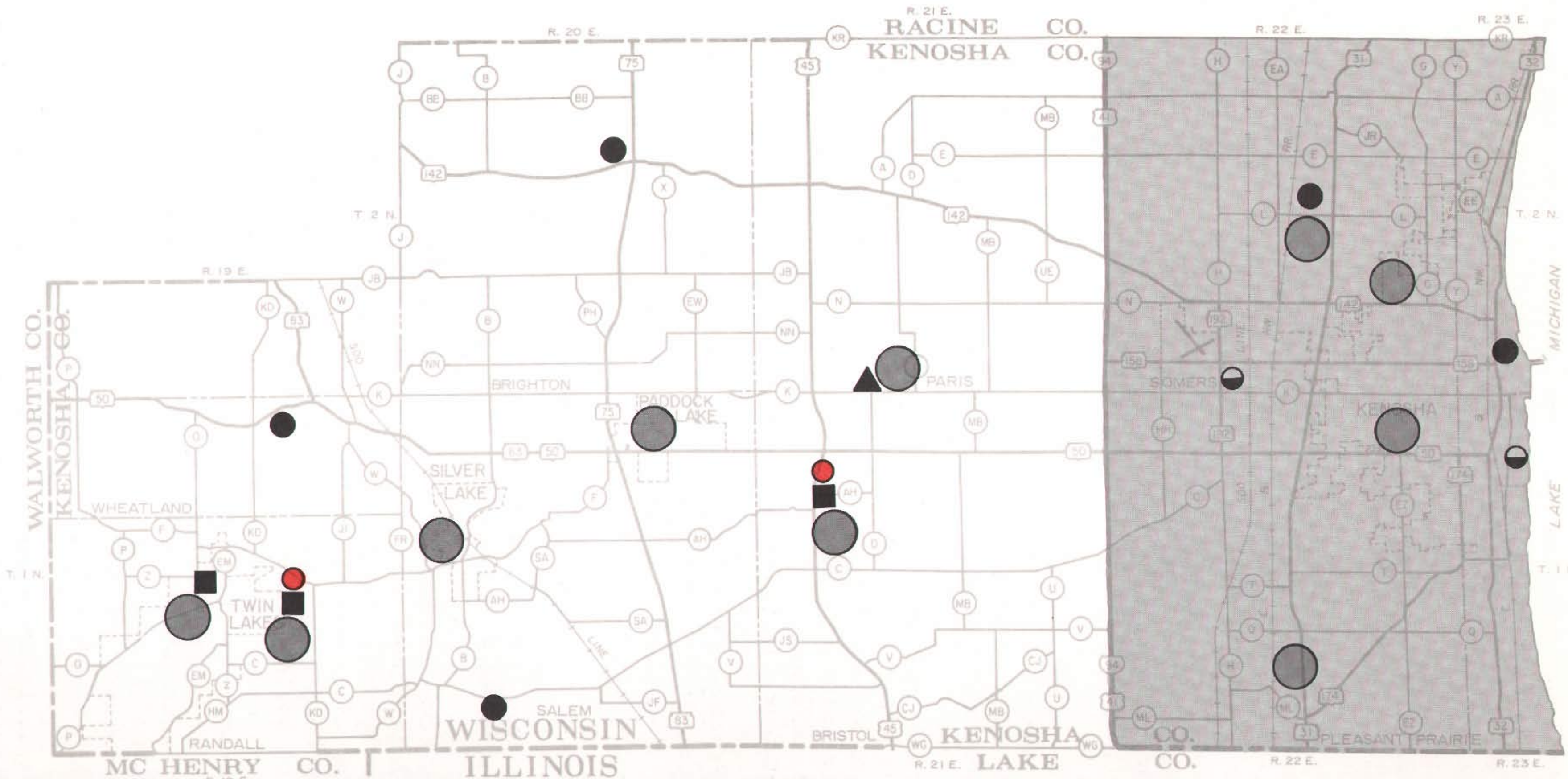
Under Alternative Plan 6, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 6 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to one of the two separate incinerators, or to landfills; 2) continued transport of the remaining unrecycled solid wastes directly to one of the two separate incinerators or to a landfill; 3) processing of a portion of the solid wastes at two new incineration systems designed to burn solid waste for steam generation; 4) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily one existing commercial general-use landfill located in the County. The locations of the landfill, transfer stations, and incinerators under Alternative Plan 6, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 38.

The post-collection solid waste transportation system in the study area would, under this alternative, vary from the existing system because of the disposal site locations. Some of the residential solid wastes would continue to be transported by collection vehicles or residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. The majority of the solid wastes generated in the City of Kenosha and the Towns of Somers and Pleasant Prairie would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 12,000 tons, or about 9 percent on an average annual basis, would be transferred, with the remaining 127,000 tons, or 91 percent, being hauled directly to the incinerators or to a landfill.

Based upon a review of the potential uses of the steam energy produced, as well as of the seasonal distribution of the waste generated, two separate incineration systems were proposed, each with a capacity of 150 tons per day. A total of 56,000 tons per year, or about 39 percent of the average annual solid waste load, would be incinerated. Each 150-ton-per-day modular incineration facility would have the capacity to produce between 720,000 and 780,000 pounds of steam per day at a pressure of 200 to 300 psi. Approximately 8,500

## Map 38

### ALTERNATIVES 6 AND 7: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO INCINERATORS, WITH DISPOSAL AT ONE EXISTING COMMERCIAL GENERAL-USE LANDFILL




LEGEND

- COMMERCIAL GENERAL-USE LANDFILL (1)
- INCINERATOR (2)
- EXISTING TRANSFER STATION (5)
- GENERALIZED LOCATION OF RECYCLING STATIONS (10)
- PUBLIC GENERAL-USE LANDFILLS TO BE ABANDONED DURING THE PLAN PERIOD (3)
- TRANSFER STATIONS TO BE CONSTRUCTED EARLY IN PLAN PERIOD (2)
- AREA FROM WHICH A PORTION OF THE SOLID WASTE WOULD BE TRANSPORTED TO AN INCINERATOR
- AREA FROM WHICH SOLID WASTE WOULD BE TRANSPORTED TO WASTE MANAGEMENT OF WISCONSIN-PHEASANT RUN LANDFILL

GRAPHIC SCALE
0 1/2 1 2 MILES
0 4000 8000 12000 FEET

Source: SEWRPC.

tons of ash would be generated by each facility per year, which would be disposed of at an approved landfill. One incinerator facility was proposed to be located in the vicinity of the City of Kenosha sewage treatment plant, with the other facility proposed to be located in the central-western portion of the City of Kenosha near the Kenosha airport. This alternative includes provisions and associated costs to extend steam conveyance lines from each incineration facility to adjacent energy users.

Under this alternative, a countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 83,000 tons, or 58 percent of the average annual solid waste load generated in the study area, would be disposed of at the Pheasant Run landfill, a commercial general-use facility owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 6 is $29,112,000, with an average annual net operation and maintenance cost, including all landfilling costs, of $3,381,000, and including an estimated credit of $1,285,000 derived from annual steam sale revenues. The total average annual cost of capital and operation and maintenance is $5,914,000, or about $42 per ton of solid waste.

## Alternative Plan 7: Processing of a Portion of the Residential, Commercial, and Industrial Solid Wastes at Two Separate Incinerators Designed for Electric Power Generation, with Disposal at One Existing Commercial General-Use Landfill

Under Alternative Plan 7, solid wastes generated in the study area would be recycled, incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 7 are: 1) continued transport of unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to one of two separate incinerators, or to disposal sites; 2) continued transport of a portion of the remaining unrecycled solid wastes directly to one of two separate incinerators or to landfills; 3) processing of a portion of the solid wastes at two new incineration systems designed to burn solid waste for electric power generation; 4) initiation of a countywide solid waste residential recycling program, with transport of recyclables to recycling centers primarily by residents; and 5) disposal of all unrecycled and unincinerated solid wastes and incinerator ash by landfilling, using primarily one existing commercial general-use landfill located in the County. The locations of the landfill, transfer stations, and incinerators under Alternative Plan 7, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are also shown on Map 38.

The post-collection solid waste transportation system in the study area would, under this alternative, vary from the existing system because of the disposal site location. Some residential solid wastes would continue to be transported by collection vehicle or by residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. The majority of the solid wastes generated in the City of Kenosha and the Towns of Pleasant Prairie and Somers would be hauled directly to one of the incinerator sites under this alternative. Of the total quantity of unrecycled solid wastes generated, about 12,000 tons, or about 9 percent on an average annual basis, would be transferred, with the remaining 127,000 tons, or 91 percent, being hauled directly to the incinerator or to landfills.

Based upon a review of the potential uses of the electric energy produced, as well as of the seasonal distribution of the waste generated, two separate incineration systems were proposed, each with a capacity of 150 tons per day. A total of 56,000 tons per year, or about 39 percent of the average annual solid waste load, would be incinerated. Each 150-ton-per-day modular incineration facility would have the capacity to produce between 720,000 and 780,000 pounds of steam per day at a pressure of 200 to 300 psi. The steam would be used for operating a turbine to generate between 54,000 and 59,000 kilowatts per day of electricity, of which 48,000 to 52,000 kilowatts per day would be available for sale. Approximately 8,500 tons of ash would be generated by each facility per year, which would be disposed of at an approved landfill. One incinerator facility was proposed to be located at the City of Kenosha sewage treatment plant, with the other proposed to be located at the Ocean Spray Cranberry plant.

Under this alternative, a countywide residential solid waste recycling program would be established for the study area consisting of 10 recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers. This recyclable material would be transported to recycling centers primarily by residents using private vehicles.

The remaining 83,000 tons, or 58 percent of the average annual solid waste load generated in the study area, would be disposed of at the Pheasant Run landfill, a commercial general-use facility owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 7 is $33,072,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $3,961,000, and including an estimated credit of $673,000 derived from annual electricity sale revenues. The total average annual cost of capital and operation and maintenance is $6,838,000, or about $48 per ton of solid waste.

### Alternative Plan 8: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Incineration with Electric Power Generation, and with Disposal at One Existing Commercial General-Use Landfill

Under Alternative Plan 8, solid wastes generated in the study area would be either recycled, processed into refuse-derived fuel (RDF) and incinerated, or landfilled. The principal components of the solid waste management system under Alternative Plan 8 are: 1) continued transport of a portion of the unrecycled solid wastes to one of the five existing and two proposed transfer stations located in the County which serve municipalities in the study area, followed by transport to the RDF processing facility, or to landfills; 2) continued transport of the remaining solid wastes directly to the RDF processing facility or to landfills; 3) processing of a portion of the solid wastes at an RDF production facility; 4) incineration of the RDF at a new incineration system designed to burn RDF for electric power generation; 5) initiation of a countywide residential solid waste recycling program, with transport of recyclables to recycling centers primarily by residents; and 6) disposal of all unrecycled and unprocessed solid wastes, RDF residues, unprocessed solid wastes, and incinerator ash by landfilling, using primarily one existing commercial general-use landfill located in the County. The locations of the landfill, transfer stations, and RDF facility under Alternative Plan 8, and of the subareas of the study area from which the wastes generated are to be conveyed to each site, are shown on Map 39.

The post-collection solid waste transportation system in the study area would, under this alternative, vary from the existing system because of the disposal site locations. Some of the residential solid wastes would continue to be transported by collection vehicles or by residents using private vehicles to one of the five existing and two proposed transfer stations in the study area. The majority of the solid wastes generated in the City of Kenosha and the Towns of Pleasant Prairie and Somers would be hauled directly to the RDF processing site under this alternative. Approximately 12,000 tons, or 9 percent of the average annual amount of solid wastes generated in the study area, would be transferred under this alternative, with the remaining 127,000 tons, or 91 percent, being hauled directly to the RDF facility or to landfills.

The RDF preparation would require construction of a specialized facility which would be located at the City of Kenosha transfer station. A diagram of the process to be used is shown in Figure 17.

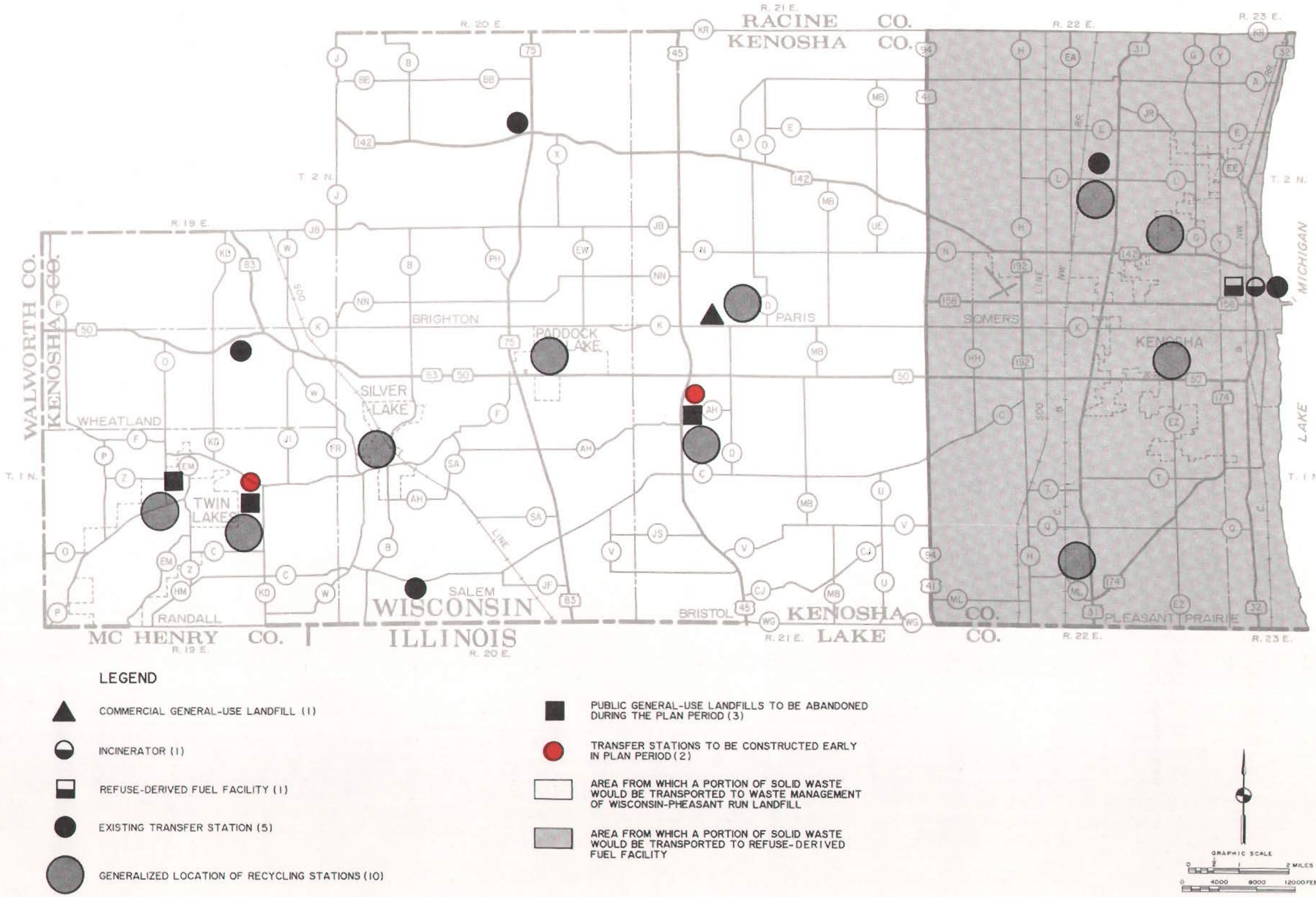
The 60,000 tons of waste per year received at the processing facility would be converted into approximately 42,000 tons of RDF product. This material would be incinerated at a 200-ton-per-day incinerator. Approximately 3,000 tons per year of ferrous material recovered as a by-product of processing the solid waste into RDF would be recycled. Waste materials generated as a result of the conversion process would total approximately 15,000 tons per year. These materials would be disposed of at an approved landfill.

The 200-ton-per-day incineration facility, which for the purpose of this evaluation would also be located at the City of Kenosha transfer station, would have the capacity to generate approximately 60,000 kilowatts per day of electricity, of which approximately 53,000 kilowatts per day would be available for sale. In addition to the 15,000 tons per year of waste from the RDF processing operation, approximately 6,000 tons of incinerator ash would be generated by this facility per year, which would also be disposed of at an approved landfill.

Under this alternative, a countywide residential solid waste recycling program would be established for the study area consisting of nine recycling centers. These recycling facilities, six of which are required under Chapter 144 of the Wisconsin Statutes, would be located as described under Alternative Plan 2. About 3,000 tons per year, or about 2 percent of the average annual quantity of solid wastes generated in the County, would be recycled at these centers.

## Map 39

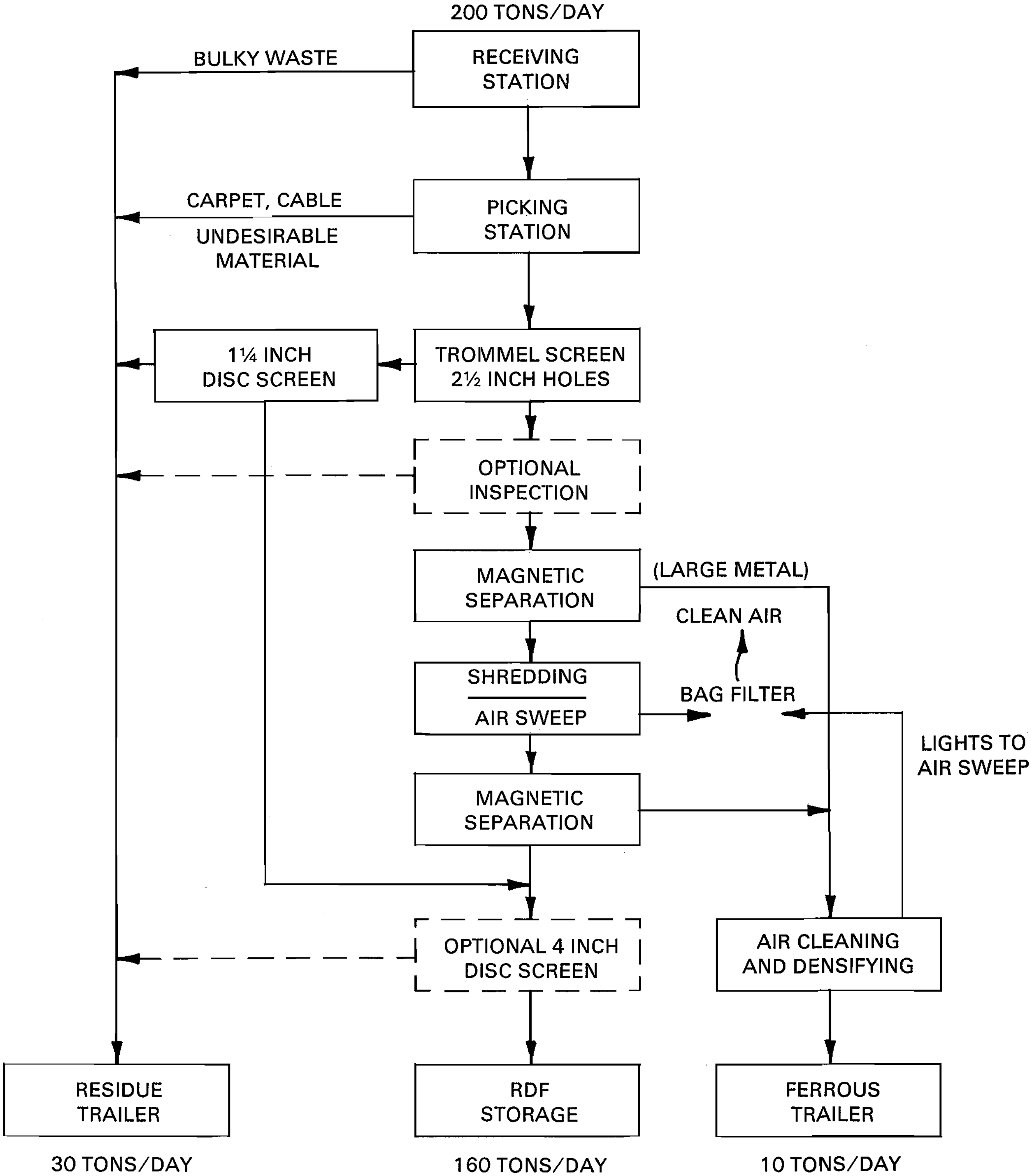
### ALTERNATIVE 8: PROCESSING OF A PORTION OF THE SOLID WASTES INTO A REFUSE-DERIVED FUEL FOR INCINERATION, WITH DISPOSAL AT ONE EXISTING COMMERCIAL GENERAL-USE LANDFILL




Source: SEWRPC.

**Figure 17**

**SCEMATIC DIAGRAM OF REFUSE-DERIVED FUEL PRODUCTION**




Source: Black & Veatch Engineers-Architects, and SEWRPC.

This recyclable material would be transported to recycling centers primarily in private vehicles.

The remaining 83,000 tons, or 58 percent of the average annual solid waste load generated in the study area, would be disposed of at landfills, including the Pheasant Run landfill, a commercial general-use facility owned and operated by Waste Management of Wisconsin, Inc., located in the Town of Paris.

The estimated capital cost for the development of the solid waste management facilities proposed under Alternative Plan 8 is $20,531,000, with an average annual operation and maintenance cost, including all landfilling capital costs which were assumed to be made incrementally over the life of each facility, of $2,874,000, which includes an estimated credit of $1,100,000 derived from annual electric power sale revenues. The total average annual cost of capital and operation and maintenance is $4,660,000, or about $33 per ton of solid waste.

## Accessory Alternatives

As previously noted, three additional solid waste management alternatives may have application in Kenosha County. These alternatives have been termed "accessory" because generally they will not result in the disposal of large quantities of solid wastes and, in most instances, would be carried out in conjunction with one of the "major" alternatives. These three accessory alternatives are described below, with the costs shown in Table 39.

Accessory Alternative 1—High Level of Residential Solid Waste Recycling: Under Accessory Alternative 1, a high level of residential solid waste recycling would be initiated using the same 10 recycling centers to be used under each of the eight major alternatives. However, this alternative would result in the recycling of an additional 6,000 tons of material per year, rather than an additional 3,000 tons as under the major alternatives. These quantities are over and above the levels presently being recycled. The increased amount of recycling would result from the implementation of an extensive information and education program; longer hours of operation of the recycling centers; greater use of nonprofit agencies and organizations for supplying volunteer labor to the stations and for conducting "drives" for recyclables; increased emphasis on public information and "advertising"; the provision of economic incentives, i.e., paying for recyclables; and limited curbside pickup.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 1 is $270,000, with an average annual operation and maintenance cost of $235,000, including an estimated $100,000 paid to recycled material suppliers and including costs for a full-time countywide recycling coordinator and additional part-time paid labor. The total average annual cost of capital and operation and maintenance is $258,500, or about $43 per ton of recycled solid waste. If the cost of the payment to suppliers for the recycled material were not included in the costs, the total average annual cost would be $26 per ton. Under this alternative, savings in transportation and landfill disposal costs would approximate $90,000 per year. Deducting this cost from the total annual cost yields a cost of $168,500 per year, or $28 per ton.

## Table 39

### PRINCIPAL FEATURES AND COSTS OF SOLID WASTE MANAGEMENT ACCESSORY ALTERNATIVES FOR KENOSHA COUNTY

| | | Cost Estimates: 1990-2010[a] | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Gross Average Annual Costs | | | | | Net Total Average Annual Costs | | | | | |
| | | | | | | | | Net Total Average Annual Costs Less Revenue | | | Net Total Average Annual Costs Less Revenues and Savings in Landfill Costs | | |
| Accessory Alternative | Principal Components | Total Capital | Amortized Capital Cost[b] | Transport | New Facilities Operation and Maintenance | Gross Total Average Annual Cost | Gross Unit Cost (dollars per ton) | Revenues | Total | Unit (dollars per ton) | Savings in Landfill Disposal[f] | Total | Unit (dollars per ton) |
| 1. High Level of Residential Solid Waste Recycling . . . . . . | Initiation of a program for a high level of residential solid waste recycling | $270,000 | $23,500 | $15,000 | $220,000[c] | $258,500 | $43.08[d] | - -[e] | $258,500 | $43.08 | $90,000 | $168,500 | $28.08[d] |
| 2. Separate Collection of Residential Newsprint for Recycling . . . . . . | Initiation of a separate residential newsprint collection program | $ 15,000 | $ 1,300 | $35,000 | - - | $ 36,300 | $36.30[g] | $15,000 | $ 20,000 | $20.00 | $15,000 | $ 5,000 | $ 5.00[g] |
| 3A. Composting . . . . . | Initiation of a municipal composting program—with no separate collection | $105,000 | $ 9,000 | - - | $ 42,000 | $ 51,000 | $42.50[h] | - - | $ 51,000 | $42.50[h] | $18,000 | $ 33,000 | $27.50[h] |
| 3B. Composting . . . . . | Initiation of a municipal composting program—with separate collection | $145,000 | $12,600 | $35,000 | $ 42,000 | $ 89,600 | $74.60[h] | - - | $ 89,600 | $74.60 | $18,000 | $ 71,600 | $59.66 |

[a]Based on 1985 costs.

[b]Amortized at 6 percent for 20 years.

[c]Includes cost of payment for materials transported to the centers.

[d]Based on an estimated 6,000 tons per year.

[e]Revenues are used to reimburse volunteer labor.

[f]Based on a $15-per-ton tipping fee at landfills.

[g]Based on an estimated 1,000 tons per year.

[h]Based on an estimated 1,200 tons per year.

Source: SEWRPC.

Another option that could be considered under this alternative is the institution of a mandatory source separation program which would be similar to the system described above. However, the quantities collected would potentially be increased to about 10,000 tons per year as opposed to about 6,000 tons per year using the higher level voluntary-incentive approach noted above. Under the mandatory source separation alternative, the average annual cost for solid waste disposal was estimated to be $350,000, or $35 per ton. Assuming no payment to suppliers for the recycled material, the total annual cost would be about $200,000, or $20 per ton. Under this option, savings in landfill disposal costs would approximate $150,000 per year. Deducting this cost from the total annual cost yields a cost of $200,000 per year, or $20 per ton.

As will be discussed in a subsequent section of this report, there was legislation being proposed in 1988 which may have an impact on this alternative.

Accessory Alternative 2—Separate Collection and Recycling of Newsprint: Under Accessory Alternative 2, a separate curbside collection program to collect and recycle newsprint would be initiated. All collection vehicles, including those which are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes. This separate collection of newsprint is anticipated to result in the recovery and recycling of about 1,000 tons per year. This quantity would be in addition to the newsprint recycled at the 10 drop-off recycling centers established countywide or by the community programs already in effect.

The estimated capital cost for the development of the solid waste facilities proposed under Accessory Alternative 2 is $15,000, with an average annual operation and maintenance cost of $35,000. The gross total average annual cost of capital and operation and maintenance is $36,300, or about $36 per ton. Assuming there is a market for this material, a revenue of about $15,000 per year could be expected, which could be used to offset the operational costs. This would result in a net cost of about $20,000 per year, or about $20 per ton. In addition, landfill disposal costs would be reduced by about $15,000 per year, yielding a net cost of $5,000, or about $5.00 per ton. In certain areas such as narrow streets where vehicle maneuverability and size may be restricted, such a program may not be practicable.

Accessory Alternatives 3A and 3B—Composting: Under Accessory Alternative 3, a comprehensive program for the composting of the vegetative debris contained in solid wastes, including grass clippings, leaves, and brush, would be implemented. Composting is the controlled biological decomposition of organic material in the presence of oxygen to produce humus. Decomposed vegetative materials contain beneficial nutrients and can be used as a soil conditioner in gardens and flower beds and around landscape plants. It is important to note that removal of these materials from the residential solid waste stream would be desirable should one of the alternatives involving incineration be included in the recommended plan. Incineration of vegetable debris lowers the heat content of the incinerated waste because of the high amount of moisture present and can also result in moisture-related operation and maintenance problems at incinerators.

As noted in Table 36, approximately 6,300 tons of yard wastes are anticipated to be generated annually in the County during the plan period. The establishment of composting operations in each of the municipalities in the County is anticipated to result in approximately 1,200 tons being composted, or about 20 percent of the yard wastes generated, assuming no mandatory control of the yard waste. Under Alternative 3A, the materials would be delivered by individual residents to one of seven composting sites in the County. Two sites would be located in the City of Kenosha, with one site each located in the Villages of Paddock Lake, Silver Lake, and Twin Lakes and in the Towns of Pleasant Prairie and Somers. The composting sites would be located near the previously described recycling centers established under the countywide residential solid waste recycling program.

As is discussed in a subsequent section of this report, legislation that was being proposed in 1988 could have an impact on this alternative. The establishment of a mandatory recycling program for yard waste could approximately double the amounts processed at these recycling centers.

The estimated capital cost for the development of the solid waste management facilities proposed under Accessory Alternative 3A is $105,000, with an average annual operation and maintenance cost of $42,000. The gross average annual cost of capital and operation and maintenance is $51,000, or about $42 per ton of composted solid waste. However, savings in landfill disposal costs would be approximately $18,000 per year, yielding a net average annual cost of $33,000, or about $27 per ton of composted solid waste.

An option under this alternative would be to provide for the separate collection of yard waste materials in the more urbanized areas of the County, as proposed under Alternative 3B in Table 39. Thus, in addition to the establishment and operation of seven composting sites, a separate pickup of yard waste materials would be provided in the City of Kenosha, the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and portions of the Towns of Pleasant Prairie and Somers. It was assumed that such pickup would be conducted by the municipalities, which could, however, provide the service through a private collection firm as is done under the present solid waste collection system. For costing purposes, it was assumed that this collection would be conducted at weekly intervals during the six-month period from mid-April through mid-October, with the collection being made using additional storage racks on the existing collection vehicles, supplemented by separate collections in open trucks, rather than packer trucks, during peak periods. For costing purposes, bi-weekly collection was assumed, with no need to supplement the other solid waste collections during the other six months.

Under this option, the capital cost of the alternative would increase to about $145,000, with the increase of $40,000 being due to the purchase of trucks to make the pickups during peak periods, and to the need to retrofit existing collection vehicles with special racks. Only 30 percent of the new truck costs were assigned since the trucks would also be used for other purposes. The average annual cost of this alternative would be $77,000. The gross average annual cost of capital and operation and maintenance is $89,600, or about $75 per ton of composted solid waste. The savings in landfill disposal costs would be approximately $18,000 per year, yielding a net average annual cost of $71,600, or about $60 per ton of composted solid waste.

## ALTERNATIVES PERTAINING TO MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE

Five alternative plans were developed for the handling of municipal sewage treatment plant sludge generated at the nine publicly owned facilities in Kenosha County. Under each alternative, it was assumed that the sludge would be stabilized using the existing systems consisting of aerobic or anaerobic sludge digestion processes. Following stabilization, the extent of the dewatering to be accomplished was considered to be similar to that achieved by the existing system where practical. However, under certain alternatives, it was necessary to modify the existing system to provide for a sludge solids content which was consistent with the disposal or utilization method as described under each alternative.

The principal features and costs of the five alternative plans considered for municipal sewage treatment plant sludge management are summarized in Table 40. Each alternative is described below. The unit-cost and other detailed data utilized in the development of these alternative cost estimates are provided in Appendix E. All costs are expressed in 1987 dollars.

### Alternative Plan 1: Continued Use of the Existing Sewage Treatment Plant Sludge Management Systems

Under Alternative Plan 1, municipal sewage treatment plant sludge generated in the study area would be landfilled or disposed of in a commercial storage lagoon prior to being applied to agricultural land, as shown on Map 40 and

## Table 40

## PRINCIPAL FEATURES AND COSTS OF MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE ALTERNATIVES FOR KENOSHA COUNTY: 1990-2010

| Sewage Treatment Plant Sludge | | Cost Estimates 1990-2010[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Annual Costs and Revenues | | | | | | | |
| Alternative | Principal Components | Initial Capital Cost | Annual Amortized Capital Cost[b] | Transport and Lagoon and/or Land Application Disposal | Landfill Disposal[c] | New Facilities Operation and Maintenance | Average Annual Revenue | Total Average Annual Cost | Unit Cost (per dry ton) | Total Present Worth of Capital and Operation and Maintenance[b] |
| 1. Continued use of existing sewage treatment plant sludge management systems | Disposal of sewage treatment plant sludge by landfilling, land application, or storage in lagoons | $ -- | $ -- | $120,000 | $235,000[d] | $ -- | $ -- | $355,000 | $ 54.61[d] | $4,080,000 |
| 2A. Processing of a portion of the sludge at an incinerator, with land application and landfill disposal of the remaining unincinerated sludge | Incineration of sewage treatment plant sludge together with residential, commercial, and industrial wastes at a new facility<br>Disposal of unincinerated sludge by land application and landfilling | 2,114,000 | 184,000 | 70,000 | 10,000 | 150,000 | --[e] | 414,000 | 63.69 | 4,759,000 |
| 2B. Processing of a portion of the sludge at an incinerator, with land application and landfill disposal of the remaining unincinerated sludge | Incineration of sewage treatment plant sludge separately<br>Disposal of unincinerated sludge by land application and landfilling | 4,000,000 | 348,000 | 70,000 | 20,000 | 300,000 | --[e] | 738,000 | 113.54 | 8,483,000 |
| 3A. Processing of sludge at composting facilities followed by sale and land application of composted sludge | Composting of sewage treatment plant sludge<br>Sale and land application of composted sludge | 3,800,000 | 331,000 | 2,000 | 10,000 | 570,000 | 75,000[f] | 838,000 | 128.93 | 9,632,000 |
| 3B. Processing of a portion of the sludge at a composting facility followed by sale and land application of composted sludge, and landfill disposal and land application of the remaining sludge | Composting of a portion of the sewage treatment plant sludge<br>Sale and land application of composted sludge<br>Disposal of unprocessed sludge by land application and landfilling | 1,200,000 | 104,000 | 70,000 | 20,000 | 300,000 | 70,000[f] | 424,000 | 65.23 | 4,824,000 |
| 4. Disposal of sludge primarily by land application | Land application of most sewage treatment plant sludge | 100,000 | 13,000 | 140,000 | 5,000 | 170,000[g] | -- | 328,000 | 50.46 | 3,770,000 |
| 5. Processing of a portion of the sludge at a soil conditioner manufacturing facility, with land application and landfill disposal of the remaining sludge | Soil conditioner manufacturing of a portion of the sewage treatment plant sludge<br>Disposal of unprocessed sludge by land application and landfilling | -- | -- | -- (Costs will vary depending upon a number of uncertain factors.) | -- | -- | -- | -- | -- | -- |

[a]Based on 1987 costs.

[b]Economic analysis and amortization rates based upon an annual interest rate of 6 percent, and a 20-year amortization period.

[c]Landfill disposal costs are based on an average cost of $15 per ton. This cost includes both operation and maintenance costs at the landfills, as well as capital costs needed for expansion and upgrading of the facilities at the major large commercial general-use landfills. The capital cost is included in the annual cost since the expenditures are expected to be made incrementally over the life of the facility.

[d]Landfill disposal costs are based upon an average cost of $15 per ton. Using costs presently experienced at landfill sites within the study area—$7.00 per ton—results in a total cost of $35.38 per dry ton.

[e]Because of the moisture and lime-laden properties of the sludge to be incinerated, which is anticipated to reduce slightly the overall heat content of the incinerated materials, an annual average revenue component has not been determined.

[f]Based on rate of $15 per ton of 50 percent of the composted sludge.

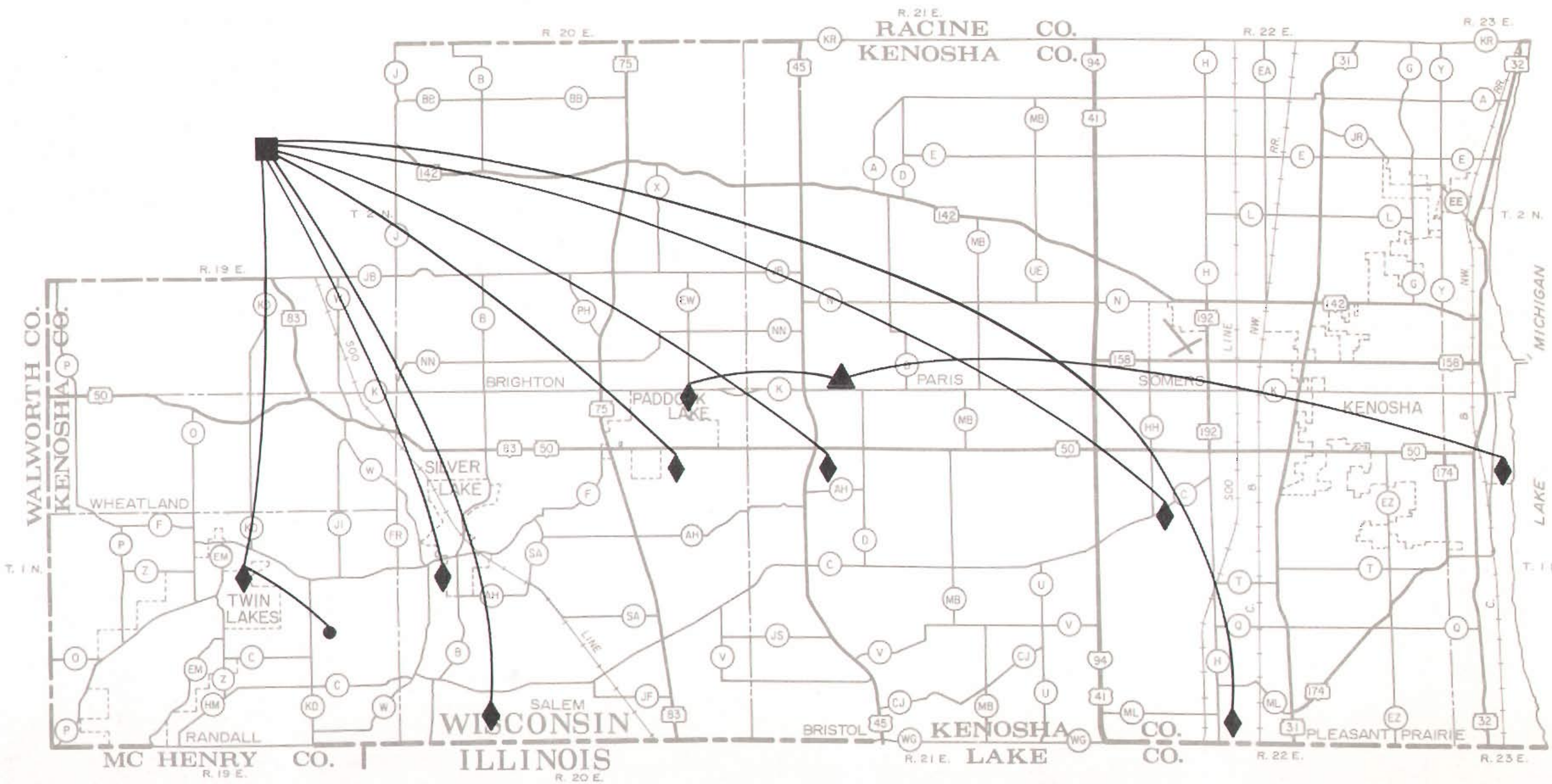
[g]Cost for new land application to be developed.

Source: SEWRPC.

summarized on Table 41. The principal components of the sludge management system under Alternative 1 are: 1) transport of the majority of sewage treatment plant sludge in partially dried form to a landfill; 2) transport of a small portion of the sludge in partially dried form to approved landspreading sites; and 3) transport of a portion of the sludge in liquid form to a private commercial storage lagoon for temporary storage prior to landspreading. The existing sludge management system is described in Chapter II. It is important to note here that sludge generated at the Town of Somers treatment plant was, at the time of the inventory in 1985, processed at the City of Kenosha treatment plant. That plant was abandoned in 1986, and wastewater generated in the

## Map 40

### EXISTING MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE DISPOSAL SITES FOR KENOSHA COUNTY: 1987




LEGEND

- ▲ WASTE MANAGEMENT OF WISCONSIN, PHEASANT RUN LANDFILL
- ■ PAT'S SANITARY SERVICE STORAGE LAGOON
- ● LAND APPLICATION SITE
- ◆ EXISTING PUBLIC SEWAGE TREATMENT PLANT

Source: SEWRPC.

## Table 41

## EXISTING MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE DISPOSAL SITES FOR KENOSHA COUNTY: 1987

| Municipal Sewage Treatment Plant | Sludge Type | Disposal Site |
|---|---|---|
| City of Kenosha | Dewatered | Waste Management of Wisconsin, Pheasant Run Landfill |
| Town of Pleasant Prairie Sewer Utility District D | Liquid | Pat's Sanitary Service Storage Lagoon |
| Town of Pleasant Prairie Sewer Utility District 73-1 | Liquid | Pat's Sanitary Service Storage Lagoon |
| Town of Salem Sewer Utility District No. 1 | Liquid | Pat's Sanitary Service Storage Lagoon |
| Town of Salem Sewer Utility District No. 2 | Liquid | Pat's Sanitary Service Storage Lagoon |
| Town of Bristol Utility District No. 1 and 1A | Liquid | Pat's Sanitary Service Storage Lagoon |
| Village of Paddock Lake | Dewatered | Waste Management of Wisconsin, Pheasant Run Landfill |
| Village of Silver Lake | Liquid | Pat's Sanitary Service Storage Lagoon |
| Village of Twin Lakes[a] | Liquid | Pat's Sanitary Service Storage Lagoon |

[a]Because of recent environmental restrictions and sludge drying bed malfunction, the Village of Twin Lakes municipal sewage treatment plant was unable to apply dewatered sludge to agricultural lands in 1987. However, such disposal is anticipated to take place during the plan period.

Source: SEWRPC.

Somers service area was connected to the Kenosha sewerage system for treatment. Municipal sewage sludge generated at the City of Kenosha and the Village of Paddock Lake sewage treatment plants, which is estimated to total 6,270 dry tons annually, or 96 percent of the sludge generated annually in the County, would be transported in partially dried form to a landfill for disposal. As shown on Map 40 and summarized in Table 41, sludge generated at the remaining seven public sewage treatment plants is primarily transported in liquid form to a private, commercially operated storage lagoon prior to land application, or is land applied in partially dried form. The former would be stored temporarily and eventually spread on agricultural lands in Kenosha and Walworth Counties. The land requirements for application of sludge for each of the treatment plants are identified in a subsequent section of this report. A small portion of the sludge generated at these smaller sewage treatment plants is partially dried and used for local landscaping.

The estimated annual cost for the development of the sludge management facilities proposed under Alternative Plan 1 is $355,000, or about $55 per dry ton. This cost includes an annual landfilling cost, including capital costs which were assumed to be made incrementally over the life of each facility, of $235,000, or 66 percent of the total annual cost.

## Alternative Plans 2A and 2B: Processing of a Portion of the Sludge at an Incinerator, with Land Application of the Unincinerated Sludge

Under Alternative Plans 2A and 2B, municipal sewage treatment plant sludge generated in the study area would be incinerated, disposed of in a commercial storage lagoon, or applied to agricultural land, as shown on Map 41. The principal components of the sludge management system under Alternative 2 are: 1) transport of the majority of the sludge to an incinerator followed by processing at that facility; 2) transport of the remaining sludge to a commercially operated storage lagoon followed by land application; and 3) disposal of the incinerator ash at an existing landfill located within the County.

Under Alternative Plan 2A, municipal sewage sludge generated at the City of Kenosha treatment plant, the Town of Pleasant Prairie Sewer Utility D facility, and the Town of Pleasant Prairie Sanitary District 73-1 facility, which is estimated to total 6,350 dry tons annually, or 98 percent of the sludge generated annually in the County, would be transported to an incinerator located at the City of Kenosha transfer station, where it would be processed at a facility capable of incinerating sludge in combination with conventional solid wastes. Sludge generated at the remaining treatment plants, which are estimated to together produce approximately 150 dry tons of sludge, or 2 percent of the sludge generated annually in the County, would be transported either to a private, commercially operated storage lagoon or to the Waste Management of Wisconsin, Pheasant Run landfill, in a manner similar to the existing system. The former would be stored temporarily and eventually spread on agricultural lands in Kenosha and Walworth Counties. Limited additional quantities of sludge would be disposed of by landfilling when incinerator operation interruptions or climatic conditions precluded disposal either at the incinerator or by land application.

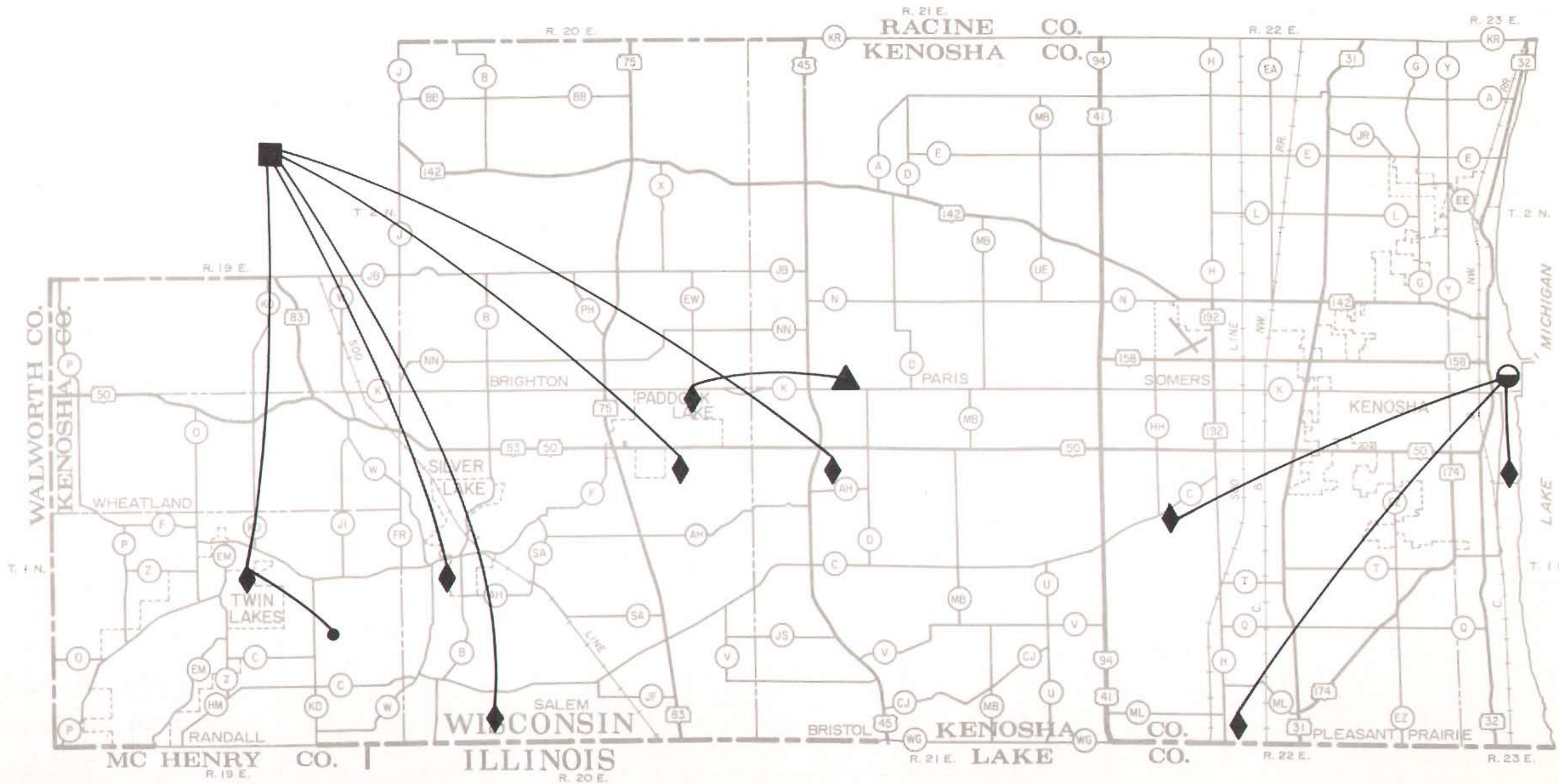
The estimated capital cost for the development of the sludge management facilities proposed under Alternative Plan 2A is $2,114,000, with an average annual operation and maintenance cost of $230,000. The capital and operation and maintenance costs for this alternative include sludge drying facilities at the two Pleasant Prairie treatment plants and modification of the incinerator to store, process, and incinerate sludge. The total average annual cost of capital and operation and maintenance is $414,000, or about $64 per dry ton of sludge.

The capital cost included above for the incineration system includes costs for sludge storage and conveyance, and for feeding sludge into the incineration system, and the cost for dewatering equipment at the two Town of Pleasant Prairie facilities. Only a small incremental cost was added to the incineration system, since the sludge represents a relatively small quantity of material compared to the amount of conventional solid waste which would also be burned at this facility.

Under Alternative Plan 2B, an option was considered providing for a separate incinerator for sludge alone. Under this option, the capital cost of the alternative would increase to about $4,000,000 for the construction of a new incineration facility designed to burn sludge only, with an additional $150,000 per year in operation and maintenance costs. This option would result in a total average annual cost of $738,000, or about $114 per dry ton of sludge.

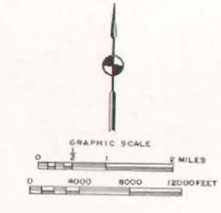
## Map 41

### ALTERNATIVES 2A AND 2B: PROCESSING OF A PORTION OF THE MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE AT AN INCINERATOR, WITH DISPOSAL OF THE REMAINING SLUDGE AT EXISTING SYSTEMS




LEGEND

- ▲ WASTE MANAGEMENT OF WISCONSIN, PHEASANT RUN LANDFILL
- ■ PAT'S SANITARY SERVICE STORAGE LAGOON
- ● LAND APPLICATION SITE
- ♦ EXISTING PUBLIC SEWAGE TREATMENT PLANT
- ◒ INCINERATOR




Source: SEWRPC.

## Alternative Plans 3A and 3B: Processing of a Portion of the Sludge at a Composting Facility, with Land Application of the Uncomposted Sludge

Under Alternative Plans 3A and 3B, municipal sewage treatment plant sludge generated in the study area would be composted, applied to agricultural land, or landfilled, as shown on Map 42. The principal components of the sludge management system under Alternative 3 are: 1) transport of the majority of the sludge to, and processing at, one of six composting facilities; and 2) disposal of the processed sludge by sale and/or application as a soil conditioner on agricultural land, parkland, or residential lawn and flower gardens.

Under Alternative Plan 3A, municipal sludge generated at six of the facilities would be transported and processed at a composting site. It is important to note here that a composting system similar to that operating at the Metropolitan Denver Sewage Disposal District--the aerated windrow composting method--was assumed to be used at each of the six composting sites. Under this alternative plan, it was necessary to provide dewatering facilities at each of the seven sewage treatment plants which do not have adequate facilities. In addition, each composting site was assumed to be fitted with a partial enclosure to protect the composted material from inclement weather. The composted sludge would be available for sale and for use by local units of government or residents as a soil conditioner, or would be spread on agricultural land. Land suitability for application of sludge in Kenosha County was discussed in Chapter IV. Limited quantities of sludge would be disposed of by landfilling when composting operation requirements or climatic conditions precluded the use of these systems.

The estimated capital cost for the development of the sludge management facilities proposed under Alternative Plan 3 is $3,800,000, with an average annual operation and maintenance cost of $507,000, including a credit of $75,000 for revenue from the sale of the composted sludge. The total average annual cost of capital and operation and maintenance is $838,000, or about $129 per dry ton of sludge. Without consideration of revenue from the sale of compost, the net unit cost is $140 per dry ton of sludge.

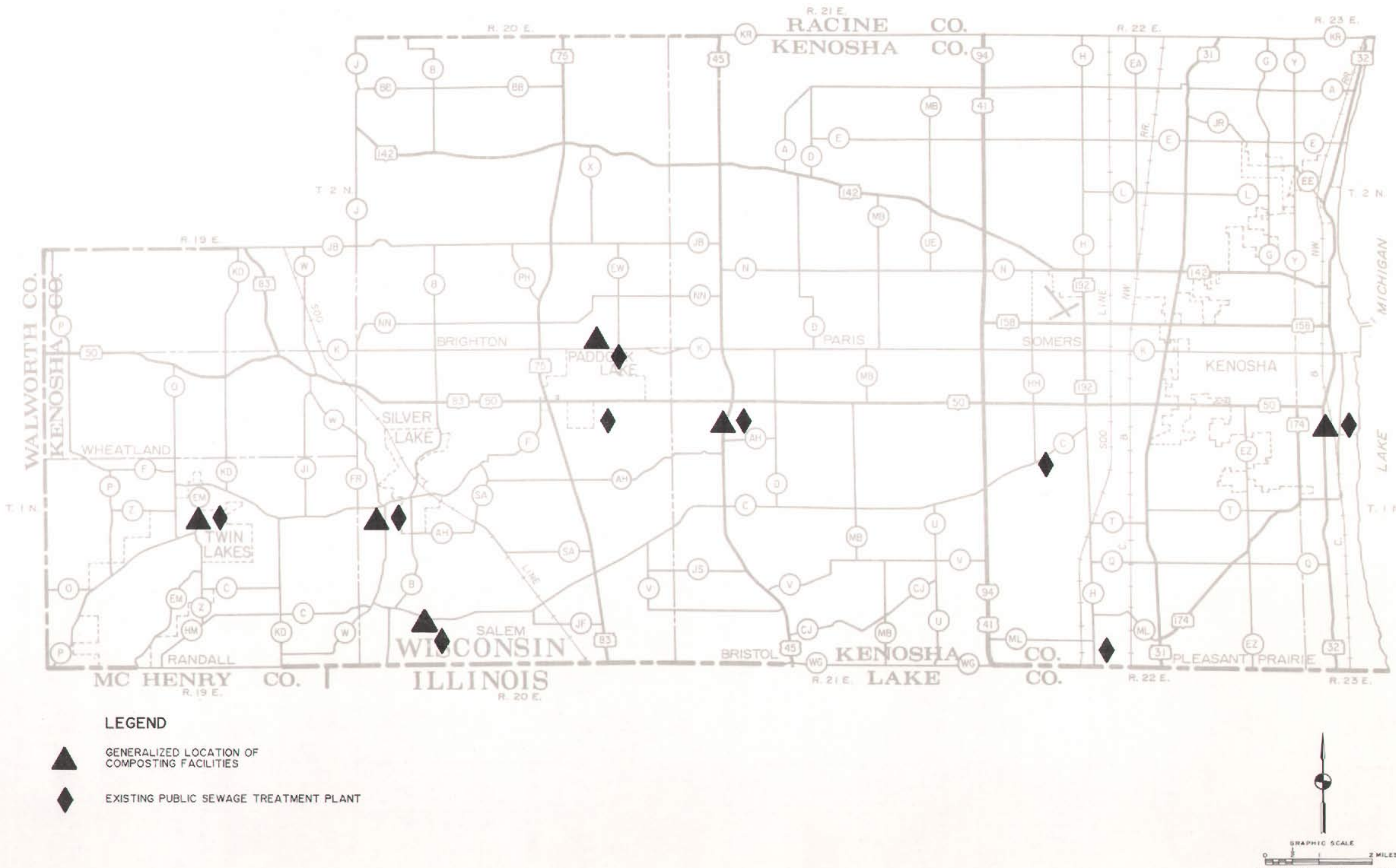
Under Alternative Plan 3B, another option was considered providing for only one composting site east of IH 94 which would be used for composting sludges generated at the City of Kenosha and Town of Pleasant Prairie sewage treatment plants. Sludge from the remaining plants would be disposed of in the existing system as described under Alternative Plan 1. Under this option, the estimated capital cost for the development of the proposed sludge management facilities is $1,200,000, with an average annual operation and maintenance cost of $320,000, including a credit of $70,000 for revenue from the sale of composted sludge. The total average annual cost of capital and operation and maintenance is $424,000, or about $65 per dry ton of sludge. Without consideration of the revenue from the sale of composted sludge, the net unit cost would be about $76 per dry ton of sludge.

## Alternative Plan 4: Disposal of the Sludge Primarily by Application to Agricultural Lands, with Landfilling of the Unspread Material

Under Alternative Plan 4, all of the municipal sewage treatment plant sludge generated in the study area would be applied to agricultural land or landfilled. The principal components of the sludge management system under Alter-

## Map 42

### ALTERNATIVE PLAN 3A: PROCESSING OF A PORTION OF THE SLUDGE AT A COMPOSTING FACILITIES WITH LAND APPLICATION OF THE REMAINING SLUDGE




Source: SEWRPC.

## Table 42

### LAND APPROVED AND REQUIRED FOR LAND APPLICATION OF MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE GENERATED IN KENOSHA COUNTY: 1988

| Municipal Sewage Treatment Plant | Land Approved for Land Application (acres) | Land Required for Land Application[a,b] (acres) |
|---|---|---|
| City of Kenosha | 534 | 600 |
| Town of Pleasant Prairie Sewer Utility District D | -- | 6 |
| Town of Pleasant Prairie Sanitary District No. 73-1 | -- | 3 |
| Town of Salem Sewer Utility District No.1 | 97 | 3 |
| Town of Salem Sewer Utility District No. 2 | -- | 3 |
| Town of Bristol Utility District No.1 | 11 | 8 |
| Village of Paddock Lake | 22 | 3 |
| Village of Silver Lake | -- | 4 |
| Village of Twin Lakes | 17 | 8 |
| Total | 681 | 638 |

[a]Based on the total amount and characteristics of sludge generated for each municipal sewage treatment plant in 1986. See Table 37 for further details.

[b]Based on a total nitrogen fertilizer rate of 200 pounds per acre.

Source: SEWRPC.

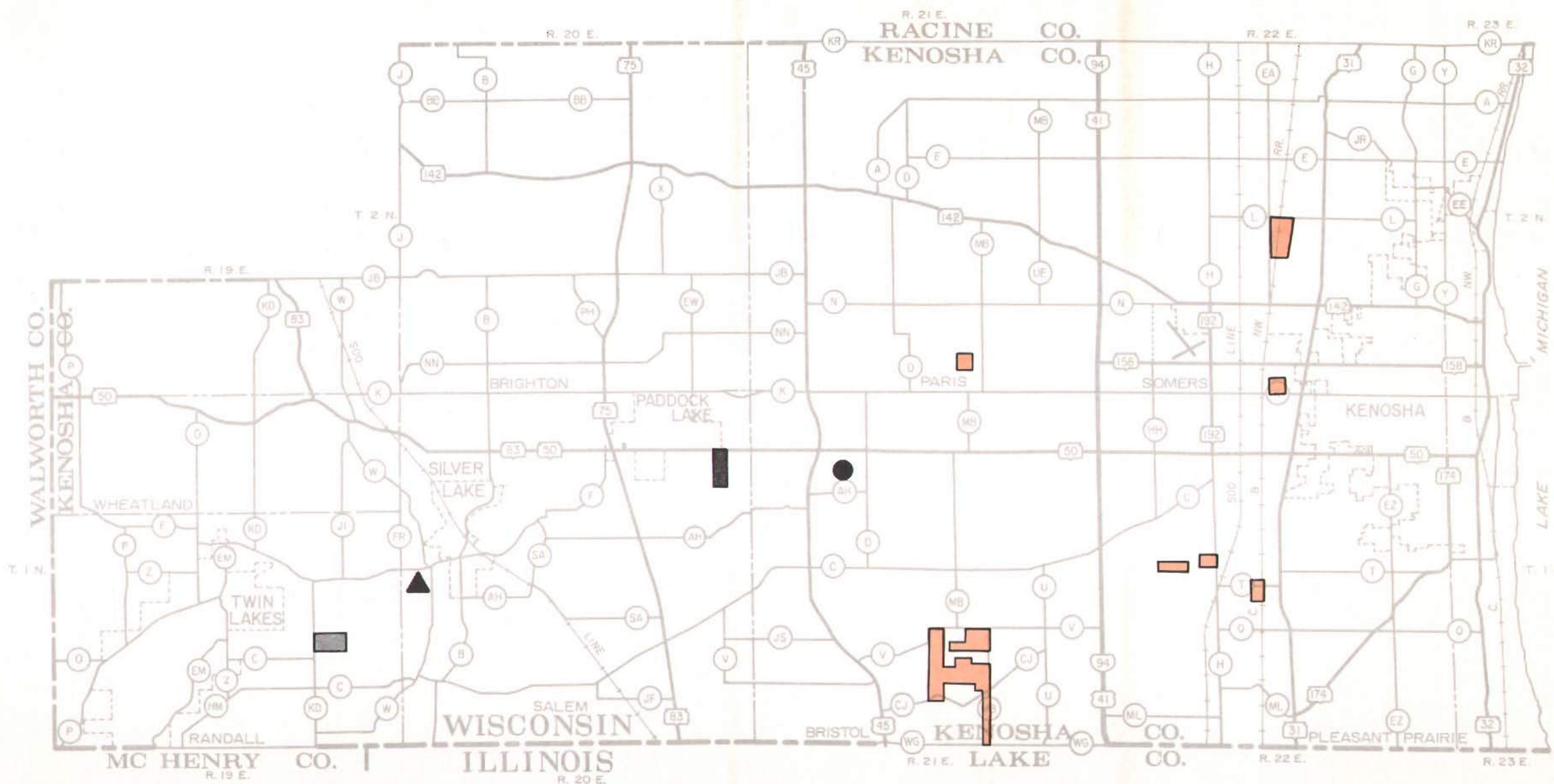
native 4 are the transport of the sludge to approved land application sites and the disposal of the sludge by spreading on agricultural land or by landfilling.

Municipal sewage treatment plant sludge generated at the nine facilities anticipated to be operating through the plan period would be disposed of primarily by spreading it on agricultural land. The land requirements for application of sludge for each of the treatment plants are shown on Table 42 along with information pertaining to the amount of land presently approved for land application, as shown on Map 43. The alternative assumes sludge would be transported and spread at the moisture content set forth in Table 37. Thus, no new dewatering system costs were added. Approximately 6,500 dry tons, or all of the material generated annually in the County, would be disposed of in this manner. During periods when climatic or site conditions precluded the use of approved sites for land application of sludge, the sludge would be landfilled at existing facilities. However, no landfilling was assumed for those plants with storage capacity in sludge drying beds, or, in the case of the City of Kenosha, in a domed storage building.

The estimated capital cost for the development of the sludge management facilities proposed under Alternative Plan 4 is $100,000, with an average annual operation and maintenance cost of $315,000. The total average annual cost of capital and operation and maintenance is $328,000, or about $50 per dry ton of sludge.

## Map 43

### LAND APPROVED FOR APPLICATION OF MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE: 1988




LEGEND

AGRICULTURAL LANDS APPROVED BY MUNICIPAL SEWAGE TREATMENT PLANT

- TOWN OF BRISTOL UTILITY DISTRICT NUMBER ONE
- TOWN OF SALEM SEWER UTILITY DISTRICT NUMBER ONE
- CITY OF KENOSHA SEWAGE TREATMENT PLANT
- VILLAGE OF PADDOCK LAKE SEWAGE TREATMENT PLANT
- VILLAGE OF TWIN LAKES SEWAGE TREATMENT PLANT

Source: Wisconsin Department of Natural Resources and SEWRPC.

## Alternative Plan 5: Processing of a Portion of the Sludge at a Soil Conditioner Manufacturing Facility, with Land Application and Landfilling of the Remaining Processed Sludge

Under Alternative Plan 5, a portion of the municipal sewage treatment plant sludge generated in the study area would be processed into a soil conditioner, applied to agricultural land, or landfilled, in a manner similar to that described under Alternative Plan 3B, as shown on Map 42. The principal components of the sludge management system under Alternative 5 are: 1) processing of a portion of the sludge to produce a soil conditioner product; and 2) transport and disposal of the remaining sludge by land application and landfilling.

Municipal sludge generated at the City of Kenosha sewage treatment plant, which is estimated to total 6,250 dry tons annually, or about 96 percent of the sludge generated in the County annually, would be processed at a facility to produce a soil conditioner product for commercial uses. The material could be bagged for sale to home and commercial gardens. Sludge generated at the remaining treatment plants, which together are estimated to produce 250 dry tons of sludge annually, or 4 percent of the sludge generated annually in the County, would be transported either to a private commercially operated storage lagoon or to the Waste Management of Wisconsin, Pheasant Run landfill, in a manner similar to the existing system. The former would be stored temporarily and eventually spread on agricultural lands in Kenosha and Walworth Counties.

Another option to be considered is the production of an organic fertilizer-soil conditioner which utilizes dewatered sludge as a base which would be distributed in bagged or bulk form. Such a product--Milorganite--is produced at the Milwaukee Metropolitan Sewerage District Jones Island sewage treatment plant. In addition, the Milwaukee Metropolitan Sewerage District is evaluating the marketability of a similar product to be used as a plant soil-type material in smaller bags. The Kenosha Water Utility has conducted experiments with a similar product--Ken-Soil--which contains a mixture of dewatered sludge, vermiculite, and peat moss. That mixture neutralizes the high alkalinity pH of the sludge. Small-scale experiments have been conducted which indicate that this alternative is technically feasible. However, it is recognized that the viability of the option will depend upon securing a market for the product and upon securing an agreement with a private commercial enterprise in the business of producing and/or handling fertilizer and soil conditioning materials.

The Kenosha plant is in a relatively advantageous position compared to other major treatment plants with regard to the use of sludge in the manufacture of soil conditioner or soil-type material for two reasons. The first is that the sludge generated at Kenosha contains over 40 percent solids. Second, data have been developed on product material mixes and suitability.

Under this alternative, it was assumed that it would be necessary to blend sludge in a mixture using at least 50 percent peat moss and/or vermiculite. A processing system requiring grinding and mixing equipment to blend material would be needed. Revenue costs from the sale of the material on the order of $20 per ton in bulk could likely be expected. Further studies would need to be conducted to evaluate other options involving bagging, which could increase the value to about $40 per ton. This option would also require a bagging facility operation and the associated capital and operation costs.

Detailed costs for this type of operation would be dependent upon the processing site, location, available equipment, market conditions, and marketing system in place. Thus, further analysis would be needed. However, review of this alternative indicates that this option could be practical if the costs or viability of sludge landfilling change in the future. It is likely that under certain circumstances, the alternative could be at least as cost-effective as the composting alternative set forth above which resulted in a net cost of about $65 per ton. If arrangements could be made with a private commercial manufacturer and/or supplier of similar material, this option could be less costly. It would be necessary, however, to pursue the alternative on a smaller scale basis and to obtain more data on the marketability of the product by discussion with commercial businesses handling related products.

## EVALUATION OF ALTERNATIVES

The preceding section of this chapter described eight major and three accessory alternatives for solid waste management in Kenosha County. In addition, it presented information on five alternative management plans applicable to municipal sewage treatment plant sludge. This section describes the advantages and disadvantages attendant to each of the alternatives considered, presents a comparison of the alternatives, and identifies a preferred alternative. The evaluation of each alternative considers the technical feasibility, regulatory compliance, practicality of implementation, social and public acceptance, and economics, as required under Chapter 185 of the Wisconsin Administrative Code, and also considers other objectives established at the outset of the study by the Technical Advisory Committee for the Kenosha County solid waste management planning program, as set forth in Chapter I. Consideration was also given in the analyses to the viability of the alternatives under the range of future conditions which were set forth in Chapter III. The range of future conditions was developed in an attempt to deal with the current uncertainties about key conditions that may be expected to influence the demand for public facilities and services in Kenosha County. These key conditions with regard to solid waste management include the design year resident population and employment levels in the County and variations in the cost and availability of energy. Table 43 summarizes the cost and the major advantages and disadvantages of each alternative.

### Alternative Plan 1: Continued Use of Existing Solid Waste Management Systems

The major advantage of Alternative Plan 1 is that the system is largely in place, with the only new component being the establishment of a countywide residential solid waste recycling system. Thus, this alternative may be rated high in terms of feasibility of implementation and in terms of compatibility with land use plans and zoning. This alternative is based upon proven, low-level technology systems. Disposal of the solid wastes by landfilling is generally flexible and can be used for nearly all solid wastes with little or no processing.

The major disadvantage of this alternative is the reliance on a technology having potential for rapidly escalating costs and environmental constraints. Landfill disposal costs within the Southeastern Wisconsin Region have generally risen at rates higher than general price inflation over the past 10 years. Analyses of the landfill tipping fees for private waste haulers at landfills in southeastern Wisconsin for a 10-year period indicate that from 1974 until 1984, tipping fees increased at an annual rate of about 20 percent. These increases may be attributed, in part, to changing public regulations affecting the siting and operation of landfills. As newer landfills, or major expansions of existing landfills, become necessary, the full cost of meeting the most recent landfill siting and groundwater protection regulations may be expected to be included in landfill costs. Landfill costs in Kenosha County have been relatively stable. Further, environmental regulations may eventually

# Table 43

## COMPARISON OF PRINCIPAL FEATURES AND COSTS OF KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN ALTERNATIVES

| Residential, Commercial, and Industrial Wastes | | Key Considerations | | |
|---|---|---|---|---|
| Alternatives | Principal Requirements | Unit Cost (dollars per ton) | Advantages | Disadvantages |
| 1. Continued use of existing solid waste management systems | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes at existing commercial general-use landfills and at existing public general-use landfills | $17.18 to 22.10[a] | • No new disposal facilities required<br>• Compatible with existing land use planning and zoning<br>• Utilizes flexible, proven landfilling technology<br>• Not sensitive to fluctuations in loadings | • Potential for rapidly escalating costs<br>• Dependence on facilities outside the County<br>• Dependence on a nonoptimum transportation network |
| 2. Disposal of solid wastes at a single existing commercial general-use landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes primarily at one existing commercial general-use landfill | $22.53 | • No new disposal facilities required<br>• Compatible with existing land use planning and zoning<br>• Utilizes flexible, proven landfilling technology at a site within the County<br>• Economy-of-scale using one major landfill facility | • Potential for rapidly escalating costs<br>• Uncertainty regarding potential for expansion of landfill facilities to meet future disposal needs<br>• Dependence on a nonoptimum transportation network<br>• No backup system should capacity of one large landfill facility be limited by environmental or other constraints |
| 3. Disposal of solid wastes at two existing commercial general-use landfills and at three existing private special-use landfills | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Disposal of unrecycled solid wastes primarily at two existing commercial general-use landfills | $22.23 | • No new disposal facilities required<br>• Compatible with existing land use planning and zoning<br>• Utilizes flexible, proven landfilling technology<br>• Backup provided by the use of more than one large landfill | • Potential for rapidly escalating costs<br>• Uncertainty regarding expansion of landfill facilities to meet future disposal needs<br>• Dependence on a nonoptimum transportation network |
| 4. Processing of a portion of the solid wastes at one new incinerator designed for steam production, with disposal of unincinerated and unrecycled solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at one new incinerator designed for steam production<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | $30.43 | • Provides flexible, integrated long-term disposal facilities using proven technologies<br>• Backup system provided by use of two different disposal methods<br>• Energy produced through incineration of solid wastes<br>• Reduced landfill requirements and lower transportation costs<br>• Potential for substantial cost savings if energy costs escalate | • High initial capital costs, high level of technology<br>• Requires siting and construction of large incinerator facility<br>• Uncertainty concerning markets for energy produced<br>• Uncertainty concerning disposal of incinerator ash and air pollution control requirements<br>• Potential for conflicts with existing land use planning and zoning |
| 5. Processing of a portion of the solid wastes at one new incinerator designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at a new incinerator designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | $34.97 | • Provides flexible, integrated long-term disposal facilities using proven technologies<br>• Backup system provided by use of two different disposal methods<br>• Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product produced<br>• Reduced landfill requirements and lower transportation costs<br>• Potential for substantial cost savings if energy costs escalate | • High initial capital costs and high level of technology<br>• Requires siting and construction of large incinerator facility<br>• Uncertainty concerning disposal of incinerator ash and air pollution control requirements<br>• Potential for conflicts with existing land use planning and zoning |
| 6. Processing of a portion of the solid wastes at two new incinerators designed for steam production, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at two new incinerators designed for steam production<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | $41.65 | • Provides flexible, integrated long-term disposal facilities using proven technologies<br>• Backup system provided by use of two different disposal methods at two separate locations<br>• Energy produced through incineration of solid wastes<br>• Reduced landfill requirements and lower transportation costs<br>• Potential for substantial cost savings if energy costs escalate | • High initial capital costs and high level of technology<br>• Requires siting and construction of two large incinerator facilities<br>• Uncertainty concerning markets for energy produced<br>• Uncertainty concerning disposal of incinerator ash and air pollution control requirements<br>• Potential for conflicts with existing land use planning and zoning |
| 7. Processing of a portion of the solid wastes at two new incinerators designed for electric power generation, with disposal of unrecycled and unincinerated solid wastes and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Incineration of solid wastes at two new incinerators designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes and incinerator ash at one existing commercial general-use landfill | $48.15 | • Provides flexible, integrated long-term disposal facilities using proven technologies<br>• Backup system provided by use of two different disposal methods at two separate locations<br>• Energy produced through incineration of solid wastes, with greater flexibility for marketing energy product<br>• Reduced landfill requirements and lower transportation costs<br>• Potential substantial cost savings if energy costs escalate | • High initial capital costs and high level of technology<br>• Requires siting and construction of two large incinerator facilities<br>• Uncertainty concerning disposal of incinerator ash and air pollution control requirements<br>• Potential for conflicts with existing land use planning and zoning |

## Table 43 (continued)

| Residential, Commercial, and Industrial Wastes | | Key Considerations | | |
|---|---|---|---|---|
| Alternatives | Principal Requirements | Unit Cost (dollars per ton) | Advantages | Disadvantages |
| 8. Processing of a portion of the solid wastes into refuse-derived fuel, incineration at one incinerator designed for electric power generation, and disposal of unincinerated and unrecycled solid wastes, refuse-derived fuel residue, and incinerator ash at an existing landfill | Initiation of a program for a moderate level of residential solid waste recycling<br><br>Processing of solid wastes into refuse-derived fuel<br><br>Incineration of refuse-derived fuel at one new incinerator designed for electric power generation<br><br>Disposal of unrecycled and unincinerated solid wastes, refuse-derived-fuel residue, and incinerator ash at one existing commercial general-use landfill | $32.94 | • Provides flexible, integrated long-term disposal facilities<br>• Backup system provided by use of two different disposal methods<br>• Energy produced through incineration of high-quality refuse-derived fuel<br>• Reduced landfill requirements and lower transportation costs<br>• Potential for substantial cost savings if energy costs escalate | • High initial capital costs and high level of technology<br>• Requirements siting and construction of an incinerator and a refuse-derived fuel processing facility<br>• Uncertainty concerning refuse-derived fuel production and, potentially, the incinerator technology<br>• Uncertainty concerning disposal of incinerator ash<br>• Potential for conflicts with existing land use planning and zoning |
| Accessory Alternatives | | | | |
| 1. High level of residential solid waste recycling | Initiation of a program for a high level of residential solid waste recycling | $28.08 to 43.08 | • Recovery of reusable portions of solid waste stream<br>• Reduced landfill requirements<br>• Reduced transportation costs<br>• Reduced amount of incinerator ash due to reduction of noncombustibles | • Uncertainty regarding citizen participation<br>• Uncertainty regarding ability of municipalities to coordinate necessary volunteer activities<br>• Uncertainty regarding reliable markets for recycled materials<br>• High cost |
| 2. Separate collection of residential newsprint for recycling | Initiation of a separate residential newsprint collection program | $5.00 to 36.30 | • Recovery of reusable portions of solid waste stream<br>• Reduced landfill requirements | • Requires modifying existing collection vehicles and collection practices<br>• Uncertainty regarding reliable markets for recycled materials |
| 3. Composting | Initiation of a municipal composting program for vegetative debris | $27.50 to 74.60 | • Reduced moisture content and subsequent increase in heat value of incinerated solid wastes<br>• Provision of usable soil conditioner<br>• Reduced disposal costs | • Difficulty in siting composting operations<br>• Uncertainty regarding citizen participation<br>• Difficulty in segregating materials from other residential solid wastes<br>• High cost |
| Sewage Treatment Plant Sludge | | | | |
| Alternatives | | | | |
| 1. Continued use of existing sewage treatment plant sludge management systems | Disposal of sewage treatment plant sludge primarily by landfilling, with limited quantities of material spread on agricultural lands | $35.38 to 54.61[b] | • No new disposal facilities required<br>• Compatible with existing land use planning and zoning<br>• Utilizes flexible landfill technology<br>• Reduced concern regarding weather conditions and soil moisture | • Potential for escalating costs<br>• Uncertainty regarding long-term capacity of landfill<br>• Large quantity of a usable product for amendment of agricultural soils not being used |
| 2. Processing of a portion of the sludge at an incinerator, with land application and landfill disposal of the remaining unincinerated sludge | Incineration of solid wastes at an incinerator together with residential, commercial, and industrial wastes<br><br>Disposal of unprocessed sludge by land application and landfilling | $63.69 to 113.54 | • Flexible system using two different disposal methods<br>• Energy produced through incineration of wastes<br>• Provides additional material for incineration to help facility run at optimum operating efficiency | • High initial capital costs<br>• Requires siting and construction of large facility<br>• Uncertainty regarding impact of sludge on facility operation |
| 3. Processing of a portion of the sludge at a composting facility followed by land application | Composting of sewage treatment plant sludge<br><br>Land application of composted material | $65.23 to 128.93 | • Flexible system using two different disposal methods<br>• Reduced volume of material to be disposed of<br>• Increased options for use of material<br>• Desirable use of resource as a soil amendment | • Requires operation of new processing facility<br>• Uncertainty regarding effectiveness of system to reduce waste volume<br>• Intensive maintenance required to operate system at desired efficiency |
| 4. Disposal of sludge primarily by land application | Land application of sewage treatment plant sludge | $50.46 | • Flexible system using more varied disposal methods<br>• Optimum use of material as a soil amendment<br>• Reduced reliance on landfills<br>• Cost less subject to market pressures applicable to landfilling | • Uncertainty regarding finding suitable lands for land spreading<br>• Regulations may restrict application or make longer travel distances to suitable sites necessary<br>• Reliance on landowner cooperation<br>• Uncertainty regarding climatic conditions, season, and soil conditions |
| 5. Processing of a portion of the sludge at a soil conditioner manufacturing facility, with land application and landfill disposal of the remaining sludge | Soil conditioner or product manufacturing of a portion of the sewage treatment plant sludge<br><br>Disposal of unprocessed sludge by land application and landfilling | - -[c] | • Increases flexibility by using multiple disposal methods<br>• Desirable use of resource as a soil product or conditioner | • May require operation of a new processing facility<br>• Uncertainty about market conditions |

[a]The cost of $22.10 per ton was based upon an assumed landfill cost of $15 per ton. Using costs currently experienced at landfill sites within the study area—$10 per ton—results in a total unit cost of $17.18 per ton.

[b]The $54.61 cost per dry ton assumed a landfilling cost of $15 per wet ton. Using the cost currently paid of about $7.00 per wet ton results in a unit cost of $35.38 per dry ton.

[c]Cost varies depending upon marketability, the interest of commercial enterprise, and the location of processing sites.

Source: SEWRPC.

preclude the expansion of the landfills that are currently used for disposal of solid wastes from Kenosha County, or make such expansions costly.

This alternative was found to have the lowest cost of the alternatives considered. The transportation cost element of this alternative, however, was one of the highest of all of the alternatives considered. Therefore, future energy cost increases may result in more rapidly escalating transportation costs than under other alternatives. This alternative would not be sensitive to declines in population growth rates since no new facilities would be provided and since expansion of existing facilities would be staged to match capacity needs. Conversely, increases in population growth rates could have an impact on the viability of this alternative, since the potential for expansion at the existing landfill sites may be limited.

## Alternative Plan 2: Disposal at a Single Existing Commercial General-Use Landfill

The major advantage of Alternative Plan 2 is that the system envisioned would not require any major new facilities for the disposal of solid wastes other than a new countywide residential solid waste recycling system. Thus, this alternative may be rated high in terms of feasibility of implementation, and in terms of compatibility with land use plans and zoning. This alternative would provide a long-term solution to the solid waste disposal problem, utilizing landfilling--a proven, low-level technology. Disposal by landfilling is generally flexible and can be used for nearly all solid waste with little or no processing. Economies-of-scale could be achieved by using one large commercial general-use landfill for the disposal of the majority of solid wastes generated in the County. The major disadvantage of this alternative is the reliance on a single, commercial, general-use landfill for long-term disposal of the majority of solid wastes anticipated to be generated during the plan period. This alternative assumes that the commercial-use landfill would receive the approvals needed for expansion to accommodate landfilling of the majority of the County's solid wastes. Increasingly stringent environmental regulations regarding the siting, use, and expansion of landfills could preclude adequate expansion or make such expansion very expensive. However, there are currently preliminary plans for expansion of the Waste Management, Inc., landfill in the Town of Paris on about 80 acres, which, if approved incrementally, would provide about 15 years of capacity. This alternative was found to have one of the lowest costs of the alternatives considered. This alternative does, however, have the highest transportation costs of the alternatives considered because of the need to transport most of the solid wastes to one location rather than to multiple locations. Based upon historical trends and the potential for increases in cost due to new regulations, disposal costs under this alternative could escalate over and above the general inflation rate.

This alternative may also be expected to be sensitive to energy cost increases since it would involve relatively high transportation costs. Therefore, future cost increases may result in more rapidly escalating costs than under other alternatives. This alternative would not be sensitive to declines in population growth rates since the capital expenditures for the construction of additional landfill capacity would be staged to match capacity needs. Conversely, increases in population growth rates could have an impact on the viability of this alternative, since the potential for expansion of the existing landfill facilities may be limited.

## Alternative Plan 3: Disposal at Two Existing Commercial General-Use Landfills

The major advantage of Alternative Plan 3 is that the system envisioned would not require any major new facilities for the disposal of solid wastes other than a new countywide residential solid waste recycling system. Thus, this alternative may be rated high in terms of feasibility of implementation and compatibility with land use plans and zoning. This alternative would provide a long-term solution to the solid waste disposal problem, utilizing landfilling, a proven, low-level technology. Disposal by landfilling is generally flexible and can be used for nearly all solid waste with little or no processing. This alternative provides more flexibility than Alternative Plan 2 because of the use of two large commercial general-use landfills for disposal of most of the solid wastes generated in the County.

This alternative was found to have one of the lowest costs of the alternatives considered. This alternative would have lower transportation costs than Alternative Plan 2 but would have relatively high transportation costs when compared to the other alternatives. This alternative assumes that the two commercial general-use landfills would receive the regulatory agency approvals needed to carry out expansion to accommodate landfilling of the majority of the solid wastes generated within the County. Increasingly stringent environmental regulations regarding the siting, use, and expansion of landfills could preclude adequate expansion or make such expansion costly. This alternative is superior to Alternative 2 in this regard, however, since there would be two sites at which the needed expansion could be provided, rather than one. Based upon historical trends and the potential for increases in costs due to increasingly stringent regulations, disposal costs under this alternative could escalate over and above the general inflation rate.

This alternative would also be one of the most sensitive to energy cost increases since the transportation distances and costs are greater than for most of the other alternatives considered. This alternative would not be sensitive to declining population growth rates, since the expansion of existing facilities would be staged to match capacity needs. Conversely, increased population growth rates may have an impact on the viability of this alternative, since it may not be possible to readily expand the landfills concerned.

## Alternative Plans 4 and 5: Processing of a Portion of the Solid Wastes at a Single Incinerator, with Disposal at One Existing Commercial General-Use Landfill

The major advantage of Alternative Plans 4 and 5 is the potential savings in resources and costs which can be achieved by the conversion of solid waste to energy. It should be noted that the only difference between Alternative Plan 4 and Alternative Plan 5 is that under Alternative 4, the incinerator would be designed to burn solid waste to generate steam, while under Alternative 5, the incinerator would be designed to generate electricity. The use of the incineration system in conjunction with landfilling provides more flexibility than using landfilling as the primary disposal method. Another major advantage of this alternative is that by incinerating a portion of the solid waste stream, the life of the approved landfill capacity serving the study area is extended, thereby reducing the uncertainty associated with finding new, unapproved sites, or expanding existing sites.

Alternative Plan 4, which provides for steam generation and sale, was found to be moderately costly, while Alternative Plan 5, which provides for electricity generation and sale, was found to have one of the highest costs of the alternatives considered. This difference in costs between the two alternatives indicates the sensitivity of the incineration alternatives to the market value of the energy produced. This can be an advantage in that if energy costs rise and the value of the energy produced rises accordingly, these alternatives can become more cost efficient over time. Further discussion on the relationship between landfill disposal costs and incinerator disposal costs over time under different inflation rate scenarios is presented in the concluding section of this chapter. Under certain circumstances, within a decade the costs of the incinerator alternatives providing for the generation of steam could be less than the costs of the landfill alternatives, provided a customer for that steam were available. In this regard, it is important to note that under future conditions, much of the cost of the incinerator alternatives--about 30 percent--would be fixed as part of the amortization of the initial capital cost and not subject to inflation. Transportation costs would also be lower under these alternatives than under those alternatives relying only on landfills for disposal because of the increased number of disposal sites. Economies-of-scale could be achieved through the use of one incineration facility rather than two or more as called for in other alternatives considered.

The major disadvantages of these alternatives are the high initial capital costs entailed, and the high level of technology involved with special care in the operation and maintenance of the systems. Under Alternative Plan 4, which provides for the production of steam, finding a reliable year-round market for the energy is critical, making this alternative potentially difficult to implement. The production of electricity under Alternative Plan 5 would eliminate this market problem. Based upon present values of the electric power generated, however, this alternative is substantially less favorable economically than are the alternatives calling for steam production. An additional disadvantage of this alternative, and of all other alternatives using incineration, is the present uncertainty regarding the disposal of incinerator ash. Incinerator ash resulting from the combustion of residential solid wastes can now be disposed of in commercial general-use landfills. However, regulations regarding the future testing and disposal of incinerator ash could make landfilling of this material increasingly expensive. Another disadvantage is that new air pollution regulations may require additional capital and operation and maintenance expenditures. With the construction of a new major facility, there are also potential land use planning and zoning problems.

Both of these alternatives would be relatively insensitive to increases in transportation energy costs, since their transportation costs are lower than those of some other alternatives. In addition, higher energy costs would likely increase the demand for the energy generated by the facilities and more than offset any increases in transportation costs. These alternatives would be moderately sensitive to decreases in population growth rates since the size of the facilities and the associated capital cost would be fixed at some point in time based upon estimated future needs.

## Alternative Plans 6 and 7: Processing of a Portion of the Solid Wastes at Two Separate Incinerators, with Disposal at One Existing Commercial General-Use Landfill

The major advantage of Alternative Plans 6 and 7, as well as of the other alternatives using incineration, is the potential savings in resources and costs which can be achieved by the conversion of solid waste to energy. It should be noted that the only difference between Alternative Plan 6 and Alternative Plan 7 is that under Alternative Plan 6, the incinerators would be designed to burn solid waste to generate steam, while under Alternative Plan 7, the incinerators would be designed to generate electricity. The use of incineration systems in conjunction with landfilling provides more flexibility than using landfilling alone as the disposal method. Another major advantage of this alternative is that by incinerating a portion of the solid waste stream, the life of the approved landfill capacity serving the study area is extended, thereby reducing the uncertainty associated with finding new unapproved sites or expanding existing sites.

Alternative Plan 6, which provides for steam generation and sale, was found to be moderately costly; while Alternative Plan 7, which provides for the generation and sale of electric power, was found to have the highest cost of the alternatives considered. This difference between the two alternatives indicates the sensitivity of the incineration alternatives to the market value of the energy produced. As already noted, this can be an advantage in that if energy costs rise, these alternatives can become more cost efficient over time. In this regard, it is important to note that under future conditions, much of the cost of the incinerator alternatives--about 30 percent--is fixed as part of the amortization of the initial capital cost and is not subject to inflation. Transportation costs would also be lower under these alternatives than under alternatives relying only on landfilling, or relying on landfilling and one incinerator.

The major disadvantages of these alternatives are the high initial capital cost, the high level of technology involved, and the need for special care in operation and maintenance. Under Alternative Plan 6--which provides for the production of steam--finding reliable, year-round markets for the energy is critical, making this alternative potentially difficult to implement. The production of electricity under Alternative Plan 7 would eliminate this market problem. Based upon the present values of the electric power generated, however, this alternative is substantially less favorable economically than are the alternatives calling for steam production. Another disadvantage of this alternative is the present uncertainty regarding the disposal of incinerator ash. Incinerator ash resulting from the combustion of residential solid wastes can now be disposed of in commercial general-use landfills. However, regulations regarding the future testing and disposal of incinerator ash could make landfilling of this material increasingly costly. Another disadvantage is that new air pollution regulations may require additional capital and operation and maintenance expenditures.

These alternatives would be relatively insensitive to increases in transportation energy costs, since their transportation costs are among the lowest of all the alternatives. In addition, energy costs could increase the demand for the energy generated by the facilities and have a positive impact on the economics of these alternatives. These alternatives would be moderately sensitive to decreases in population growth rates since the size of the facility and associated capital cost would be fixed at some point in time based upon estimated future needs. The alternative could accommodate increases in population growth rates since the capacity of the system could be adjusted over time. However, expansion would have to be made in logical module sizes. Thus, some additional solid waste may have to be diverted to the landfill component of the alternative.

## Alternative Plan 8: Processing of a Portion of the Solid Wastes into a Refuse-Derived Fuel for Incineration, with Disposal at One Existing Commercial General-Use Landfill

The major advantage of Alternative Plan 8 is the potential savings of resources and cost entailed. This alternative also has the advantage of producing a fuel product which has a higher heat content than do unprocessed solid wastes. Consequently, the energy produced per ton of waste would be higher and the amount of incinerator ash produced would be reduced by about two-thirds. Another major advantage of this alternative is that by incinerating a portion of the solid wastes, the life of the approved landfill capacity serving the study area is extended, thereby reducing the uncertainty associated with finding new unapproved sites or expanding existing sites.

This alternative was found to be moderately costly. However, should the cost of energy rise at a rate greater than general price inflation and the value of the energy product rise correspondingly, this alternative could become more cost efficient over time.

The major disadvantages of this alternative include high initial capital costs and the high level of technology of the systems used. This alternative would have the added disadvantage of using a technology which has undergone significant change over the past 20 years and has yet to be demonstrated to have widespread application.

This alternative would be moderately sensitive to increased energy costs since the transportation costs are relatively high. However, increases in energy costs would likely be offset by increases in revenues from the refuse-derived fuel. This alternative would be moderately sensitive to decreases and increases in population growth rates since the size of the facilities and the associated capital costs would be fixed at some point in time based upon estimated future needs.

## Evaluation of Accessory Alternatives

Accessory Alternative 1—High Level of Residential Solid Waste Recycling: The major advantage of Accessory Alternative 1 is that no significant new facilities would be needed. This alternative would use the 10 recycling facilities established under the state-mandated residential solid waste recycling program, as refined and included in the other alternatives described above, with the equipment and storage systems expanded somewhat. A higher level of residential solid waste recycling will reduce solid waste transportation and disposal costs because of the reduction in the amount of waste that would be landfilled, and would also result in the recovery of greater amounts of recyclable materials. Furthermore, this alternative would extend the life of existing landfills.

The major disadvantage of this alternative is that a high level of effort on the part of interested citizens, as well as government officials, would be required to achieve the increased recycling levels assumed under this alternative. This alternative also appears to be relatively costly, with the costs substantially exceeding landfill costs. However, the costs incurred are similar to the costs expected for the incineration of solid wastes. The required public participation would be difficult to achieve, and without attainment of the assumed increased recycling, this alternative would be even more costly. The fluctuating value of recyclable products and availability of reliable markets would also be major concerns under this alternative.

Accessory Alternative 2—Separate Collection and Recycling of Newsprint: The major advantage of Accessory Alternative 2 is that significantly more newsprint would be removed from the residential solid waste stream than under any of the other recycling programs. This reduction in the volume of residential solid wastes would result in about the same costs being incurred as with the disposal of residential solid wastes by landfilling, and substantially less cost than with incineration.

The major disadvantage of this alternative is that separate collection of newsprint would require the retrofitting of both municipally and privately owned and operated collection vehicles with special racks or brackets to temporarily store the newsprint. Also, it is uncertain whether a significant portion of the public would participate in a program to separate newspaper from other household solid wastes to facilitate separate collection. Finally, convincing the local units of government and private operators providing residential solid waste collection service to participate in the program could be a major obstacle to successful implementation of this alternative. The fluctuating value of newsprint is also a major concern under this alternative.

Accessory Alternative 3—Composting: The major advantage of Accessory Alternative 3 would be the reduction, by about 1 percent, of the residential solid waste stream. Removal of large quantities of moisture-laden vegetative material from the solid waste stream represents a relatively low-cost means of removing a significant amount of material from the landfills, thereby extending the life of the existing facilities. Should any of the alternatives involving incineration be implemented, this alternative would reduce moisture-related operation and maintenance problems which could result from the combustion of these materials. Removal of these materials would also increase the heat content of the material to be incinerated and improve combustion, thus improving the efficiency of incineration facilities. Composting of these vegetative materials would result in the availability of a soil-conditioning material which could be used by residents on homesites and by local units of government on publicly owned parklands.

The major disadvantage of this alternative is the difficulty of cost-effectively separating these materials from the other residential solid wastes using a low-level technology. Also, the citizen participation required may be difficult to achieve on a voluntary basis. Additionally, the costs of this alternative are substantially higher than landfilling. However, the costs are about the same as expected for incineration. Further, siting composting areas in some municipalities may be difficult because of the lack of available space and/or environmental considerations regarding odor, aesthetics, and the runoff or infiltration of nutrient-rich water from the site.

## Evaluation of Alternative Municipal Sewage Treatment Plant Sludge Management Practices

Alternative Plan 1—Continued Use of the Existing Sewage Treatment Plant Sludge Management Systems: The major advantage of Alternative Plan 1 is that since no new facilities would be needed, new major capital expenditures would not be required. Thus, this alternative may be rated high in terms of feasibility of implementation and in terms of compatibility with land use plans and zoning. This alternative is based upon proven, low-level technology systems. Disposal of sludge by a combination of landfilling and disposal into storage lagoons, with eventual land application on agricultural lands, is flexible and usable at all times of the year. At the present time, this alternative is substantially less costly than the other alternatives considered.

The major disadvantage of this alternative is the reliance on a technology with a potential for escalating costs and increasingly stringent environmental constraints. Landfill disposal costs within the Southeastern Wisconsin Region have generally increased at rates higher than the rate of general price inflation over the past 10 years. Furthermore, since the majority of the sludge generated in Kenosha County is anticipated to be landfilled under this alternative, little beneficial use--other than the possible incorporation of the sludge into the daily cover material at the landfill concerned--will be attained from the sludge generated. The most significant potential problem with this alternative is that present state policies and regulations are being directed toward a reduction in landfilling. This may have an impact on the viability of this alternative.

This alternative was found to have the lowest costs of the alternatives considered. However, the transportation cost element is the highest of all the alternatives considered. Therefore, future energy cost changes may result in higher cost increases than under the other alternatives considered.

Alternative Plan 2—Processing of a Portion of the Sludge at an Incinerator, with Land Application and Landfill Disposal of the Unincinerated Sludge: The major advantage of Alternative Plan 2 is that sludge disposal could be accomplished largely at a single centrally located site and would not fully rely on the use of landfills or land application sites, except for ash landfilling. Another advantage is the savings in resources which could be achieved through the conversion of sludge to energy. This resource savings is relatively limited, however, owing to the high moisture and lime content of the sludge compared to conventional solid waste. The use of incineration in conjunction with landfilling provides more flexibility than using a single disposal method. Furthermore, by incinerating the majority of the sludge generated in Kenosha County, the life of the approved landfills serving the study area is extended, thereby reducing the uncertainty associated with new, unapproved sites.

The major disadvantages of this alternative are the high initial capital and operation and maintenance costs entailed, and the high technology level of a system requiring special operation and maintenance. Highly skilled personnel are required to ensure proper operation, and special pollution control devices may be necessary to control emissions to the atmosphere. Another disadvantage of this alternative is the present uncertainty regarding the disposal of incinerator ash. Incinerator ash resulting from the combustion of a mixture of residential solid waste and sewage sludge can now be disposed of in commercial general-use landfills. However, regulations regarding the future testing and disposal of incinerator ash derived from these source materials could make landfilling of this material expensive.

This alternative was found to have one of the highest costs of the alternatives considered.

Alternative Plan 3—Processing of a Portion of the Sludge at a Composting Facility Followed by Land Application: The major advantage of Alternative Plan 3 is the savings in resources which could be achieved through the conversion of sludge to compost. The use of composting in conjunction with land application also provides more flexibility than using a single disposal method. Finally, composting of sludge would result in the beneficial use of a resource when applied as a soil amendment to approved sites.

The major disadvantage of this alternative is the high initial capital costs entailed, and the additional operation and maintenance associated with the system--aerated windrow composting. Further, siting composting areas in some municipalities may be difficult because of the lack of available space and/or environmental concerns regarding odor, aesthetics, and the runoff or infiltration of nutrient-rich water from the site.

This alternative was found to have the highest cost of the alternatives considered.

Alternative Plan 4—Disposal of Sludge Primarily by Land Application: The major advantage of this alternative is the beneficial use derived when sludge is applied as a soil conditioner to approved sites. Land application of sludge affords an environmentally acceptable means of disposal, while at the same time providing a substitute or supplement for conventional fertilizers. In addition, disposal of sludge by land application is less subject to inflationary price increases than the other disposal alternatives considered. Finally, disposal of sludge by land application reduces the present reliance on landfilling and its potential for rapidly escalating costs and environmental constraints.

The major disadvantage of this alternative is the uncertainty over acquiring sites suitable for landspreading of sludge. The land requirements for land application of sludge, as set forth by the Wisconsin Department of Natural Resources and as described in Chapter IV, may restrict application or require longer travel distances to suitable sites. Finally, during periods when weather, site conditions, or cropping practices preclude the use of land application, sludge generated in the study area will require temporary storage or disposal by landfilling.

This alternative was found to have one of the lowest costs of the alternatives considered.

Alternative Plan 5—Processing of a Portion of the Sludge as a Soil Product-Conditioner Facility: The major advantage of Alternative Plan 5 is the savings in resources which could be achieved through the conversion of sludge to a soil product-conditioner. The use of a soil conditioner production system in conjunction with landfilling and land application also provides more flexibility than using a single disposal method. Soil product-conditioner manufacturing of sludge would result in the beneficial use of a resource when applied as a soil amendment to approved sites. This alternative could be economically attractive--particularly if an arrangement could be made with an established commercial firm in a related business.

The major disadvantage of this alternative is the high initial capital costs entailed, and the high additional operation and maintenance associated with the system if the soil product-conditioner manufacturing is done by the sewage treatment plant. The alternative viability is dependent upon the marketability of the product.

## ALTERNATIVE SEPTIC AND HOLDING TANK WASTES AND HAZARDOUS WASTE MANAGEMENT PRACTICES

### Septic and Holding Tank Wastes

Septic and holding tank wastes generated within Kenosha County are anticipated to total approximately 270 tons of solids per year--on a dry-weight basis--by the year 2010. It is recommended in the adopted, areawide water quality management plan that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant. In Kenosha County, essentially all of these wastes will likely be discharged to sewage treatment plant systems. Consequently, the projected quantities and recommendations were reflected in the alternative sewage treatment plant sludge management plan evaluations.

### Toxic and Hazardous Wastes

An estimated 5,550 tons of toxic and hazardous wastes were generated in Kenosha County in 1984 by a variety of manufacturing or industrial processes.

Such wastes are regulated by the DNR under Chapter NR 181 of the Wisconsin Administrative Code. Approximately 2,200 tons, or about 40 percent of these materials, consisted of metal pickle liquors which are recycled at sewage treatment plants, being used as an agent in the removal of phosphorus from wastewater. The remaining toxic and hazardous wastes are either recycled through a variety of chemical processes; incinerated at approved facilities; or landfilled at approved sites outside Wisconsin. Disposal of these wastes is a costly and specialized endeavor, the evaluation of which is beyond the scope of this report. Accordingly, this category of wastes is addressed only to the extent necessary to ascertain the extent of the toxic and hazardous waste disposal problem in Kenosha County. Consideration of alternative plans for resolving the toxic and hazardous waste problems should be considered in the context of an area broader than Kenosha County and may involve statewide considerations.

Households are also sources of toxic and hazardous wastes. The toxic materials used by households typically consist of automotive maintenance supplies, pesticides, paints, solvents, cleaning products, and other compounds used by residents. It was estimated that between 25 and 30 tons of household toxic and hazardous materials may be discarded in Kenosha County annually. This quantity is equal to between 0.8 pound and 1.0 pound of toxic and hazardous waste per ton of residential solid waste.

The Wisconsin Department of Natural Resources regulates hazardous wastes generated by what are termed "small quantity generators" under Chapter NR 181 of the Wisconsin Administrative Code. Small quantity generators are defined as those that produce between 220 and 2,200 pounds of hazardous waste per month and do not accumulate and store, at any time, quantities of hazardous wastes greater than 2,200 pounds. Requirements pertaining to small-quantity generators have generally not been as stringent as those applied to generators of large quantities of hazardous materials with regard to temporary storage, disposal, documentation of shipments, and accumulation of materials. Historically, no reliable records were required to be kept of the quantities and types of wastes or of the destinations involved. Recently implemented new standards require small quantity generators either to manage wastes onsite, or to transport wastes offsite within 180 days. In addition, the new regulations do not allow disposal of these materials in sanitary landfills, and full manifesting is now generally required for all shipments of hazardous wastes. Alternative plans for resolving these toxic and hazardous waste problems should be considered in the context of an area broader than Kenosha County, as recommended in this report for all industrially and commercially generated toxic and hazardous wastes.

The growing concern about the cumulative impact of this diffuse source of toxic and hazardous wastes on the environment has resulted in the development of local management programs. These efforts have typically consisted of a two-element approach to resolution of the problem. The first element is an information and education program which addresses alternatives to the use of products that contain toxic or hazardous substances, and the proper disposal of discarded, unwanted, or unusable products that contain such substances. The second element consists of the supervised collection and disposal of products that contain toxic and hazardous wastes. These collection and disposal efforts range from a once-per-year collection in a small municipality where residents bring their materials to a centralized location, to regional or statewide collection and disposal programs. In Wisconsin, Chapter NR 187 of the Wisconsin Administrative Code establishes general conditions and eligibility requirements for the issuance of household hazardous waste collection and disposal grants. Through this program, financial assistance is made available to municipalities to create and operate local programs for the collection and disposal of household hazardous wastes. To date, household hazardous waste collection efforts have taken place in nine counties in Wisconsin, either with cost-share assistance from the State under Chapter NR 187, or under a special grant program funded by the U. S. Environmental Protection Agency. Typically, these collection and disposal efforts consist of a widespread public information program to inform citizens of the day, time, and place at which they can bring a variety of household substances containing toxic and hazardous materials. A private contractor that specializes in categorizing, packing, transporting, and disposing of toxic and hazardous substances is hired to conduct these functions. To date, two household hazardous waste collection programs have been held in the City of Kenosha under a special U. S. Environmental Protection Agency grant.

An information and education program regarding the use and disposal of household toxic and hazardous substances and a system for the collection and disposal of such materials should be developed as part of a solid waste management program. The most feasible and cost-effective way to develop the information and education effort would be to expand the public relations and publicity element of the previously described residential solid waste recycling program. Informational and educational materials developed for the recycling program could include information on household toxic and hazardous waste materials. In Kenosha County, the development of a program for the collection and disposal of household toxic and hazardous substances can best be undertaken by individual municipalities or, in some cases, by several smaller municipalities acting cooperatively. The cost of a special collection program for toxic and hazardous wastes varies with the types of materials accepted, the amount of advance publicity, the time and personnel necessary for coordination, and the individual contractor used. In Kenosha County, one special collection could be held annually to accept toxic and hazardous substances.

The one special collection at two locations for toxic and hazardous household substances in the County would cost a total of about $30,000. This would cover the cost of disposal of collected materials, as well as the operation and laboratory testing. In addition, the public information and education program would cost $5,000 per year.

## CONCLUSIONS OF INITIAL ALTERNATIVES ANALYSIS

In order to identify a preferred solid waste management plan for Kenosha County, it is necessary to address the following seven basic issues:

1. Should incineration be incorporated into the plan along with landfilling?

2. If incineration is incorporated, what type of energy product should be generated?

3. How many of each of the major facilities should be provided for and of what size?

4. What level of recycling effort should be provided?

5. Should the municipal sewage treatment plant sludge and solid waste management alternatives be combined?

6. Should processes such as composting, soil product-conditioner manufacturing, and/or land application of municipal sewage treatment plant sludge, which recycles the material, be considered further as a management alternative?

7. How does recently proposed legislation affect the solid waste management alternatives considered?

Based upon the data previously presented, each of these seven issues is addressed in the following sections.

## Incineration

The alternative plan evaluation highlighted three considerations as being important in determining whether or not to include incineration in the recommended solid waste management plan for Kenosha County. These considerations were monetary cost, environmental cost, and feasibility of implementation.

The data on the alternatives indicate that a solid waste management system that includes incineration could cost less than systems relying primarily on landfilling only if a viable market for the steam produced as a result of the incineration of wastes can be found, and then only if energy costs and landfill costs are changed in a means favorable to incineration. Even under favorable circumstances, the incineration costs would likely be comparable to landfill costs only in the second half of the plan period. It is also apparent that incineration will remain more costly than landfilling over the plan period if it is necessary to produce electric power and to rely on the sale of that power for revenue to the Wisconsin Electric Power Company at current buyback rates. The analyses indicate costs per ton of \$15, \$39, and \$49 for landfilling, incineration with steam production, and incineration with electric power production, respectively.

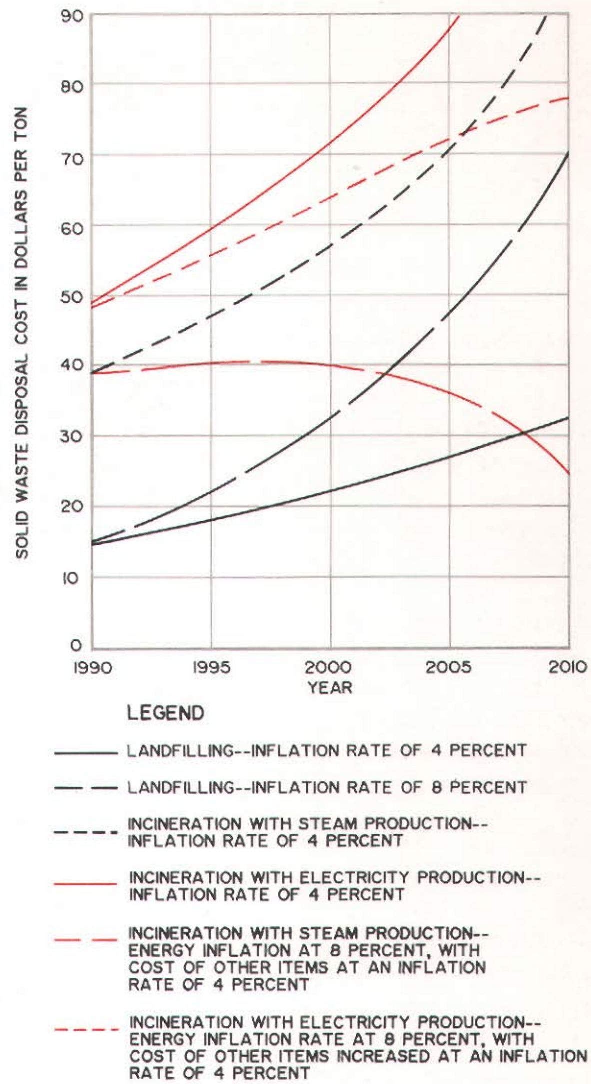
The evaluation must also consider the potential impact of inflation on the costs of landfilling and incineration. About 30 percent of the cost of the incineration alternative are fixed as amortization of the initial capital investment. Landfilling costs have historically tended to escalate at rates higher than the underlying general price inflation rates. The potential for energy costs to rise at higher rates than the underlying inflation rate must also be considered. Figure 18 illustrates the relationship between landfill and incineration costs under various scenarios relating to varying inflation rates. The curves indicate that only under the most favorable circumstances will incineration be less costly than landfilling.

The monetary costs of incineration and landfilling appear to favor landfilling. However, in evaluating the alternatives, the Technical Advisory Committee considered another cost termed avoided environmental costs. In this regard, it was noted that as of 1988, 51 active and abandoned landfill sites in southeastern Wisconsin were considered by the Wisconsin Department of Natural Resources as posing significant risks to the environment and requiring potential major expenditures for remedial measures to abate environmental pollution. As further investigations are conducted, this list could be expanded to include sites in Kenosha County. It is recognized, in this respect, that any newly constructed or expanded landfill sites must be designed to meet more stringent requirements in an attempt to avoid environmental problems. Further, new regulations proposed by the U. S. Environmental Protection Agency would also add significant costs to the operation of landfills.

The inclusion of incineration in the plan components can reduce the need for landfilling by between 15 and 20 percent over the plan design period, and could reduce the potential for problems requiring remedial actions. This environmental consideration cannot be quantified in terms of monetary costs. However, the Advisory Committee did consider this environmental consideration to weigh significantly in favor of including incineration in the plan recommendations. Another consideration is recently enacted State legislation directed toward reducing the dependence on landfilling of solid wastes in the State. This legislation declares recycling and resource recovery systems preferable to land disposal. Specifically, state policy lists priorities for action in this order: 1) reductions in the amount of waste generated; 2) reuse of solid waste; 3) recycling; 4) composting; 5) energy recovery; and 6) land disposal.

## Figure 18

### PROJECTION OF SOLID WASTE DISPOSAL COSTS UNDER VARYING INFLATION RATES




Source: SEWRPC.

Finally, the feasibility of implementation of the plan components was considered. It is possible that the implementation of an incineration system will, for a number of reasons, be more difficult to achieve than continued landfilling. Thus, on the basis of ease of implementation, landfilling would be the favored alternative. However, the Advisory Committee noted that incineration of solid wastes was expanding rapidly, both in Wisconsin and throughout the rest of the United States. During the implementation period of this plan, technological advances and potential reductions in incineration costs are bound to improve the implementability of such a system in Kenosha County. Upon careful consideration of these factors, it was concluded by the Advisory Committee that, while the implementation of an incineration system may be more difficult to achieve than landfilling, it should be possible to implement such a system over the 20-year plan design period.

Another consideration in the evaluation of the alternatives was the potential production of refuse-derived fuel. It may be noted by comparing Alternative Plans 5 and 8 that the costs of producing refuse-derived fuel and incinerating that product are about the same as the cost of burning the solid waste directly with minimal processing. In view of the costs and the desirability of relying on proven technology, it was concluded that the recommendations and costs included herein would assume the use of incineration without refuse-derived fuel production. However, it is important to note that the use of fluidized bed incineration technology can have certain advantages with regard to air pollutant emission control and costs. At this time, however, large-scale operations of such systems have not been tested in the United States. However, should refuse-derived fuel alternatives be shown to be viable and cost-favorable as the plan is implemented, consideration could be given to refining the plan with regard to the type of incinerator and the type of pre-incineration processing of the solid wastes.

In view of the substantially higher costs of an incineration system under existing conditions, it was concluded that an incineration system should be included in the plan recommendations only as a longer term objective which could be implemented at such time as energy costs appeared to be escalating at rates higher than the general inflation rate, and at such time as a user (or users) of the steam energy product was found.

## Type of Incineration Energy Product

As noted above, the alternative plans which envision the production and sale of steam as an energy product are more cost-effective than alternatives which rely on the sale of electric power at the present buyback rate for revenue. Revenues from the sale of steam based on a rate of $4.50 and $5.00 per thousand pounds of steam--a rate representative of steam rates charged to users in southeastern Wisconsin--range from about $20 to $35 per ton of refuse incinerated. Revenues from the sale of electricity at the current buyback rates range from $12 to $20 per ton of refuse incinerated. The range in revenue generated by the sale of electric power is based on a relatively low rate of

$0.035 per kilowatt hour (kwh) and a relatively high rate of $0.046[1] per kwh. The lower rate, termed the primary weighted average avoidance rate, is the amount paid by the Wisconsin Electric Power Company (WEPCo) for electric power generated by facilities such as solar collection systems, and by hydro power or similar electric power-generating equipment outside the WEPCo electric power generating station network. The lower rate was assumed for all alternative incineration facilities evaluated. The higher rate, termed the nominal large-user rate, is the amount that the largest users of electric power pay WEPCo. This rate was not used in the specific evaluation of alternatives, but, as described below, could be realized during the plan implementation period.

Based upon the evaluation of the alternatives, it is apparent that the most favorable energy production option would provide for incineration producing steam for use by a viable steam user. Under this alternative, incineration may be cost competitive during the second half of the plan period should an energy user for the steam product be found and should energy and landfill costs rise at a relatively high rate. A less favorable energy production system would provide for incineration producing electric power which could be sold directly to a large user, thus potentially securing higher buyback rates. However, under this alternative, it does not appear that incineration would be cost competitive in the foreseeable future.

The least favorable energy production system would provide for the sale of the electric power generated by incineration to the Wisconsin Electric Power Company at the present buyback rates. It may be concluded that reliance on the current "avoided cost" buyback rate--$0.035 per kwh--also does not appear to be a cost-competitive alternative to landfilling in the foreseeable future.

Considering the economics involved, it is recommended that the incineration facilities be included in the plan only as an option to be considered later in the plan period and only if a viable steam customer is found. The use of facilities which generate electric power is not considered to be practical from a cost standpoint at this time and is not recommended.

### Number and Size of Incineration and Landfill Facilities

A comparison of the data for Alternatives 2 and 3 indicates that the costs of utilizing either one or two large commercial general-use landfills are about the same. The location of the Pheasant Run landfill in the Town of Paris, coupled with its existing capacity and favorable potential for expansion, led to the conclusion by the Technical Advisory Committee that it would be a logical primary disposal site for solid wastes generated in Kenosha County during most of the plan period. However, this is not meant to preclude the use

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[1]During 1987, the nominal large user rate was estimated to be $0.043 per kilowatt hour. This estimated rate is based upon a number of assumptions regarding demand during on- and off-peak hours. The rate is subject to change annually.

of other sites if market costs dictate this to be favorable. Other existing commercial general-use landfills outside Kenosha County may be expected to continue to receive limited amounts of solid wastes generated in the study area during the plan period. These landfills include: the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; and the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County. It recognized that these commercial general-use landfills, as well as smaller special-use landfills outside the County, may be used for the disposal of some solid wastes, with the specific sites being selected based upon competitive market costs, as is currently the case.

With regard to the number of incineration systems should such systems be considered later in the plan period, a comparison of the data for Alternative 4 and Alternative 6 indicates that the use of a single incinerator system is more cost-effective than the use of two facilities.

With regard to the size of an incinerator facility, it may be expected that the solid wastes to be incinerated would originate primarily in the City of Kenosha and the Towns of Pleasant Prairie and Somers. Accordingly, it was assumed that approximately 38,000 tons per year, or about 90 percent of the unrecycled residential solid wastes generated in the City of Kenosha and in the Towns of Pleasant Prairie and Somers, would be incinerated. Analyses of the composition and location of the commercial and industrial solid waste stream indicates that an additional 17,000 tons of commercial and industrial solid wastes generated in these three areas could also be available for incineration. The total annual quantity of solid wastes to be incinerated was thus assumed to approximate 55,000 tons, with a potential range of between 45,000 and 65,000 tons of solid wastes per year. Accordingly, an incineration system with a capacity of between 150 and 250 tons per day is estimated as the system size that would be required late in the plan period, based on consideration of the seasonal distribution of the waste stream should conditions change which would make the installation of an incinerator practical, i.e., a user for a steam energy product is found and the cost of energy and landfilling escalate at relatively high rates.

With regard to landfill capacities, under the alternative that no incineration systems will be implemented during the plan period and assuming that an additional 7,000 tons per year of solid waste would be recycled, or composted, about 135,000 tons, or 95 percent of the solid waste, would be landfilled. Over the 20-year plan implementation period, then, the disposal needs would require a landfill capacity of about 2,700,000 tons, or about 6,000,000 cubic yards. In addition, if the majority of the sludge generated in the County is landfilled, as set forth under Alternative Plan 1, about 125,000 dry tons of sludge, or 96 percent of the sludge, would be landfilled, requiring an additional 350,000 cubic yards of landfill capacity. Under the assumption that an incineration system is developed late in the planning period--for the last 10 years--the landfill capacity required during the plan period would be reduced by about 13 percent, resulting in a need for conventional solid waste disposal of about 1,900,000 tons, or about 5,200,000 cubic yards.

The siting option for an incinerator, should one be found to be practical late in the plan period, will depend upon the location of the steam user and would require construction at or in proximity to a large commercial and/or industrial user or users. As discussed in Chapter IV, a number of sites in the County near potential large-scale energy users were evaluated as potential sites for an incinerator. The conclusion was reached that there are several suitable sites in and adjacent to the City of Kenosha which could accommodate an incinerator and from which electricity and/or steam could be economically transported to industrial and/or commercial users for sale. However, siting of a facility located so as to be a major energy supplier to a specific user would require a detailed feasibility study. Such a study would be a prerequisite for the selection of a specific type of incinerator and its location.

## Level of Recycling

Based upon a review of the accessory alternatives considered, it was concluded that a high level of residential recycling at the community recycling centers, as described in Accessory Alternative 1, should be considered as a long-term goal even though the cost appears relatively high and even though the system is dependent on recyclable market prices. It is recommended that the high-level efforts be carried out using the voluntary recycling approach as set forth under Accessory Alternative 1. That approach will result in the recycling of up to 6,000 tons per year, or about 10 percent of the presently unrecycled residential waste stream.

It does appear that the separate collection of newsprint for recycling, as described in Accessory Alternative 2, could be considered, since the cost would be nearly the same as that of landfilling and less than the cost of incineration. However, a separate collection system may be expected to remove only 600 to 1,400 tons per year over and above the material collected at the recycling centers noted above, or 1 to 2 percent of the residential solid waste stream. Thus, such separate collection of newsprint probably would not have a significant impact on the size and configuration of other plan components. Nevertheless, because of its potential cost-effectiveness, it is recommended that such recycling be incorporated into the final plan. Such recycling could be implemented on a local basis, with each community evaluating the effectiveness within the context of its own collection system.

Consideration was also given to implementing a composting program as set forth in Accessory Alternative 3. Even though the cost of this alternative appears high when compared with the cost of landfilling, it is recommended that such a program be incorporated into the county solid waste management plan. As will be discussed in more detail in the following section of this report, recent State legislation has included provisions to ban the disposal of yard waste in landfills after 1992, making this component a more important element of the plan. It is estimated that 1,200 tons, or about 2 percent of the presently unrecycled solid waste generated annually, would be composted under a system as envisioned in Accessory Alternative 3.

## Combined Solid Waste and Sludge Management Systems

Since it has been indicated in the previous sections that a major solid waste incineration system is not likely to be implemented, there is no potential to combine the sludge disposal system using incineration as the primary disposal means. The sludge and conventional solid waste management systems would potentially be combined in the landfilling process. Based upon the analyses conducted, both sludge and conventional solid waste could be landfilled during the plan period to some extent. While the landfilling of solid waste will likely be done at the same site, it is desirable to segregate these two different types of wastes, since they may need to be placed in different areas and in different ways during landfilling. Thus, there appear to be no specific means by which the disposal of both solid waste and sludge could be accomplished more efficiently in a combined process.

## Land Application, Composting, and Soil Product-Conditioner Manufacturing

The alternatives evaluation indicated that a sludge management system that includes land application or composting would be more costly than the current system which relies primarily on landfilling at current landfill costs. Landfilling costs have, however, historically escalated at rates higher than the underlying general price inflation rates. In addition, as new landfills, or major expansions of existing landfills, become necessary, the full cost of meeting the most recent landfill siting and groundwater protection regulations may be expected to be included in the landfill costs. Further, environmental regulations may eventually preclude the expansion of existing landfills, or make such expansions exceedingly costly. Consequently, landfilling may prove to be a costly long-term solution for the disposal of municipal sewage treatment plant sludge generated in Kenosha County.

In terms of cost, it appears that land application of sludge will be about the same as landfilling should such landfilling costs rise to $15 per ton. In addition, composting and soil product-conditioner manufacturing would still be about 20 percent more costly than landfilling even if landfill costs rise to $15 per ton. However, should an arrangement be available whereby some of the costs of composting or soil product-conditioner manufacturing could be shared--i.e., by working with a commercial operation in a fertilizer or soil conditioner-related business--those options may prove cost competitive.

As can be noted by comparing Alternatives 3A and 3B, there appear to be economies-of-scale which can be achieved in developing larger composing or soil production facilities. The alternatives indicate that such facilities are more costly than landfilling and land application of sludge when considering facilities sized for the sludge generated in Kenosha County. However, at a larger scale, such facilities may become cost-effective. The Kenosha sewage treatment plant is located within about 35 miles of the Racine Water and Wastewater Utility and the Milwaukee Metropolitan Sewerage District sewage treatment plants. Thus, the operation of a system serving more than one major sewage treatment plant could be viable and may prove more economical than a system serving only the Kenosha plant. It is thus recommended that this option be held open for future consideration as an alternative to landfilling and land application.

The land requirements for application of sludge, as described in Chapter IV, may constrain use of this means of disposal and may require longer transport distances. However, based on the criteria for the land application of sewage treatment plant sludge, approximately 23,000 acres in Kenosha County, or 13 percent of the total area of the County, have a high potential for land application. The amount of land considered potentially suitable for land application of sludge was based solely upon physical criteria and does not take into account landowner or operator concerns and preferences. In some instances, landowners or operators do not allow application of sludges on only portions of a field, but rather want entire fields conditioned uniformly. Thus, only a portion of that area may actually be available without meeting the desires of landowners and operators for uniform conditioning of fields through special arrangements or additional incentives. A total of 681 acres has been approved by the Wisconsin Department of Natural Resources for land application of sludge generated at the following five municipal sewage treatment plants: City of Kenosha, Town of Salem Utility District No. 1, Town of Bristol, Village of Paddock Lake, and Village of Twin Lakes. The quantities and characteristics of the sludge generated by the municipal sewage treatment plants currently operating in Kenosha County indicate that approximately 650 acres will be required for landspreading over the 20-year design period. Consequently, a sufficient quantity of approved agricultural lands currently exists to accommodate the total annual sludge load expected to be generated in Kenosha County through the plan period.

With regard to ease of implementation, land application of sewage sludge may be more difficult to achieve than continued landfilling. During periods when weather or site conditions preclude land application, sludge generated in the study area must be temporarily stored, or disposed of by landfilling. The City of Kenosha sewage treatment plant facilities include one domed enclosure and one open storage facility designed to store dewatered sludge during periods when land application is not possible. This enclosure has a capacity of about 2,500 dry tons of sludge. The City of Kenosha sewage treatment plant may be expected to generate approximately 6,250 dry tons per year, or nearly 96 percent of the total sludge generated in Kenosha County.

In view of the potential long-term cost advantages, the potential for escalation of landfill tipping fees, the benefits derived from incorporating sludge into agricultural lands, and the need to provide multiple disposal options to ensure facility backup and flexibility, it is recommended that an alternative sludge disposal method be pursued. It is recommended that land application of sludge be pursued as a long-term objective in the recommended plan unless some favorable arrangement is made with a commercial enterprise to share the costs for composting or for soil product-conditioner manufacturing. In such case, the latter option is recommended to be pursued.

## Recent Solid Waste Legislation

One Wisconsin senate bill and four Wisconsin assembly bills were adopted by the Wisconsin State Legislature and signed into law in 1988. These bills included Wisconsin State Senate Bill 100 (the FY 1988 State Budget) which has several waste reduction and recovery measures, including: 1) provision of $50,000 in funding for a waste reduction and recovery demonstration program;

2) removal of the requirement for compensation by local governments that enact flow control; 3) requirement that recycling be developed to the extent that it is economically feasible as a part of any waste-to-energy system that is covered by flow control; 4) establishment of a state program--but no funding--for scrap tire stockpile cleanup and scrap tire recovery; and 5) requirement that the DNR prepare a plan for reducing the generation of hazardous wastes.

Assembly Bill 243 prohibits detachable metal rings on beverage containers and nonbiodegradable or nonphotodegradable plastic ring connectors. Assembly Bill 647 prohibits the disposal of yard waste in landfills after January 1, 1993. Assembly Bill 648 requires state agencies to recycle at least 50 percent of their waste paper and to purchase products with recycled materials. Finally, Assembly Bill 650 requires plastic containers to be labeled to show the type of resin. In addition to the bills that were passed, several other proposed bills relating to solid waste recycling were proposed but were not passed or signed into law. These proposed bills provided for increased emphasis on recycling, including items such as mandatory source separators and grant programs for recycling centers.

Given the existing and proposed legislation, it is recommended that 10 recycling centers, including the six required by amendments to Chapter 144 of the Wisconsin Statutes, be incorporated into the recommended plan. In addition, it is recommended that an information and education program pertaining to the recycling of residential solid waste be developed together with an information and education program pertaining to the disposal of household toxic and hazardous substances. Finally, since it appears likely that the disposal of yard wastes in landfills will be prohibited early in the plan period, it is recommended that seven composting sites for vegetative debris be incorporated into the recommended plan.

In addition to these solid waste recycling bills, the Wisconsin Department of Natural Resources is in the process of implementing two new administrative rules: Chapter NR 105--Surface Water Quality Criteria for Toxic and Organoleptic Substances--and Chapter NR 106--Water Quality Effluent Limits for Toxicants. Chapter NR 105 will propose the ambient concentrations of toxic substances which shall be maintained to protect surface water quality and the uses of surface waters. Chapter NR 106 will specify how water quality-based effluent limits for discharges to surface waters will be calculated and imposed in Wisconsin surface water discharge permits. The impact of these rules on wastewater treatment facilities and the quantity and quality of the municipal sludges generated has not yet been ascertained. However, there may be an increase in the quantity of sludge generated, and the quality of the sludge could be impacted by potential requirements to remove additional materials. Thus, any plan selected should be flexible in reacting to these potential changes.

## PRELIMINARY RECOMMENDED PLAN

Based upon the evaluation of the eight alternative solid waste management plans, the three accessory alternatives, and the five alternative sludge plans considered, it was concluded that a recommended solid waste management plan for Kenosha County should consist of a combination of several components carefully designed to meet the needs of the County. The recommended plan should incorporate source separation and the recycling of the separated material; incineration of a portion of the solid waste with the production of steam and electric power; and landfilling of the remainder of the solid waste and the incinerator ash at the existing landfills. The plan should also include the use of a combination of landfilling and landspreading for disposal of sewage treatment plant sludge.

The principal components of a recommended solid waste and sludge management plan would include: 1) temporary storage of solid wastes by individual residents and commercial, industrial, and institutional waste generators; 2) the separation by the residents of a portion of the recyclable residential solid waste prior to collection, with transport of the separated portion by the residents to local recycling centers or composting sites, including separate collection of newsprint; 3) initiation of a special household toxic and hazardous waste management program; 4) continued collection and transport of the remaining unrecyclable residential solid wastes by collection vehicles directly to a landfill site or to one of five existing and two proposed transfer stations and then by larger vehicle to a landfill site; 6) disposal of unrecycled solid waste at landfills within and adjacent to Kenosha County; and 7) disposal of municipal sewage treatment plant sludge using a combination of land application and landfilling. In addition to these plan components, it was found that incineration of a portion of the solid waste stream may be feasible later in the plan period and should be reevaluated if energy costs and landfilling costs tend to rise at rates higher than the general inflation rate.

## Component 1: Storage

Solid wastes would continue to be stored by residents, and by commercial, industrial, and institutional solid waste generators. Solid wastes would continue to be stored by residents in galvanized metal cans, heavy-duty plastic trash cans, heavy-duty plastic bags, or, where applicable, specialized mobile carts designed for mechanized collection. Residents of multifamily buildings as well as commercial, industrial, and institutional generators of solid wastes would continue to store wastes in large bulk, portable containers designed for mechanized collection. It is recommended that the individual communities continue to evaluate the use of mechanized collection as equipment changes are made over the plan period.

## Component 2: Recycling and Composting

A countywide recycling program would be initiated which would include the establishment of 10 recycling centers to facilitate the recovery of newsprint, glass, aluminum, and plastic from the solid waste stream, as well as the development of a comprehensive information and education program and publicity campaign to encourage citizen participation. Approximately 6,000 tons, or about 10 percent, of the currently unrecycled residential solid waste generated annually would be recycled under this program. A countywide composting program would also be initiated. Yard wastes consisting primarily of leaves and grass clippings would be composted at seven sites located throughout the County. These materials would be deposited at these sites by residents and by municipal public works departments during periods of the year when vegetative materials such as leaves are collected separately, usually in the fall. Approximately 1,200 tons of yard wastes, or about 19 percent of the yard wastes generated annually in the County, and about 2 percent of the currently unrecycled residential solid waste load, would be composted.

In addition, newsprint would be collected separately, with racks for this purpose to be installed on all collection vehicles. Approximately 1,000 tons of newsprint, or about 2 percent of the currently unrecycled residential solid waste generated annually, would be recycled under the separate newsprint collection program.

## Component 3: Household Toxic and Hazardous Waste Management

A countywide household toxic and hazardous waste management program would be initiated and used as an interim measure for handling such wastes until a broader toxic and hazardous waste management program is developed on a statewide or regional basis. An information and education program regarding proper use and disposal of a wide variety of household materials containing toxic and hazardous substances would be developed in conjunction with similar efforts proposed for the recycling and composting component. A program of annual "special collections" for household products containing toxic and hazardous substances would be implemented. The conduct of these collections would be the responsibility of the individual municipalities. It is important to note that economies-of-scale could be realized if several small communities held joint collections. The material collected is expected to be primarily liquids such as paints, thinners, and cleaning fluids. It is estimated that 2,500 to 3,000 gallons of material annually could be collected and disposed of under this program if an annual collection were made at two locations in the County.

## Component 4: Collection and Transport

The existing collection and transport systems would be maintained. Those municipalities providing residential solid waste collection and transport would continue to do so, and those municipalities served by private contractors would continue to be so served. Most commercial and industrial solid wastes would continue to be collected and transported by private contractors. It is recognized that there may be changes in collection services from municipal to private collection and vice versa over time, with such changes being dictated by cost and service needs.

## Component 5: Transfer

Under this component of the combined alternative, the existing transfer systems operating in the County would be maintained. In addition, two new transfer stations would be constructed: one in the Town of Bristol and one in the Town of Randall at such time as the existing landfills operated by those towns are abandoned. Most residential solid wastes would continue to be transported to one of the five transfer stations currently operating in the County.

## Component 6: Disposal by Landfilling

Unrecycled solid wastes would total about 134,000 tons per year and would be disposed of at existing commercial general-use landfills. If the incineration of solid waste becomes viable late in the plan period, the quantity of solid waste to be landfilled would be reduced to about 90,000 to 100,000 tons per year.

The commercial general-use landfill assumed to be used is the Pheasant Run landfill in the Town of Paris owned and operated by Waste Management of Wisconsin. Some solid wastes would continue to be disposed of at the Village of Twin Lakes, the Town of Bristol, and the Town of Randall landfills prior to closure and abandonment of these facilities. While the plan assumes use of the Pheasant Run landfill over the plan design period, the use of other sites in adjacent counties could become less costly as a result of market factors.

## Component 7: Incineration

One incinerator designed to generate steam as an energy product could be constructed in the County later in the plan period if a viable steam customer is found. This system is expected to be viable only if landfilling and energy cost escalation exceeds the general inflation rate over the first 10 years of the plan period. The system would have a capacity of between 150 and 250 tons per day, and would incinerate about 45,000 to 65,000 tons per year. The incineration facility would be a mass burn modular system readily capable of expansion. The incineration system will likely not be practical from a cost viewpoint until the second half of the plan period.

## Component 8: Sludge Disposal by Landfilling and Land Application

Municipal sewage treatment plant sludge would be disposed of through the use of a combination of land application on suitable agricultural lands and landfilling, as is currently done, with additional land application or the production of compost or soil product being added to the system over the plan design period. Currently, landfilling is the primary means of disposal. Over the plan design period, it is recommended that the present system be revised in a manner that would provide for agricultural land application, or compost-soil product production, of about 3,200 dry tons of sludge per year, or about 50 percent of the sludge generated annually in the County. In this regard it is noted that landfilling is at the present time substantially less costly than alternatives which provide for a productive use of the sludge. Thus, it is recommended that these other options be carefully integrated into the sludge management system over time in order to maximize resource recovery without substantially increasing costs. Further, the study indicates that compost or soil product production will not be cost-effective if carried out locally unless arrangements can be made with a commercial fertilizer manufacturer or marketing firm to share the capital and operating costs of processing. Alternatively, it may be possible to carry out such a program at a larger scale if facilities are developed in conjunction with the Racine Water and Wastewater Utility and/or the Milwaukee Metropolitan Sewerage District.

The remaining sludge that is dewatered, or about 3,100 dry tons per year, would be landfilled. About 50 dry tons of sludge per year that are not dewatered could be disposed of by a commercial operator and transported to a storage lagoon or to the City of Kenosha sewage treatment plant for dewatering prior to landfilling or other disposal.

It is recommended that landspreading or compost-soil product production of the sludge be phased in over the initial 10 years of the plan design period, reducing the heavy dependence on landfilling as a disposal method. This recommendation would apply to all sewage treatment plants in the County, since the continued availability of the privately operated storage lagoon to which about 176 tons of sludge, or 2.5 percent of the sludge produced, is now transported is uncertain.

An analysis of the suitable lands needed for application of sludge indicates that approximately 650 acres per year would be required. As of January 1. 1988, about 700 acres had been approved by the Wisconsin Department of Natural Resources for land application. It is anticipated that approval of enough suitable land can be accomplished once this component of the recommended plan is fully implemented.

## Recommended Combined Alternative Plan Costs

The estimated capital cost for the development of the solid waste management facilities for handling and disposal of conventional solid waste within the County under the recommended plan is $540,000. The average annual operation and maintenance cost of the recommended plan is $3,130,000, including an allowance for capital expenditures at landfills which are expected to be made incrementally over the plan period. The average annual capital and operation and maintenance cost of this plan would be about $3,180,000, or about $22 per ton of solid waste. A breakdown of the costs of the recommended plan is set forth in Chapter IX.

The estimated capital cost of the recommended municipal sewage treatment plant sludge management plan is $500,000 for land-spreading equipment and land purchase. Average annual operating and maintenance costs are estimated to be $340,000. The average annual capital and operation and maintenance costs are $390,000, or about $60 per dry ton of solids. A breakdown of these costs is set forth in Chapter IX.

# Chapter VIII

# EVALUATION OF SPECIFIC IMPLEMENTATION METHODS

## INTRODUCTION

This chapter describes and evaluates alternative implementation options for each of the components of the recommended solid waste and municipal sewage treatment plant sludge management plan for Kenosha County as that plan is described in Chapter VII of this report. The chapter is divided into three sections. The first section considers facility ownership options for each component of the recommended solid waste management plan; the second section considers operational options for each component; and the final section presents the recommended plan implementation measures.

In Chapter VI of this report, facility ownership and financing alternatives were described, and the advantages and disadvantages of each option, as generally applicable to solid waste and sludge management systems, were presented. In this chapter, the ownership and operation options more specifically applicable to each of the eight components of the recommended solid waste and municipal sewage treatment plant sludge management plan are identified and evaluated.

The individual components of the recommended plan, as described in Chapter VII, are as follows:

1. Continued storage of solid wastes by private individuals, commercial establishments, institutions, and industries.

2. Initiation of a source separation program which includes residential solid waste recycling and a yard waste composting program.

3. Initiation of a residential toxic and hazardous waste information, education, and management program as an interim measure until a broader program for collection and disposal of such wastes is developed, providing for management of such wastes from all sources.

4. Continued collection and transport of solid wastes by municipally and privately owned and operated vehicles.

5. Transfer of solid wastes at five existing and two proposed transfer stations.

6. Disposal of unrecycled solid wastes at existing landfills located within Kenosha County and adjacent counties.

7. A long-term contingent plan element providing for the processing of a portion of the solid wastes generated within the County at a single new incineration facility designed to burn solid waste to produce steam

energy. This element would be implemented only at such time as a viable steam customer becomes available and the costs of energy and landfilling have escalated so as to make the alternative economically attractive.

8. Disposal of municipal sewage treatment plant sludge using a combination of landfilling and land application.

## OWNERSHIP OPTIONS

The following sections briefly describe the advantages and disadvantages of each of the facility ownership options available to implement each component of the recommended plan. In the evaluation of these options, consideration was given to the level of government involvement and control; the need for public capital investment; tax base impacts; achievable economies-of-scale; financing; and the need to develop new facilities and programs versus continued use of existing facilities and programs. Table 44 presents a comparative analysis of ownership options for each of the components of the recommended plan related to these factors.

### System Component No. 1: Storage

In most cases, storage facilities consist of simple galvanized metal cans, heavy-duty plastic cans, or heavy-duty plastic bags which are owned and used by residents of single-family residences and apartment buildings with up to six units. Residents of larger, multifamily residential buildings, as well as operators of commercial and industrial establishments, usually store solid wastes in large, bulk containers designed for mechanized collection. These containers may be owned by the solid waste generator, or, more typically, by a private collection agency.

The only facility ownership option considered for the storage component of the recommended plan was continued ownership of the storage facilities by private individuals and private solid waste collection contractors. A potential exists for municipal ownership under certain conditions whereby larger individual portable containers designed for mechanized collection are phased into the collection system based upon local consideration of costs. The principal advantage of continued ownership of the storage facilities by private individuals and contractors is that it represents a system that is working satisfactorily. Also, continuation of this system avoids the need for large capital expenditures by local units of government to institute a different system. The principal disadvantage of this option is the limited control by the local units of government concerned over the type and location of some of the storage facilities.

### System Component No. 2: Source Separation—Residential Solid Waste Recycling

The source separation recycling component of the recommended plan envisions the provision of 10 recycling centers to facilitate the recovery of newsprint, glass, aluminum, oil, and perhaps plastics from the solid waste stream. These centers would consist primarily of a dedicated area containing storage facilities, including a semitrailer for paper and smaller containers for glass, aluminum, and other material. The area would ideally be fenced and have a small enclosed office area. Five ownership options were considered for these centers: ownership by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by a group of municipalities, and by the County.

Ownership by a Private Nonprofit Organization: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a private nonprofit organization. The principal advantage of such ownership is that the local units of government would not need to incur capital expenditures for the provision of the recycling centers. The principal disadvantage of this option is that the local units of government would have limited control over the location and operation of the center. Also, nonprofit organizations may have difficulty in financing construction of adequate recycling centers. This ownership option is considered to have only limited applicability in Kenosha County.

Ownership by a Private Profit-Oriented Business: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a private, profit-oriented business. The principal advantages of this option are that local units of government would not have to incur capital expenditures for development of the recycling centers, and some economies-of-scale may be provided, particularly if the owners are already involved in other private recycling programs. Another advantage of this option is that the recycling facilities could be located at the site, or sites, of the purchaser or purchasers of some of the recycled materials, thus reducing the need to transport the recycled materials. The principal disadvantage of this option is that the local units of government would have limited control over the location and operation of the centers. Additionally, the establishment of new facilities for this purpose may not be viable since costs may exceed the revenues at such facilities if labor is required to be a fully reimbursed cost.

Some recycling of solid wastes does occur at private profit-oriented businesses in Kenosha County--most notably the recycling of large amounts of cardboard and paper generated at commercial facilities. These private operations are recommended to be maintained and expanded. A small number of recycling centers can be provided in conjunction with ongoing private recycling operations. However, the sites available may be expected to provide only a portion of the sites needed in the County. Thus, this type of recycling center ownership alone probably would not provide for full implementation of the comprehensive residential recycling program envisioned under this component of the recommended plan.

Ownership by Individual Municipalities: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by the individual municipalities concerned. The advantages of this option include the level of control provided to local governments and the availability of sites used for other purposes which can accommodate recycling as an additional compatible use. Also, a larger number of options would be available to municipalities for financing construction of the recycling centers than would be available to private organizations, particularly

# Table 44

## COMPARISON OF OWNERSHIP OPTIONS FOR THE PRELIMINARY RECOMMENDED SOLID WASTE AND SEWAGE SLUDGE MANAGEMENT PLAN FOR KENOSHA COUNTY

| Solid Waste Management Systems Component | Ownership Option | Level of Local Government Control | Level of County Government Control | Public Capital Expenditure | Tax Base Impact Status | Primary Decision-Making Criteria | Economy-of-Scale | Number of Financing Options | Maintains Existing System | Viability in Kenosha County | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Storage of Solid Wastes | Private with municipal participation if larger portable containers are phased into system | Low | Low | No | No significant impact | N/A | Low | N/A | Yes | Viable | - - |
| 2. Residential Solid Waste Recycling and Composting of Yard Wastes | | | | | | | | | | | |
| Residential Solid Waste Recycling | Private nonprofit | Low | Low | No | Tax exempt | Nonprofit motivated | Low | Low | No | Viable | Provides for community involvement and revenues for nonprofit organizations |
| | Private profit-oriented | Low | Low | No | No significant impact | Profit motivated | Low-moderate | Moderate | No | Viable | Technical expertise is available |
| | Individual municipality | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | In some cases | Viable | - - |
| | Group of municipalities | Moderate | Moderate | Yes | Tax exempt | Cost and level of service | Moderate | High | | Viable | Intermunicipality coordination required |
| | County | Low | High | Yes | Tax exempt | Cost and level of service | High | High | No | Viable | Managerial and technical expertise easily retained |
| Composting of Yard Wastes | Individual municipality and County | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | In some cases | Viable | Provision of a compost product for municipal and citizen use |
| 3. Residential Toxic and Hazardous Waste Management | Private nonprofit | Low | Low | No | Tax exempt | Level of environmental concern | Moderate | Low | N/A | Viable for limited situations | Inadequate facilities for widespread, countywide program |
| | Private profit-oriented | Low | Low | No | No significant impact | Profit-motivated | Moderate | Moderate | N/A | Not viable | - - |
| | Individual municipality | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | N/A | Viable | - - |
| | Group of municipalities | Moderate | Low | Yes | Tax exempt | Level of intergovernmental cooperation | High | High | N/A | Viable | Most applicable for small municipalities |
| | County | Moderate | High | Yes | Tax exempt | Cost and level of service | High | High | N/A | Viable | - - |
| 4. Collection and Transport of Solid Wastes | Private profit-oriented | Moderate | Low | No | Contributes to tax base | Profit motivated | Moderate | Moderate | Yes | Viable | - - |
| | Individual municipality | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | Yes | Viable | - - |

## Table 44 (continued)

| Solid Waste Management Systems Component | Ownership Option | Level of Local Government Control | Level of County Government Control | Public Capital Expenditure | Tax Base Impact Status | Primary Decision-Making Criteria | Economy-of-Scale | Number of Financing Options | Maintains Existing System | Viability in Kenosha County | Other |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5. Transfer of Solid Wastes | Individual municipality with potential private partnership for two new facilities | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | Yes | Viable | - - |
| 6. Disposal of Solid Wastes | Private profit-oriented | Low | Low | No | Contributes to tax base | Profit motivated | Moderate | Moderate | Yes | Viable | - - |
| | Individual municipality | High | Low | Yes | Tax exempt | Cost and level of service | Low | High | Yes | Viable | Used only for limited quantities of water |
| 7. Incineration of Solid Wastes | Private profit-oriented | Low | Low | No | Contributes to tax base | Profit motivated | Low-moderate | Moderate | N/A | Viable | Technical expertise is available |
| | Individual municipality | High | Low | Yes | Tax exempt | Cost and level of service | Low-moderate | High | Yes | Viable only for largest municipalities | Need to obtain required technical expertise |
| | Group of municipalities | Moderate | Moderate | Yes | Tax exempt | Cost and level of service | Moderate | High | N/A | Viable | Need to obtain required technical expertise |
| | County | Low | High | Yes | Tax exempt | Cost and level of service | High | High | N/A | Viable | Costs distributed over larger tax base |
| 8A. Disposal of Sewage Sludge by Landfilling | Private profit-oriented | Low | Low | No | Contributes to tax base | Profit motivated | Moderate | Moderate | Yes | Viable | - - |
| 8B. Disposal of Sewage Sludge by Land Application | Individual municipality | High | Low | Yes | Tax exempt | Cost and meeting needs of sludge disposal | Low | High | No | Viable | Used for majority of sludge |
| | Private profit-oriented | Low | Low | No | Contributes to tax base | Profit motivated Conform with normal cropping operations | Moderate | High | No | Viable | Used for limited quantities of sludge |

NOTE: N/A indicates information is not applicable..

Source: SEWRPC.

private nonprofit organizations. The principal disadvantage of this option is that public capital expenditures, responsibilities, and liabilities would be incurred by the municipalities for development of the recycling centers.

Ownership by a Group of Municipalities: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by a group of municipalities. The principal advantages of this option are the level of control provided to the local units of government; the increased economies-of-scale associated with operation of a system which serves more than one municipality; and the availability of compatible sites. The principal disadvantages of this system are that public capital expenditures, responsibilities, and liabilities would be incurred by the participating municipalities, and that a high degree of municipal cooperation and coordination would be required. Additionally, the character of development in western Kenosha County is such as to reduce the potential for more than one community to share facilities at a convenient location.

Ownership by the County: Under this option, facilities necessary for the residential solid waste recycling component of the recommended plan would be owned by the County. The principal advantage of this option is the centralized control that would be provided. In this respect, the County would be better able to retain the expertise needed to manage the facilities. A wide range of options would be available to the County for financing construction of the centers. It might also be possible to secure lower prices for equipment and facilities if a single agency were to secure these for multiple sites. Similarly, it may be possible to secure higher revenues from the recycled materials if larger quantities are dealt with. The principal disadvantage of this option is that capital expenditures, responsibilities, and liabilities would be incurred by the County to construct the recycling centers required. Furthermore, administrative facilities and a dedicated staff would be required to coordinate the activities at all of the centers.

Summary: Implementation of the recycling component of the recommended plan requires the establishment of 10 residential solid waste recycling centers within the County. It is recommended that ownership be provided through a combination of two of the available options for implementation--private profit-oriented businesses and individual municipalities. Because of the potential profit involved in recycling, private ownership is possible, but is recommended only where the recycling center can be located at the site of an existing or newly proposed commercial recycling business. This arrangement may be expected to provide for the provision of one or two of the needed recycling centers. For the remaining eight or nine recycling centers, it is recommended that the individual municipalities assume the responsibility for ownership, development, and operation.

## System Component No. 2: Source Separation—Composting of Yard Wastes

The composting facilities incorporated into the recommended plan include a fenced area for compost processing and storage, the use of large temporary storage containers, and intermittently used equipment such as a chipper and material-handling equipment at seven composting facilities.

The only facility ownership option considered for this component of the recommended plan was ownership of the composting facilities by individual local units of government and the County. The profit potential of these operations is limited, thereby precluding implementation by private concerns. In this respect, it is specifically recommended that the composting program initiated by the City of Kenosha in 1987 for processing vegetative debris be continued. The other six composting sites would be located on municipally or county owned or controlled land, and equipment owned by local public works departments could be used for the limited amount of materials handling necessary. While most sites would be municipally owned, it is envisioned that county ownership or joint county-municipal ownership could be viable at some locations where county land and equipment are available and where there are uses for the compost material. Such sites could include county public works yards and parks. The principal advantage of this option is the high level of control by local governments and the ability to share costly equipment. While it is unlikely that the composted material will generate revenues, the municipality owning the site has the advantage of providing a compost product for municipal and citizen use. The principal disadvantages are the need for municipalities to undertake an additional program, and the uncertainty about whether a program under which residents have to transport yard wastes to a centralized location for composting would be successful.

## System Component No. 3: Residential Toxic and Hazardous Waste Management

The residential toxic and hazardous waste management program of the recommended plan envisions the use of temporary sites which provide for a building and for the material-handling equipment for carrying out a program of one annual special collection of household products containing toxic and hazardous substances. Five ownership options were considered for these facilities: ownership by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by groups of municipalities, and by the County.

Ownership by a Private Nonprofit Organization: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by one or more private nonprofit organizations. The principal advantage of this option is that local units of government would not incur capital expenditures for the facilities; nor would they have to allocate space at municipally owned facilities for this purpose. The principal disadvantage is that facilities owned or controlled by nonprofit organizations may be inadequate in some situations to accommodate the equipment, materials, and temporary storage area necessary for such special collections. This option could be viable if a private nonprofit organization would be the owner of a major recycling center which could also be used for household toxic and hazardous materials collection once or twice per year.

Ownership by a Private Profit-Oriented Business: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by private, profit-oriented businesses. A comprehensive household toxic and hazardous waste management program would require the location of facilities in a number of communities throughout the County. The establishment of these facilities by private business for use once or twice per year per site does not appear to be viable unless an existing landfill or other solid waste handling site were located at a site convenient to most residences. This does not appear to be the case in Kenosha County.

Ownership by Individual Municipalities: Under this option, the facilities necessary for the collection and temporary storage of household toxic and hazardous wastes would be owned by the individual local units of government. Communities throughout the State that have conducted special residential toxic and hazardous waste collections have found that facilities owned by local units of government are often the most convenient and least objectionable locations for drop-off sites. The principal advantage of this alternative is the high level of control by local governments and the ability to use sites and facilities normally used for other municipal purposes. The principal disadvantage is the need to find adequate facilities on existing municipally owned property and the need to coordinate the collection so as to not conflict with ongoing municipal services and activities at the site or sites to be used.

Ownership by a Group of Municipalities: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by a group of municipalities. The principal advantage of this system is that smaller municipalities, which individually might not have adequate space or facilities for the conduct of a residential toxic and hazardous waste collection program, could cooperate to find a site which could be jointly used. The principal disadvantage is the degree of intermunicipal cooperation that would be required.

Ownership by the County: Under this option, facilities necessary for the collection and temporary storage of household toxic and hazardous materials would be owned by the County. An advantage of this option is the large number of sites that may be available because of the widespread ownership of lands by the County. It may also be possible to utilize a single set of equipment and personnel at the multiple sites because of the centralized control provided by this option. Because of the scale involved, the County may also be able to better secure a disposal method and may be able to negotiate lower costs. The principal disadvantage of this option is the management effort that would be entailed in coordinating the collection and site-specific location for the annual collection called for by the recommended program.

Summary: Implementation of the residential toxic and hazardous waste management component of the recommended plan requires the establishment of convenient, centrally located buildings and grounds for the collection and temporary storage of the materials collected. In most cases, such facilities can best be provided by individual municipalities, or by a group of smaller municipalities at a mutually agreed-upon, centrally located site.

## System Component No. 4: Collection and Transport of Solid Wastes

The collection and transportation component envisioned to be incorporated into the recommended plan includes the continued use of the collection and transportation vehicles and auxiliary equipment currently owned by the municipalities and private contractors in Kenosha County. It should be noted that the separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out as part of the routine collection and transportation. As indicated in Chapter VII, the separate collection of newsprint is envisioned to be carried out by a combination of municipally and privately owned and operated residential solid waste collection services. Recycling of this material would be carried out by the municipalities in conjunction with their residential solid waste recycling programs.

The only facility ownership option considered for this component of the recommended plan was a flexible system providing for continued ownership of the existing collection and transportation equipment and facilities by both municipalities and private contractors. The principal advantage of this option is that it represents an existing system which functions adequately. The principal disadvantage of this alternative is the limited degree of local government control over the management and operation of the privately owned and operated portion of the system. Such control could expedite special solid waste management efforts such as the collection of newsprint. This option anticipates that there may be some changes over the plan design period from public to private, or from private to public, systems based upon local considerations.

## System Component No. 5: Transfer of Solid Wastes

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the five transfer stations already operating in the County and the development of two additional transfer stations at such time as three smaller landfills currently operated are closed. Most residential solid wastes would continue to be transported to one of these transfer stations.

The only facility ownership option considered for this component of the recommended plan was continued ownership of the existing five transfer stations by the municipalities concerned, with the option of private for-profit ownership of the two proposed facilities. The principal advantage of this option is that only two new facilities would need to be constructed; consequently, local units of government would not need to incur major capital expenditures for five of the seven facilities. At two facilities capital expenditure would be required. In addition, the municipalities would have control over the level of service and operation. The principal disadvantage of this option is that upon full plan implementation, intergovernmental arrangements may need to be completed to allow transfer of residential solid wastes from a community without a transfer station to a transfer station located in another community.

## System Component No. 6: Disposal of Solid Wastes by Landfilling

The solid waste landfilling component envisioned to be incorporated into the recommended plan includes the continued use of existing commercial general-use landfills within and adjacent to Kenosha County.

The only facility ownership option considered for this component of the recommended plan was continued ownership of the commercial general-use landfills by private owners. The principal advantage of this alternative is that expansion of the existing commercial landfill anticipated to be used for disposal of most of the unrecycled solid wastes would require no large capital investment by local units of government, since this facility is privately owned. In addition, management of these facilities would rest with owners possessing proven experience in this field. The principal disadvantages of this system are that local units of government would have limited control over management and operation of the privately owned facility, and that they could incur increased disposal costs as the private owners of the facility seek to raise fees and maximize profits.

## System Component No. 7: Incineration of Solid Wastes

Incineration is a contingent component of the recommended plan which would be implemented late in the plan design period and only if landfilling and energy costs escalate to make this component economically attractive, and if a viable user of the steam generated is found. Should this component become viable late in the plan period, the construction of one incineration facility would be required with a capacity of 150 to 250 tons per day and designed to produce steam as an energy product. Four ownership options were considered for the incineration component of the recommended plan: ownership by a private profit-oriented business, by individual municipalities, by groups of municipalities, and by the County.

Ownership by a Private Profit-Oriented Business: Under this option, the facility necessary for the incineration component of the recommended plan would be owned by a profit-oriented business. The principal advantages of this option are that the County or local units of government would not incur the large capital expenditures required for construction of the facility. Also, the technical and managerial expertise needed to construct and manage the incinerator facilities would be readily available in the private sector. The principal disadvantages of this option are that the local units of government would have only limited control over the management and operation of the facility; fewer alternatives would be available to finance construction of the facilities; and the facility would be operated under a profit motive, which could significantly and disproportionately increase tipping fees over the long term. Implementation under this ownership alternative would be dependent entirely on economic considerations.

Ownership by Individual Municipalities: Under this option, the incinerator would be owned by an individual municipality. Because of the major capital expenditures involved and because the plan recommends the construction of a relatively large facility, it was concluded that this option would be viable only for the City of Kenosha. The principal advantage of this option is the high level of control which the City of Kenosha would have over the siting, design, management, and operation of the facilities. The principal disadvantage of this option is the high capital cost that would be incurred by the City of Kenosha.

Ownership by a Group of Municipalities: Under this option, the incinerator facility would be owned by groups of municipalities. The principal advantages of this option are the level of local control that would be provided over the management and operation of the facilities, and the larger number of options that would be available for financing construction of the facilities. The principal disadvantage of this option is the large public capital investment that would be required by the local units of government that cooperatively owned the facility. An additional disadvantage would be the potential difficulties inherent in achieving the required coordination and cooperation between not only the owner municipalities, but also other user municipalities.

Ownership by the County: Under this option, the incinerator would be owned by the County. The principal advantages of this option are the high level of control and coordination that would be provided and the larger number of options that would be available for financing construction of the facilities. The principal disadvantage of this option is the large capital investment that would be required by the County, and the complex coordination necessary to ensure the availability of adequate amounts of waste for optimum operation of the system.

Summary: The recommended plan envisions, as a contingent element, the potential construction of an incinerator designed for steam generation late in the plan design period. The ownership of the facility would be dependent in part on the steam customer and could include any combination of municipal, county, and private profit-oriented ownership. Since the facility would likely serve only a portion of the County, sole county ownership is not envisioned.

## System Component No. 8A: Disposal of Sewage Sludge by Landfilling

The municipal sewage treatment plant sludge management program of the recommended plan includes the continued transport of a portion of the sewage treatment plant sludge generated in Kenosha County to existing commercial general-use landfills.

The only facility ownership option considered for this component of the recommended plan was the continued ownership of the existing commercial general-use landfills by private operators. The principal advantage of this alternative is that expansion of the existing commercial landfills anticipated to be used for disposal in Kenosha County would require no large capital investment by local units of government. In addition, management of these facilities would rest with owners and operators with proven experience in the field. The principal disadvantages of this system are that local units of government would have limited control over management and operation of the privately owned facilities, and that they may incur increased disposal costs.

## System Component No. 8B: Disposal of Sewage Sludge by Land Application

The municipal sewage treatment plant sludge management program of the recommended plan provides for the transport of a portion of the sludge generated in Kenosha County to agricultural land application sites, and a portion to a privately owned, commercially operated storage lagoon. Sludge transported to the commercially operated storage lagoon would be stored temporarily and eventually spread on agricultural lands.

Ownership by Private Owners: Under this option, the land application sites, storage lagoon, and associated equipment would be under private ownership. In the case of the land application sites and the associated equipment, this would be the farm operators concerned. In the case of the storage lagoon, a private sludge disposal service would be the owner. The principal advantage of this alternative is that no large capital investment would be required of the local units of government. In addition, management of these facilities would rest with owners and operators with proven experience in the field. The principal disadvantage of this option is that local units of government would have limited control over management and operation of the privately owned facilities. Because of this, the operation of the land application sites may be directed toward optimizing crop production and not sludge disposal operations. This can increase land requirements, as well as storage costs, for sludge application.

Ownership by Individual Municipalities: Under this option, the land application sites, storage lagoons, and associated equipment would be owned by the municipalities. The principal advantage of this option is the level of control which the units of government would have over the management and operation of the facilities. Ownership of land and equipment by the municipality would optimize sludge land application rather than crop production.

Summary: It is recommended that the City of Kenosha Water Utility and the Villages of Paddock Lake and Twin Lakes provide the facilities and vehicles for transporting, storing, and applying dewatered sludge. Land application sites would continue to be privately owned. Further, continued private ownership of the application facilities for the other sewage treatment plants currently operating in Kenosha County is recommended. It is, however, recommended that each municipal sewage treatment plant develop in the early stages of the plan design period an alternative means of sludge storage and land application which would be municipally owned and operated. Such a system would provide a backup system to the present use of the privately owned and operated storage lagoon and land-spreading systems.

## OPERATIONAL OPTIONS

The operation of the facilities necessary for the eight components of the recommended solid waste and municipal sewage treatment plant sludge management plan, while influenced by the facility ownership, need not necessarily be determined by the ownership. In some cases, it may be preferable for the facility owner also to be responsible for operation. In other cases, the operation of the facilities may be better performed by an agency other than the owner. The evaluation of operational options included consideration of the level of local or county governmental control, flexibility, availability of technical expertise, potential for equipment sharing, and efficiency of operation. Table 45 presents a comparative analysis of the various operational options considered for the recommended solid waste management plan.

## Table 45

## COMPARISON OF OPERATION ALTERNATIVES FOR THE PRELIMINARY RECOMMENDED SOLID WASTE AND SEWAGE SLUDGE MANAGEMENT PLAN FOR KENOSHA COUNTY

| Solid Waste Management System Component | Operation Alternative | Level of Local Government Control | Level of County Government Control | Level of Flexibility | Decision-Making Criteria | Potential Availability of Technical Expertise | Potential for Equipment Sharing by Government Departments | Efficiency of Operation | Maintains Existing System | Viability in Kenosha County |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. Storage of Solid Wastes | Private | Low | Low | High | N/A | N/A | N/A | Moderate | Yes | Viable |
| 2. Residential Solid Waste Recycling and Composting of Yard Wastes | | | | | | | | | | |
| Residential Solid Waste Recycling | Private nonprofit | Low | Low | Low | Level of involvement | Moderate | N/A | Moderate | In some cases | Viable |
| | Private profit-oriented | Low | Low | Moderate | Profit motivated | High | N/A | High | In some cases | Viable |
| | Individual municipality | High | Low | Moderate | Cost and level of service | Moderate | High | Moderate | In some cases | Viable |
| | Group of municipalities | Moderate | Moderate | Moderate | Cost and level of service | Moderate | Moderate | High | No | Viable |
| | County | Low | High | High | Cost and level of service | High | High | High | No | Viable |
| Composting of Yard Wastes | Individual municipality | High | Low | Moderate | Cost and level of service | Moderate | High | High | In some cases | Viable |
| 3. Residential Toxic and Hazardous Waste Management | Private profit-oriented | Moderate | Low | High | Profit motivated | High | N/A | High | N/A | Viable |
| 4. Collection and Transport of Solid Wastes | Private profit-oriented | Moderate | Low | High | Profit motivated | High | N/A | High | Yes | Viable |
| | Individual municipality | High | Low | Moderate | Cost and level of service | High | High | Moderate | Yes | Viable |
| 5. Transfer of Solid Wastes | Individual municipality with participation by private profit-oriented | High | Low | Moderate | Cost and level of service | Moderate | High | High | Yes | Viable |
| 6. Disposal of Solid Wastes | Private profit-motivated | Low | Low | Moderate | Profit motivated | High | N/A | Moderate | Yes | Viable |
| | Individual municipality | High | Low | Moderate | Cost and level of service | Moderate | High | Moderate | Yes | Viable |
| 7. Incineration of Solid Wastes | Private profit-oriented | Low | Low | Moderate | Profit motivated | High | N/A | High | N/A | Viable |
| | Individual municipality | High | Low | Moderate | Cost and level of service | Low | High | Moderate | N/A | Viable |
| | Group of municipalities | Moderate | Moderate | Moderate | Cost and level of service | Low | Moderate | Moderate | N/A | Viable |
| | County | Low | High | Moderate | Cost and level of service | Moderate | High | High | N/A | Viable |
| 8A. Disposal of Sewage Sludge by Landfilling | Private profit-motivated | Low | Low | Moderate | Profit motivated | High | N/A | Moderate | Yes | Viable |
| | Individual municipality | High | Low | Moderate | Cost and level of service | Low | Moderate | Moderate | No | Viable |
| 8B. Disposal of Sewage Sludge by Land Application | Individual municipality in cooperation with private landowners | High | Moderate | Moderate | Crop production | High | N/A | High | N/A | Viable |

NOTE: N/A indicates information is not applicable.

Source: SEWRPC.

## System Component No. 1: Storage

Storage facilities consist of small storage containers which are owned by individuals and large bulk containers which are owned by the contractors or by the multifamily residential complexes, commercial establishments, and industries served. Larger portable containers designed for mechanized pickup may be phased into residential areas over the plan period, depending upon local considerations of cost. The small storage containers are generally placed on the curbside by the individual owners on a weekly or bi-weekly basis for pickup. Most industrial and commercial solid wastes are placed into large bulk containers which are subsequently emptied by a waste collection contractor. The only option considered for this component was continued operation of the required storage facilities under existing arrangements by private individuals and solid waste collection contractors.

## System Component No. 2: Source Separation—Residential Solid Waste Recycling

The source separation recycling facilities recommended in the plan include 10 recycling centers to facilitate the recovery of newsprint, glass, aluminum, oils, and plastic from the solid waste stream. Five operation options were considered for the operation of these facilities: operation by private nonprofit organizations, by private profit-oriented businesses, by individual municipalities, by groups of municipalities, and by the County.

Operation by a Private Nonprofit Organization: Under this option, the residential solid waste recycling component facilities would be operated by a private nonprofit organization. The principal advantage of this option is that volunteer labor provided by nonprofit organizations would be utilized to operate the recycling centers, with revenues from the sale of recycled materials being used to operate the centers and compensate the organizations supplying the volunteers. This option may be the only way to operate these facilities in the foreseeable future without a net operational loss. This option has proven to be effective where local organizations have an interest in recycling for environmental and other nonprofit-motivated reasons. The principal disadvantages of this option are the potential lack of technical expertise; the potential problems of maintaining interest over time in a program based upon nonprofit motivation; and the difficulty in coordinating work schedules for operation of the recycling centers. Residential solid waste recycling centers are currently operated by private nonprofit organizations in Kenosha County. Consequently, it is likely that such organizations could assist municipalities in the operation of municipally owned recycling centers through the provision of organizational expertise and volunteer labor.

Operation by a Private Profit-Oriented Business: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by a private profit-oriented business. The principal advantage of this system is the technical and managerial expertise which could be readily provided by the private sector in operating the facility and securing markets for the recycled materials. Furthermore, the operation of a residential solid waste recycling center in conjunction with an ongoing private recycling business could result in efficiencies by being located at, and operated by, a major recycling operation which is the ultimate user, or seller, of the recyclables. The principal disadvantage of this system is the lack of control by local units of government over the management and operation of the centers. It is unlikely that private operators would solicit this type of work except in conjunction with ongoing operations owing to the low profitability when the labor costs entailed are fully incurred. Some recycling of solid wastes--primarily cardboard and paper from commercial operations--may be expected to continue in any case at private profit-oriented businesses.

Operation by Individual Municipalities: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by individual municipalities. The principal advantage of this system is the level of control that would be provided by local governments over management and operation of the centers. The principal disadvantage is the need to obtain technical expertise in both operating the facilities and securing stable markets for the recycled materials. This option also has the potential disadvantage of being an added tax burden on the community, since labor costs would likely not be fully offset by revenues from the sale of recyclables.

Operation by a Group of Municipalities: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by a group of municipalities. The principal advantages and disadvantages of this system are similar to those of a system operated by an individual municipality.

Operation by the County: Under this option, the facilities necessary for the residential solid waste recycling component of the recommended plan would be operated by the County. The principal advantage of this component is that it would provide for a coordinated countywide recycling system. In addition, the County may be better able to market the recyclables at a larger scale, and thus increase the revenues. The principal disadvantage of this option is the need for the County to assume a new responsibility in operating and administering the program. This option would likely result in increased public sector costs since labor costs--even management and coordination efforts--would likely not be offset by revenues from the sale of recyclables.

Summary: Implementation of this component requires the establishment of 10 recycling centers. Recycling may be expected to continue to occur at facilities owned by private nonprofit and private for-profit organizations. It is envisioned that the 10 recycling centers will be operated by a combination of private nonprofit organizations, private for-profit businesses, municipalities, and the County.

The private for-profit businesses would be involved where residential solid waste recycling centers are located at already operating commercial recycling businesses. In other cases, it is recommended that a combination of private nonprofit organizations and municipalities be responsible for the operation of the centers. In this regard, it is recommended that the municipalities assume primary responsibility for the operation of the centers. Operational assistance from nonprofit volunteer groups should be encouraged. However, the Technical Advisory and Intergovernmental Coordinating Committee guiding the plan preparation, after considering all options for the operation of such centers, specifically recommended that the lead implementation responsibility rest with the municipalities, and that operation not be contingent upon volunteer groups providing labor and management services. It should be noted in this regard that the costs of recycling center operations are expected to be higher than the costs for landfilling. Thus, the municipalities would likely experience increased costs for solid waste management upon implementation of this plan component. It was also recommended by the Committee that countywide coordination of the recycling programs be the responsibility of a task force established by the County in cooperation with the municipalities. The task force would be comprised of one representative from each municipality in which a recycling center is recommended to be located, one representative of the County Board, a possible representative from a landfill operation, and advisory members from the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension office. That task force would provide leadership, on a countywide basis, in the areas of coordination, organizational assistance, and recyclable material marketing. Public education and information services are recommended to be carried out through the University of Wisconsin-Extension office.

## System Component No. 2: Source Separation—Composting of Yard Wastes

The composting facilities envisioned to be incorporated into the recommended plan include the use of large temporary storage containers, a fenced area for compost windrows, and intermittently used processing equipment, such as a chipper, and material-handling equipment, such as a front-end loader, at seven composting sites. The ongoing composting program conducted by the County for processing vegetative debris originating in county park and open space areas would continue under the plan. The composting sites would be located on municipally owned land, and existing equipment owned by local public works departments would be used for handling the materials to be composted. The only option considered for this component of the recommended plan was continued operation of the composting facilities by individual local units of government and the County. It is recommended that overall coordination of the composting program be provided by the same countywide task force proposed to be established under the recycling center program, and that the public education and information program be provided by the University of Wisconsin-Extension office in a coordinated effort with the residential recycling program.

## System Component No. 3: Residential Toxic and Hazardous Waste Management

The residential toxic and hazardous waste management program envisioned to be incorporated into the recommended plan includes temporary sites which provide for a building, or enclosure, and material-handling equipment for carrying out a program of one annual special collection of household products containing toxic and hazardous substances. Because of the specialized nature of collecting, packaging, transporting, and disposing of toxic and hazardous wastes, it is recommended that this program be coordinated and administered countywide by the Kenosha Water Utility, the staff of which has experience in collecting and handling special materials. It is recommended that the Kenosha Water Utility coordinate the efforts with the local units of government and that the public information and education program be coordinated by the Utility, the local units of government, and the University of Wisconsin-Extension office. A private for-profit firm could also be engaged to assist in the operation and in the disposal of selected materials.

## System Component No. 4: Collection and Transport of Solid Wastes

The collection and transport component envisioned to be incorporated into the recommended plan includes continued use of the collection and transportation vehicles and auxiliary equipment owned by the municipalities and private contractors in Kenosha County in a manner similar to the existing situation. The separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out in conjunction with the routine collection and transportation. The only option evaluated for this component was a flexible approach that provides for continued operation of the collection and transportation facilities by municipalities and private contractors. This option represents the existing system, which works successfully.

## System Component No. 5: Transfer of Solid Wastes

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the five existing and two new transfer stations in the County. Most residential solid wastes would continue to be transported to one of these transfer stations. The only option evaluated for this component was a flexible approach providing continued operation of the transfer stations by the municipalities concerned, with participation by private profit-oriented contractors if found practical based upon local cost analyses and market conditions, as under the existing system. The principal advantage of this option is that no changes to the existing method of operation would be needed.

## System Component No. 6: Disposal of Solid Wastes by Landfilling

The solid waste landfilling component envisioned to be incorporated into the recommended plan includes the continued use of one existing commercial general-use landfill. The only option evaluated for this component was continued operation of the existing commercial general-use landfill by the private sector. The principal advantage of this option is that the technical expertise needed to properly operate the facilities already exists. The principal disadvantage of this system is that the operation of the large commercial general-use landfill which will be used to dispose of most of the solid wastes generated during the plan period is profit-motivated, and may result in increasingly expensive tipping fees.

## System Component No. 7: Incineration of Solid Wastes

Incineration is a contingent component envisioned to be incorporated into the recommended plan late in the plan design period, and only if there is an escalation in landfilling and energy costs and if a viable user of steam is found. Should such a component become viable late in the plan design period, it would require the construction of one incineration facility with a capacity of 150 to 250 tons per day designed to generate steam. If implemented, four operational options are considered viable: operation by a private profit-oriented business, by individual municipalities, by a group of municipalities, or by the County.

Operation by a Private Profit-Oriented Business: Under this option, the incinerator would be operated by a profit-oriented business. The principal advantage of this option is that the expertise would be available to operate and manage a complex, high-technology system which such facilities represent. The principal disadvantage is the additional cost entailed in having the facility operated by a private profit-oriented company rather than by municipal employees.

Operation by Individual Municipalities: Under this option, the incinerator facility would be operated by individual municipalities. This option, like the ownership option, is considered viable only for a large municipality such as the City of Kenosha. The principal advantage of this option is the high level of control which the municipality would have over the management and operation of the system and subsequently the costs. The principal disadvantage is the need to maintain a staff of highly trained technical personnel to operate and maintain the facilities.

Operation by a Group of Municipalities: Under this option, the incinerator would be operated by a group of municipalities. The principal advantage of this system is that the expenses for operation and maintenance of the facilities would be shared among a group of communities, resulting in lower costs due to economies-of-scale. The principal disadvantage of this option is uncertainty concerning the level of cooperation that would be achieved among the communities involved.

Operation by the County: Under this option, the facility necessary for the incineration system component would be operated by the County. The principal advantage of this option is the high level of control that could be exercised by the County over the services provided and operation and maintenance decisions. The principal disadvantages of this system are the need to retain specific technical personnel to operate the facility, and uncertainty concerning the level of coordination and cooperation that would be achieved among the communities involved.

Summary: The operation of the incineration system, if constructed, will depend in part on the energy user. Since this component will not be implemented until late in the plan design period, it is recommended that all four options, or a combination of these options, be considered and evaluated further at the time the incineration component is reconsidered.

## System Component No. 8A: Disposal of Sewage Sludge by Landfilling

The municipal sewage treatment plant sludge component envisioned to be incorporated into the recommended plan includes the continued use of existing commercial general-use landfills, which was the only option evaluated for this component. The principal advantage of this option is that the technical expertise needed to properly operate the facilities already exists. The principal disadvantage of this option is that the operation of these facilities is profit-motivated and may result in escalating tipping fees.

## System Component No. 8B: Disposal of Sewage Sludge by Land Application

The municipal sewage treatment plant sludge component envisioned to be incorporated into the recommended plan includes land application of sludges and the continued use of a private, commercially operated storage lagoon. The only option evaluated for this component was continued operation of the commercially operated storage lagoon by the private sector. The principal advantage of this option is that the technical expertise needed to properly operate the facilities already exists. The principal disadvantage of this option is that the operation of these facilities is profit-motivated and may consequently result in escalating costs.

For land application of sludge, the only option considered was operation primarily by the individual municipality with the possible cooperative input of the landowner, depending upon the circumstances at each site. Sludge would be handled at the site either by municipal employees or by the landowner or his employees. This system flexibility appears necessary for the proper negotiations between the municipality and the landowner.

## SUMMARY

The advantages and disadvantages of the ownership and operational options available for implementation of each component of the recommended solid waste and municipal sewage treatment plant sludge management plan were considered in order to determine which options might best facilitate implementation of the recommended plan. Maintenance of the existing ownership and operation is recommended as the best option for five of the eight plan components--storage, collection and transportation, transfer, and both solid waste and sludge landfill disposal. For the other three plan components--residential solid waste recycling and composting, residential toxic and hazardous waste management, and incineration--a flexible set of ownership and operational options is proposed.

The storage component of the recommended plan envisions the continued use of small storage containers owned by individuals and large bulk containers owned by private contractors or by the multifamily residential complexes, commercial establishments, and industries served. The small storage containers are generally placed on the curbside by the individual owners on a weekly or bi-weekly basis for pickup. Most industrial and commercial solid wastes are placed into large bulk containers which are subsequently emptied by a waste collection contractor. This ownership pattern is recommended to be continued, with the exception being the potential for municipal ownership of larger portable containers designed for mechanized collection if such systems are integrated into the storage system. Continued operation of these storage facilities under existing arrangements by private individuals and solid waste collection contractors is also recommended.

The residential solid waste recycling component of the recommended plan would provide 10 recycling centers consisting of a dedicated area with storage facilities and a small office area. The evaluation of the advantages and disadvantages of the ownership and operation options for these recycling centers indicated that a flexible approach should be considered, providing for a combination of options. With regard to ownership, private profit-oriented ownership is recommended for recycling centers that could be located at ongoing commercial recycling businesses. This may be expected to provide no more than two of the recommended 10 facilities. The other eight recycling centers are recommended to be owned by the individual municipalities. It is envisioned that the municipal centers would be operated primarily on weekends, utilizing a combination of municipal and volunteer labor supplied by local nonprofit organizations. The organizations represented in these operations would receive a share of the revenue generated as a result of selling the materials for recycling. Overall responsibility for the operation of the centers and the use of the municipally owned and operated equipment is recommended to be provided by the municipalities. It is also recommended that countywide coordination of the recycling programs be made the responsibility of a countywide task force to be established by the County and the communities. That task force would be comprised of one representative from each municipality in which a recycling center is recommended to be located, one representative of the County Board, a possible representative from a landfill operation, and advisory members from the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension office. That task force would provide leadership on a countywide basis in the areas of coordination, organizational assistance, and recyclable material marketing. Public education and information is recommended to be carried out through the University of Wisconsin-Extension office.

The composting component of the recommended plan consists of seven sites providing large temporary storage containers, a fenced area for composting, and the intermittent use of processing equipment such as a chipper and material-handling equipment such as a front-end loader. The evaluation of implementation options for the composting portion of the residential solid waste recycling component indicated that ownership and operation by individual municipalities would be the most viable approach. It is recommended that overall coordination of the composting program be provided by the same countywide task force described above for the recycling center program; and that the public education and information program be provided by the University of Wisconsin-Extension office in a coordinated effort with the residential recycling program.

The residential toxic and hazardous waste management component of the recommended plan includes the temporary use of a site which can provide a building and material-handling equipment for carrying out a program of one annual special collection within the County of household products containing toxic and hazardous substances. The evaluation of the advantages and disadvantages of the ownership options for this component indicated that buildings and grounds that are owned by local units of government would be the most viable for the collection and temporary storage of the materials collected. Municipally owned collection areas could be used for individual municipalities. With regard to operation, the specialized nature of classifying, transporting, and disposing of these materials dictates that the collection program be operated by a private contractor working under contract with the individual municipality or group of municipalities that would be responsible for publicizing the collection. It is recommended that this program be coordinated and administered countywide by the Kenosha Water Utility, the staff of which has experience in collecting and handling such materials. It is recommended that the Kenosha Water Utility coordinate the efforts with the local units of government, and that the public information and education program be coordinated by the Utility, the local units of government, and the University of Wisconsin-Extension office. The assistance of nonprofit organizations should also be sought in the conduct of public informational efforts. A private for-profit firm could also be engaged to assist in the operation and in the disposal of selected materials.

The collection and transport component of the recommended plan includes the use of collection and transportation vehicles and auxiliary equipment owned and operated by the municipalities and private contractors in Kenosha County as under existing arrangements. The separate collection and transport of newsprint for recycling is included under this plan component, since this operation would be carried out in conjunction with the routine collection and transportation. The only option evaluated for these components was of a flexible approach that provides for the continued operation of the collection and transportation facilities by municipalities and private contractors.

The transfer component envisioned to be incorporated into the recommended plan includes the maintenance of the existing transfer stations operating in the County and the construction of two new transfer stations. Most residential solid wastes would be transported to one of these transfer stations. The only option evaluated for this component was continued ownership and operation of the seven transfer stations by municipalities and private contractors, as under the existing system.

The landfilling component envisioned to be incorporated into the recommended plan, which is anticipated to accommodate a portion of the solid waste and a portion of the sewage sludge generated in the County, includes the continued use of existing commercial general-use landfills. It is recommended that ownership and operation be provided by the private owners of the existing commercial general-use landfill. In addition, the sewage sludge management component envisioned to be incorporated into the recommended plan provides for the continued use of a private sanitary service to transport a portion of the sludge generated in Kenosha County to a commercially operated storage lagoon. This sludge would be stored temporarily and ultimately applied to agricultural lands. It is recommended, therefore, that ownership and operation be provided by private owners of the sanitary service.

Incineration is a contingent component envisioned to be incorporated into the recommended plan late in the plan period if a steam user is found, and if energy and landfill costs escalate at rates which make this alternative attractive economically. This component requires an incinerator designed for steam generation. The evaluation of the advantages and disadvantages of the ownership and operation options for the incineration system component indicated that, since a portion of the solid wastes generated in one major city and two townships would be processed at the incinerator, a combination of ownership and operation options may be most equitable. These include ownership and operation by the City of Kenosha, or ownership and operation by the City of Kenosha and the Towns of Pleasant Prairie and Somers. Under each of these options, a partnership arrangement with a private profit-oriented owner and/or operator would be possible.

Finally, it is recommended that the City of Kenosha Water Utility and the Villages of Paddock Lake and Twin Lakes provide the facilities and vehicles for transporting, storing, and applying dewatered municipal treatment plant sludges. Land application sites would continue to be privately owned. Further, continued private ownership of the temporary storage and land application facilities for the other sewage treatment plants currently operating in Kenosha County is recommended. It is, however, recommended that each municipal sewage treatment plant develop in the early stages of the plan design period an alternative means of sludge storage and land application which would be municipally owned and operated. Such a system would provide a backup system to the present use of the privately owned and operated storage lagoon and land-spreading systems.

# Chapter IX

# RECOMMENDED SOLID WASTE AND MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE MANAGEMENT PLAN AND IMPLEMENTATION ACTIONS

## INTRODUCTION

Based upon the inventories, analyses, forecasts, and alternative plan evaluations presented in this report, a recommended plan for meeting the existing and probable future solid waste and municipal sewage treatment plant sludge management needs of Kenosha County was developed. The selection of the recommended plan and means of implementation followed an extensive review by the Advisory Committee of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered.

This chapter describes the recommended solid waste and municipal sewage treatment plant sludge management plan for Kenosha County, including the attendant costs. The chapter also contains an evaluation of the ability of the recommended plan to meet the adopted solid waste management plan objectives established by the Advisory Committee, as well as a discussion of the importance of and need for implementing the recommended plan, and of the procedures that should be followed in plan implementation. A proposed schedule for implementing each of the components of the recommended plan is also presented.

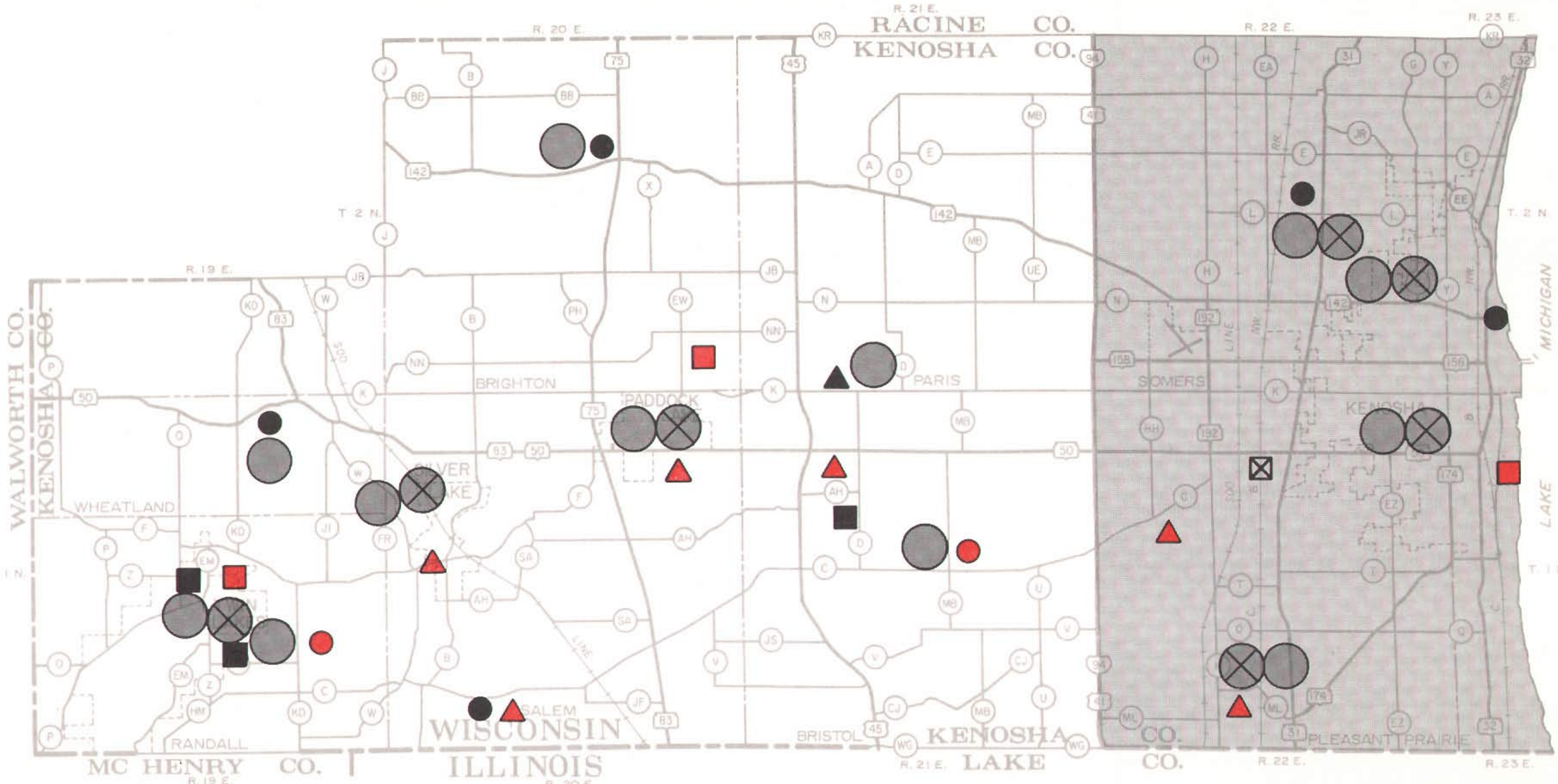
## RECOMMENDED PLAN COMPONENTS

The recommended Kenosha County solid waste and municipal sewage treatment plant sludge management plan consists of six management components--storage, source separation, collection, transportation, transfer, and disposal. In addition, a contingent recommendation providing for the processing of solid waste by incineration is made--the implementation of which will be dependent upon future conditions regarding energy users, energy costs, general price inflation rates, and landfill costs. The recommended plan is designed to accommodate the total solid waste and municipal sewage treatment plant sludge loadings expected to be generated within the County through the year 2010.

The recommended plan set forth in this chapter represents a refinement of the preliminary recommended alternative plan set forth in Chapter VII of this report. The refinements were based upon the public comments received at the public hearing held on the alternative plans, and upon the results of further analyses regarding recycling in view of the findings that incineration does not appear to be economically practical in the near future.

A description of each of the components of the recommended solid waste management plan and the associated institutional arrangements for ownership and operation is presented below. The recommended plan is shown in graphic summary form on Map 44.

# Map 44
## RECOMMENDED SOLID WASTE AND MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE MANAGEMENT PLAN FOR KENOSHA COUNTY




LEGEND

GENERALIZED LOCATION OF PROPOSED RECYCLING CENTERS (12)

GENERALIZED LOCATION OF PROPOSED COMPOSTING SITES (7)

MUNICIPAL GENERAL-USE LANDFILL ANTICIPATED TO CLOSE IN THE EARLY STAGES OF THE PLAN DESIGN PERIOD

COMMERCIAL GENERAL-USE LANDFILL

SPECIAL USE LANDFILL

EXISTING TRANSFER STATIONS (5)

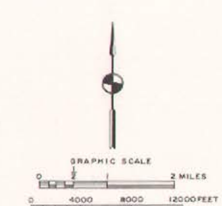
PROPOSED TRANSFER STATIONS (2)

AREA FROM WHICH UNRECYCLED SOLID WASTE WOULD BE TRANSPORTED TO LANDFILL

AREA FROM WHICH A PORTION OF THE UNRECYCLED SOLID WASTE WOULD BE TRANSPORTED TO A LANDFILL WITH A PORTION POTENTIALLY TRANSPORTED TO AN INCINERATOR DURING THE LATER PART OF THE PLAN DESIGN PERIOD SHOULD A STEAM ENERGY USER BE FOUND AND SHOULD ENERGY AND LANDFILL COSTS ESCALATE AT RELATIVELY HIGH RATES

SOURCE OF LIQUID MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE TO BE TRANSPORTED TO A COMMERCIALLY-OPERATED STORAGE LAGOON OR LAND APPLICATION SITES

SOURCE OF DEWATERED MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE TO BE TRANSPORTED TO A LANDFILL AND TO LAND APPLICATION SITES




Source: SEWRPC.

## Component 1: Storage

The first component of the recommended plan is the storage system. Proper pre-collection storage practices are an important element of an efficient solid waste management system. Under the recommended plan, it is envisioned that residents would utilize either standard, leak-proof, galvanized metal or heavy-duty plastic trash cans with a 20- to 32-gallon capacity and equipped with tight-fitting lids; and/or heavy-duty plastic bags. The use of larger, bulk, portable containers designed for mechanized collection can reduce the time and cost of collection for certain commercial and industrial establishments, and in some multifamily residential areas.

Pre-collection storage affects the design, operation, and cost of the local collection system. In Kenosha County it is expected that this function will continue to be dominated by a combination of municipally and privately owned and operated systems. Decisions on the type of collection and storage system can accordingly best be made at the local level. However, it is recommended that all local units of government periodically evaluate means of improving the efficiency of collection service. In this regard, use of larger individual portable containers designed for mechanized collection in residential areas appears to be gaining acceptance in communities in southeastern Wisconsin, based upon local consideration of costs.

Storage systems are envisioned to continue to be owned and operated by the individual solid waste generators, municipal solid waste collection services, and private solid waste collection firms. It is recognized that there may be a shift over time from the use of small containers owned by individuals to the use of larger municipally owned but still individual residence containers suitable for mechanized hoisting into collection trucks.

## Component 2: Source Separation

The second component of the recommended plan is a source separation program. The program would consist of four integrated elements: 1) a voluntary residential solid waste recycling program for paper, glass, metal, waste oil, and plastic, whereby residents would transport these materials to a recycling center; 2) a voluntary curbside collection program for newsprint, whereby municipal and private solid waste collection vehicles would be equipped with special racks for temporary storage and transport of separated newsprint; 3) a mandatory composting program for the processing of yard wastes; and 4) a voluntary household toxic and hazardous waste management program. The recommendations include provisions for recycling or removal from the waste stream of about 12,000 tons per year of material through the integrated program in the plan design year 2010. This is over and above the 900 tons per year of residential wastes currently recycled, and represents, with that present tonnage, a relatively high proportion--20 percent--of the total residential wastes anticipated to be generated in the plan design year. Such an ambitious recycling program will require a high level of participation and a corresponding high level of public education and information and incentives. However, since the plan relies primarily on landfilling for disposal, the degree to which this relatively ambitious goal for recycling is actually met should not be a critical factor in the sizing of large capital-intensive facilities.

Rather, the recycling program would serve to extend the site life of existing landfills to varying degrees depending upon the relative success of the program.

Residential Solid Waste Recycling: The first element of the source separation component is a residential solid waste recycling program under which recyclable materials consisting primarily of paper, glass, aluminum, other metals, and plastics would be transported by individuals to one of 12 recommended local recycling centers. These recycling centers would typically consist of a dedicated fenced area for storage; parking for about 8 to 12 vehicles; accessible storage containers; and, at the larger centers, a small office area. It is expected that the materials to be collected for recycling will vary over the plan design period, depending upon market fluctuations for recyclables. A schematic layout of a typical recycling center is shown in Figure 7 in Chapter V. However, each facility would be designed to meet local needs and may be developed incrementally as recycling programs are expanded. The recommended generalized locations of these centers are shown on Map 44. Because of the importance of citizen participation in making this type of center successful, the specific location of these facilities should be carefully selected by the local units of government concerned. With full implementation throughout the County, and with a relatively high level of citizen participation in the recycling program, about 6,000 tons of material would be recycled per year in the plan design year, or about 10 percent of the estimated average annual residential solid waste quantity and about 4 percent of the total average annual solid waste quantity. This amount would be over and above the 900 tons of residential wastes currently estimated to be recycled. Thus, the total tonnage recycled in this manner in the plan year would be about 6,900 tons, or 11 percent of the residential waste stream.

In order to achieve this level of participation, it will likely be necessary to institute a limited separate collection program for recyclables. Some recyclable materials that are source-separated by residents will be transported by individual residents in privately owned vehicles. However, in addition, it is recommended that the communities consider development of a program of providing periodic separate collection of recyclable materials as an adjunct to the recycling centers described earlier. Such special collections could be conducted in selected, relatively highly urbanized areas on an infrequent schedule. The collections could be made using community-owned vehicles and probably municipally hired drivers, but could rely on volunteer groups for needed additional manpower. These groups could then be given portions of the proceeds from the recyclable material sales. The use of these volunteer groups would likely necessitate collections on weekends. Alternatively, the municipalities could carry out these operations with municipal forces, or under contract to a private contractor. It is recommended that this system be pilot tested in selected areas to determine a refined level of participation that may be expected to be achieved.

The recommended plan envisions a flexible approach to ownership and operation of the recycling centers. It is recommended that ownership of the centers be provided through a combination of private profit-oriented businesses and individual municipalities. Recycling of residential solid wastes is occurring and may be expected to continue to occur in the County at facilities owned by private nonprofit organizations and municipalities. Because of the potential profit involved in recycling, private ownership is considered viable, but is recommended only where the recycling center can be located at the site of an existing or new commercial recycling business. Under these criteria, one or two of the recommended 12 recycling centers in Kenosha County would be privately owned. It is recommended that the individual municipalities assume the responsibility for ownership of the other recycling centers.

It is envisioned that the 12 recycling centers will be operated by a combination of private nonprofit organizations, private for-profit businesses, municipalities, and the County. The private for-profit businesses would consist of the already operating or new commercial recycling businesses. In other cases, it is recommended that a combination of private nonprofit organizations and municipalities assume responsibility for the operation of the centers. In this regard, it is recommended that the municipalities assume primary responsibility for the operation of the centers. Operational assistance from nonprofit volunteer groups should be encouraged. However, the Technical Advisory and Intergovernmental Coordinating Committee guiding the countywide plan preparation, after considering all options for the operation of the center, specifically recommended that the lead implementation responsibility lie with the municipalities and that the operation not be contingent upon such groups providing the primary source of labor and management. It should be noted in this regard that the cost associated with the recycling center operations are expected to be higher than the costs for landfilling. Thus, the municipalities would likely experience increased costs for solid waste management under this plan component. It is also recommended by the Committee that overall county coordination of the recycling programs be the responsibility of a countywide task force to be established by the County and the communities. That task force would be made up of one representative from each community recommended to operate a recycling center, one representative of the County Board, a possible representative from a landfill, and advisory members from the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension program. That task force would take the lead in providing, on a countywide basis, coordination, organizational assistance, and recyclable material marketing. Public education and information is recommended to be carried out through the county University of Wisconsin-Extension office. It should be recognized, and it is important to note, that the centers will be successful only with strong local support and leadership. The relatively high level of participation recommended requires that a strong incentive and public education and information program be carried out as part of the program.

Curbside Collection of Newsprint: The second element of the source separation component is a separate curbside collection of newsprint. This separate collection program is considered an optional plan element to be implemented as found locally acceptable and practicable. In certain areas, such as areas with narrow roadways where vehicle maneuverability and size may be restricted, such a program may not be practicable. Decisions regarding such a program should be made in conjunction with more comprehensive evaluations of local collection systems. Where this component is implemented, collection vehicles--whether municipally or privately owned and operated--would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid waste for transport to the recycling centers or storage locations. This separate collection program is anticipated to result in the recovery and recycling of up to 1,000 tons of newsprint annually, or about 16 pounds per capita per year. This quantity would, by weight, be about 1.5 percent of the average annual residential solid waste stream, or less than 1.0 percent of the total waste stream. The newsprint recycled under this separate collection program would be in addition to the newsprint recycled at the 12 drop-off recycling centers proposed to be established.

The facilities necessary for the collection of newsprint would continue to be owned and operated by municipalities and private industry. The collected material would primarily be transported to and recycled at the recycling centers described in the above paragraphs or, in some cases, directly to commercial recycling centers that deal in wastepaper.

Composting: The third element of the source separation component is a program whereby vegetative debris, including grass clippings, leaves, and brush, generated from residential and institutional yard and other outdoor space maintenance would be composted at seven centralized sites and by individuals within the confines of their own property. As noted earlier in this report, composting is the controlled biological decomposition of organic material in the presence of oxygen to produce humus. Humus contains beneficial nutrients and is an excellent soil conditioner. The material would be transported by individual residents, or, in the case of debris generated on publicly owned parklands, parkways, or green spaces, by county or municipally operated vehicles, to one of seven processing sites situated throughout the County. The composting sites would include a fenced storage area for storage, including, in some sites, a leachate barrier and stormwater runoff prevention measures such as berms or dikes. The stored compost would periodically be turned over using available equipment such as a front-end loader. Other equipment such as a shredder and branch chipper may be used. The generalized locations of the proposed composting centers are shown on Map 44.

It should be noted that the City of Kenosha participated in a pilot composting program during the fall of 1987. Municipal vehicles were used to transport approximately 500 cubic yards of leaves which had been collected during fall leaf drop in the Columbus neighborhood from a collection site in the neighborhood to a composting site located on 33 acres of open land at the former City of Kenosha landfill site on CTH ML in the Town of Pleasant Prairie. Based upon the results of that pilot project, potential means of expanding the operation are being considered locally.

The composting program is anticipated to result in the removal of up to 2,400 tons of material from the solid waste stream. This quantity, by weight, would be about 40 percent of the average annual quantity of vegetative debris generated, or about 4 percent of the residential and about 1 percent of the total solid waste stream. This composted amount is about 100 percent more than the amount envisioned to be composted under the alternatives set forth in Chapter VII. Owing to 1988 legislative changes previously discussed, the disposal of yard waste in landfills will be prohibited after 1992. Thus, the importance of these composting operations and the level of participation is expected to be greater than envisioned under the alternative plan evaluations.

As a result of the recently passed regulations, substantial amounts of yard waste may also be expected to be removed from the waste stream and composted using individual decentralized composting systems, or will otherwise be recycled at the source. Thus, in total there is expected to be a reduction in yard waste of about 5,000 tons per year, or about 80 percent of the yard waste generated. This represents about 8 percent of the residential and about 2 percent of the total waste generated in the County.

The separated yard waste material would be transported in the more urbanized areas by the municipalities or private contractors using segregated racks during low-volume periods and special supplemental collections during peak periods. Because of the cost involved in collecting the yard wastes separately and in operating the compost system, it is recommended that this plan element include a strong public education and information component to encourage leaving as much of the material--such as grass clippings--on the site as practical. In the rural or low-density developed areas, materials would be expected to be handled on site or transported by individual residents. In the case of yard waste debris generated on publicly owned parklands, parkways, or green spaces, transportation would be by county-operated or municipally operated vehicles to one of the seven processing sites situated throughout the County.

For convenience and economy, most of the centralized sites are recommended to be located at or near the above-referenced recycling centers. Two sites would be located in the City of Kenosha, with one site each located in the Towns of Pleasant Prairie and Somers, and in the Villages of Paddock Lake, Silver Lake, and Twin Lakes. It is envisioned that the composting sites would be provided by the municipalities concerned either by direct ownership and operation or by contracts with private operators. In this regard, at the public hearings on the plan a private solid waste collection firm indicated that a private, for-profit firm would likely consider participation in the composting facility ownership and operation. The Technical Advisory Committee agreed that such an option might be viable for some of the compost operations, and should be considered by the local units of government. It is also recommended that overall coordination of the composting program be provided by the same countywide task force described under the recycling center discussion above, and that the public education and information program be provided through the University of Wisconsin-Extension office in a coordinated effort with the residential recycling program discussed above.

Household Toxic and Hazardous Waste Management: The fourth element of the source separation component is a household toxic and hazardous waste management program. This program would consist of annual "special collections" whereby residents could bring materials containing toxic and hazardous substances to a pre-arranged location on specific dates for disposal. The number of collections would depend on the willingness of the municipalities or of the County to organize the collection and on the availability of funding from either the state or federal government. The program would include a comprehensive information and education effort to inform citizens of the types of substances which can be disposed of under these special collections, and of nonhazardous alternatives to household products presently used. Assuming one collection per year at two locations, 2,500 to 3,500 gallons of material may be expected to be collected annually under this program. The conduct of an information and education program should also reduce, to an undetermined extent, the amount of such substances that are used and eventually discarded.

This recommendation is considered an interim component recommendation pending development of programs at a regional or state level for disposal of such materials from residential sources, as well as commercial and industrial sources. Thus, it is further recommended that a plan be developed for the disposal of all toxic and hazardous wastes. However, that plan should have a geographic area broader than the County and should be prepared at the regional or state level.

The availability of convenient locations to which residents can bring their hazardous materials is paramount to the program's success. Consequently, it is recommended that the necessary facilities for the collection, classification, and temporary storage of such materials be located on municipally owned property. Because of the very specialized nature of collecting, packaging, transporting, and disposing of toxic and hazardous wastes, it is recommended that this program be coordinated and administered countywide by the Kenosha Water Utility, the staff of which has experience in conducting these collections and handling special materials. It is recommended that the Kenosha Water Utility coordinate the efforts with the local units of government, and that the public information and education program be coordinated by the Utility, the local units of government, and the University of Wisconsin-Extension. A private, for-profit firm would also be engaged to assist in the operation and in the disposal of selected materials. The assistance of nonprofit organizations such as the League of Women Voters should also be sought in conducting the public information efforts.

## Components 3 and 4: Collection and Transportation

The third and fourth components of the recommended plan are the collection and transportation systems. The recommended plan envisions the collection function to continue to be carried out in a manner similar to the existing system, which involves the use of municipally and privately owned and operated collection vehicles. As previously discussed, municipal collection service for residential solid wastes is provided only in the City of Kenosha. Private collection contractors are currently, and likely will continue to be, used for residential waste collection throughout the rest of the County. Private contractors may also be expected to continue to provide the majority of collection services throughout the County for commercial and industrial solid wastes. It is important to note that the collection and transport functions of the separate newsprint recycling element of the residential solid waste recycling program are included in the collection and transportation component. As discussed above, it is recommended that consideration be given to modifying municipally and privately owned and operated collection vehicles to temporarily store and transport separated newsprint and yard waste. In addition, the plan recommends supplementary collections of yard waste during peak generation periods in the highly urbanized areas. The plan also recommends that a supplementary collection program for recyclables be initiated in a selected portion of the City of Kenosha to determine the level of participation to be expected with such services.

Decisions pertaining to the collection of solid wastes would continue to be made by local officials and the private collection industry, with the necessary equipment and facilities to be owned and operated by a combination of municipal and private agencies. It is recognized, in this respect, that there may be some changes from municipal to private ownership and operation based upon individual municipal cost and service evaluations. Thus, a flexible ownership and operation approach is recommended.

The solid waste transportation function is closely related to the solid waste collection function, and thus decisions regarding the specific type of collection vehicle transport will continue to be made by local units of government and the private sector. Municipally and privately collected solid wastes are recommended to be transported to a transfer station or disposal site, in either municipally or privately owned and operated vehicles. Recyclable materials that are source-separated by residents, including paper, glass, metal, vegetative debris, and toxic and hazardous materials, are recommended to be transported primarily by individual residents in privately owned vehicles. However, in addition, it is recommended that the communities develop a program of providing periodic separate collection of recyclable materials as an adjunct to the recycling centers described earlier. Such special collections could be conducted in selected, relatively highly urbanized areas on an infrequent schedule. The collections could be made using community-owned vehicles and probably municipally hired drivers, but could rely on volunteer groups for additional manpower. These groups could then be given portions of the proceeds from the recyclable material sales. The use of these volunteer groups would likely necessitate collections on weekends. Alternatively, the municipalities could carry out these operations with municipal forces, or under contract to a private contractor. It is recommended that this system be pilot tested in selected areas to determine a refined level of participation that may be expected to be achieved and the associated costs.

As discussed under the collection component, decisions pertaining to the transport of solid wastes will continue to be made by local officials and the private sector.

## Component 5: Transfer

The fifth component of the recommended plan is the use of transfer stations for the consolidation of solid wastes. Most of the residential solid wastes collected in the City of Kenosha and the Towns of Brighton, Bristol, Randall, Salem, Somers, and Wheatland would be transported to one of five existing and two proposed transfer stations. Upon full implementation of the recommended plan, approximately 47,000 tons, or about 74 percent, of the anticipated average annual residential solid waste quantity would be transferred at one of the seven transfer stations shown on Map 44.

It is recommended that the facilities necessary for the transfer of solid wastes continue to be owned and operated by the municipalities concerned, with possible participation in the ownership and operation by private, profit-oriented contractors, if found to be practical based upon local cost analyses and market conditions.

## Component 6: Disposal

The sixth component of the recommended plan is the disposal system, which is applicable to both solid wastes and municipal sewage treatment plant sludge. This component is an integral part of the overall management system recommended for the study area in that it provides for the disposal of the unrecycled portion of the solid waste stream, and for a portion of the dewatered sludge generated by municipal sewage treatment plants.

The recommended plan envisions that about 51,000 tons per year of residential solid waste, or about 80 percent of the residential solid waste generated annually, and about 137,000 tons per year, or about 91 percent, of the total unrecycled solid wastes generated annually would be disposed of by landfilling. It is also recommended that a portion of the municipal sewage treatment plant sludge be landfilled. Under current conditions, about 6,000 dry tons per year, or nearly 95 percent of the sludge, is landfilled. In addition, it is envisioned that the remaining 300 tons, or about 5 percent, of the sludge would be disposed of by land application in liquid form, with limited amounts to be transported to a commercially operated storage lagoon where it would be stored temporarily and eventually spread on agricultural lands in Kenosha and Walworth Counties. However, it is recommended that over the plan period, the sludge disposal system include provisions for increased use of land application, or for compost or soil conditioner production, to reduce the reliance on landfill disposal. In this regard, it is recommended that ultimately about 3,400 dry tons per year, or about 50 percent of the sludge expected to be generated annually by the year 2010, be disposed of by land application or by compost or soil conditioner production. The land application of 3,400 tons of sludge per year will require the use of about 600 acres of land at the application sites. The recommendations include specific provisions for each municipal sewage treatment plant to develop the ability to provide for backup storage, land application facilities, and landfill capacity for disposal during periods when the primary sludge management option is disrupted.

It is recommended that the unrecycled solid wastes, as well as a portion of the municipal sewage treatment plant sludge, continue to be landfilled primarily at one existing commercial, general-use landfill--the Pheasant Run landfill operated by Waste Management of Wisconsin, Inc., in the Town of Paris. It is recognized that the small, municipally owned landfills in the Village of Twin Lakes and the Towns of Bristol and Randall would continue to accept wastes until they are filled and/or abandoned at some point in the plan design period when it is expected that new state and federal regulations will make continued operation uneconomical. Other existing commercial general-use landfills outside Kenosha County may be expected to continue to receive limited amounts of solid wastes generated within the County during the plan design period. These landfills include: the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; and the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County. It is recognized that these commercial general-use landfills, as well as smaller special-use landfills outside the County, may be used for the disposal of solid wastes, with the specific sites being selected based upon competitive market costs, as is presently the case.

As noted above, it is envisioned that over the plan period, revisions would be made to the sludge management program to provide for a portion of the sludge generated in Kenosha County which is partially dewatered--the sludge generated at the City of Kenosha, and portions of the sludge generated at the Villages of Paddock Lake and Twin Lakes facilities, and including about 3,400 dry tons per year, or about 46 percent of the total sludge generated in the County--to be disposed of by land spreading or application on agricultural lands. In addition, it is envisioned that the remaining 350 dry tons of sludge--that generated at the sewage treatment plants operated by the Town of Pleasant Prairie Sewer Utility District D, the Town of Pleasant Prairie Sanitary District 73-1, the Town of Salem Sewer Utility District No. 1, the Town of Salem Sewer Utility District No. 2, the Town of Bristol Utility District Nos. 1 and 1A, and the Village of Silver Lake, and limited portions of the sludge generated at the Villages of Paddock Lake and Twin Lakes facilities--would be disposed of primarily by land application in liquid form, with limited amounts to be transported to a commercially operated storage lagoon where it would be stored temporarily and eventually spread on agricultural lands in Kenosha and Walworth Counties. The municipal sludge disposal recommendations are summarized by sewage treatment plant in Table 46.

It is recommended that the large commercial landfills continue to be owned and operated by the private owners, with the smaller landfills to be operated by the Village of Twin Lakes and the Towns of Bristol and Randall.

As noted above, the plan recommends that land application be used as one method of disposal for about 3,400 dry tons of sludge, or about 51 percent of the total sludge generated annually in the County. As noted in Chapter VII, it was deemed appropriate to develop an integrated sludge management plan, a plan that would rely on at least two disposal methods. One method may function as the primary means of disposal during the plan design period. The selection of the disposal method to be used as the primary method would depend on such factors as costs, state and federal regulations, climate, and agricultural land cropping practices.

For the sludge land application component, it is recommended that the City of Kenosha and the Villages of Paddock Lake and Twin Lakes, which currently possess facilities and vehicles for transporting and storing dewatered sludge, maintain primary responsibility for land application of the dewatered sludge generated at their sewage treatment plants. It is recommended that the City of Kenosha Water Utility and the Villages of Paddock Lake and Twin Lakes own the facilities and vehicles for transporting and storing dewatered sludge, in combination with private ownership of the land application sites. It is recommended that these municipalities consider ownership of land application equipment, with private property owners continuing to own the application sites. Further, it is recommended that the current private sanitary service be maintained and be allowed to provide a temporary storage and land application service for the other sewage treatment plants operating in Kenosha County, with proper environmental protection monitoring of the lagoon and application sites. However, it is recommended that each municipal sewage treatment plant develop in the early stages of the plan period an alternative means of sludge

## Table 46

## KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN SLUDGE HANDLING AND DISPOSAL RECOMMENDATIONS

| Wastewater Treatment Facility | Dewatering | Landfilling | Land Application | Commercially Operated Storage Lagoon |
|---|---|---|---|---|
| City of Kenosha . . . . . . . . . . . . . . | X | X | X | - - |
| Town of Pleasant Prairie Sewer Utility District D . . . . . . . . . | - - | - - | X | X |
| Town of Pleasant Prairie Sewer Utility District 73-1 . . . . . . . | - - | - - | X | X |
| Town of Salem Sewer Utility District No. 1 . . . . . . | - - | - - | X | X |
| Town of Salem Sewer Utility District No. 2 . . . . . . | - - | - - | X | X |
| Town of Bristol Utility District Nos. 1 and 1A . . . . . | - - | - - | X | X |
| Village of Paddock Lake . . . . . . . . . | X | X | X | - - |
| Village of Silver Lake . . . . . . . . . . . | - - | - - | X | X |
| Village of Twin Lakes . . . . . . . . . . . | X | X | X | - - |

Source: SEWRPC.

storage and land application. Such a system could be used as a backup system to the privately owned and operated storage lagoon and land spreading system.

Operation relying primarily on the individual municipality with the possible cooperative input of the landowner, depending upon the circumstances at each site, is recommended. Sludge would be handled at the site either by the municipal employees or by the landowner or his employees. This system flexibility appears necessary for the proper negotiations between the municipality and the landowner. Finally, it is recommended that private sanitary service contractors under contract to the various plant operators maintain the responsibility for transport and disposal of liquid sludge on approved agricultural lands, and for the temporary storage at a centralized liquid storage facility.

### Component 7: Processing

The seventh component of the recommended solid waste management plan is a contingent recommendation that would be implemented only if certain conditions were to change in the County which would make incineration favorable economically when compared to other alternatives. These changes were discussed in Chapter VII and would include availability of a viable, long-term user for the steam which could be generated, and a relatively rapid escalation in energy costs and/or landfill disposal costs. Under certain circumstances, incineration may be expected to become practical with respect to costs in about 10 years. The plan under these circumstances would recommend construction of one modular incinerator designed ultimately to generate steam and and possibly to cogenerate steam and electricity. A schematic diagram of a typical installation is shown in Figure 10 in Chapter V. The capacity of the facility would be between 150 and 250 tons of waste per day, and the facility would burn from 45,000 to 65,000 tons of waste per year by the design year of the plan. About 16,000 tons of incinerator ash would be produced annually at such a facility upon full implementation.

More detailed investigations will be needed as part of the required facility planning effort and environmental impact analysis before the specific location of the incinerator can be finally determined. The recommended facility would have the capacity to generate between 0.8 million and 1.0 million pounds of steam per day at a pressure of 500 to 600 pounds per square inch (psi). The potential customers for the energy produced would depend on the location of the incinerator.

The recommended plan envisions that the ownership of the incineration system would be, in part, dependent upon the users served. However, it was concluded by the Advisory Committee that since a portion of the solid wastes generated in one major city and two townships would be processed at the incinerator, a combination ownership and operation option may be most equitable. Such options include ownership and operation by the City of Kenosha, and ownership and operation by the City of Kenosha and the Towns of Pleasant Prairie and Somers. Under each of these options, a partnership arrangement with a private, profit-oriented owner and/or operator would be possible.

## Air Quality Discussion

Residential solid wastes potentially contain high levels of metals and chlorine, pollutants of concern when evaluating air emission rates from their combustion. The metals are ubiquitous in the waste, being present in pigments, inks, paper stock, and plastics. A large portion of the chlorine is in plastics, primarily polyvinyl chloride. The amount of the metals that may be expected to be emitted is dependent on the furnace design. Most of the chlorine will be emitted as hydrogen chloride. Because of the high moisture content and heterogeneous nature of residential solid wastes, efficient combustion conditions sometimes are not easily maintained. Trace amounts of products of incomplete combustion, such as polyaromatic hydrocarbons (PAH's), polychlorinated biphenyls (PCB's), and polychlorinated dibenso-p-dioxin (PCDD) can be emitted.

Air pollution regulations require municipal solid waste incinerators to have particulate control equipment. This equipment will collect some of the trace metals and condensable organic compounds but only negligible amounts of hydrogen chloride or gaseous organic compounds. The condensed trace metals and hydrocarbons are present in the size ranges where particulate control equipment is least efficient. As overall particulate emissions are reduced further by use of high-efficiency electrostatic precipitators or baghouses, fine particle control is also improved. Some states, notably Massachusetts and New Jersey, now require high-efficiency particulate controls for all new refuse-burning facilities. This high-efficiency equipment is required specifically to minimize trace metal emissions, and reflects the state-of-the-art in control technology.

In addition, more incineration facilities nationwide are being constructed with flue gas scrubbers. This equipment is designed to neutralize acidic gaseous pollutants such as hydrogen chloride and sulfur dioxide. The use of scrubbers also improves the collection of trace metals and organic compounds. When combined with high-efficiency particulate control equipment, significant reductions in all metals--including mercury--and toxic organics emitted may be expected. Because of these multiple benefits, some states are now requiring the use of scrubbers in addition to high-efficiency particulate controls.

Trace organic compound emissions can also be reduced by better management of the combustion process. Use of a dry scrubbing system in conjunction with high-efficiency particulate control equipment would reduce organic compound emissions further.

The evaluation that must be conducted prior to the issuance by the State of the permits required for construction of a solid waste incineration facility will have to be exhaustive, highly technical, and facility-specific should it be determined that such a facility is viable at some future date. Based upon present-day standards, and with proper emission control technology, an incinerator should be able to receive the permits necessary and operate in a manner that will meet the existing air pollution regulations. It is possible that future requirements could have an impact upon the cost of the incinerator by requiring more efficient air pollution controls.

## Cost Analysis

In order to assist public officials and concerned citizens in evaluating the financial feasibility of the recommended solid waste and municipal sewage treatment plant sludge management plan, a schedule of capital and operation and maintenance costs was prepared. This schedule includes costs for both the publicly and privately owned and operated solid waste and municipal sewage sludge management functions identified in the plan recommendations. Costs for all the components of the recommended plan over the 20-year implementation period, expressed in 1987 dollars, are summarized in Table 47. More detailed information on these costs is set forth in Appendix F.

The capital cost of implementing the recommended management plan is estimated at $540,000 over the 20-year plan implementation period. Of this cost, about $390,000, or about 72 percent, is for recommended recycling facilities, including recycling stations ($270,000), composting sites ($105,000), and collection equipment retrofitting for curbside newsprint collection ($15,000). The remaining capital cost of $150,000, or 28 percent, is for the provision of two additional transfer stations, bringing the number of such stations in the area to seven. These costs include the costs of land acquisition, site preparation, equipment, construction, engineering, construction interest, and legal services, but do not account for inflaticn or bond-related interest or service charges. The costs are expressed in 1987 dollars.

Upon full implementation, the average annual operation and maintenance cost of the recommended plan is estimated to be $3,130,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill. Of this total, $2,010,000, or 64 percent, would be for the disposal of unprocessed solid wastes in landfills; $690,000, or 22 percent, would be for solid waste transportation; $335,000, or

## Table 47

## SUMMARY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS OF THE RECOMMENDED SOLID WASTE MANAGEMENT PLAN FOR KENOSHA COUNTY: 1990-2010

| Plan Subelement | Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Storage | $ - -[a] | $ - -[a] |
| II. Source Separation | | |
| Residential Solid Waste Recycling | $270,000 | $ 235,000[b] |
| Curbside Collection of Newsprint | 15,000 | 20,000[c] |
| Composting | 105,000 | 50,000 |
| Household Toxic and Hazardous Waste Management | - - | 30,000 |
| III. Collection | $ - -[a] | $ - -[a] |
| IV. Transportation | $ - - | $ 690,000 |
| V. Transfer | $150,000 | $ 95,000 |
| VI. Solid Waste Landfill Disposal | $ - - | $2,010,000[d] |
| Total | $540,000 | $3,130,000 |

NOTE: Total average annual cost approximates $3,180,000, or about $22.40 per ton of solid waste handled. This assumes amortization of the capital component at 6 percent over a 20-year period.

[a]No costs are included, since this plan subelement was not reevaluated and costs are expected to remain similar to present costs.

[b]Includes no credit from sale of recyclable material, since is was assumed that revenues would be used as an incentive for volunteer organizations to assist in operation.

[c]Includes a credit of $15,000 per year from revenues produced by sale of collected newsprint.

[d]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in this plan.

Source: SEWRPC.

11 percent, would be for the operation and maintenance of the recycling facilities and equipment; and $95,000, or 3 percent, would be for transfer of solid wastes.

The average annual cost of carrying out the recommended solid waste management plan, including the capital cost of the construction of new facilities and the operation and maintenance of those facilities, may be expected to total $3,180,000, or $22.40 per ton of solid waste. Based on the anticipated design year resident population of the plan area, the total average annual cost would be about $26 per capita. These costs do not include the collection system costs, which if added would result in a total cost for solid waste management of about $43 per ton.

As noted earlier, only under the scenario whereby energy and landfill costs escalate at a rate greater than general price inflation, and a reliable steam customer becomes available, would an incineration system become cost competitive, and then not for about 10 years. The capital and operating and maintenance cost of the solid waste management plan over the plan period assuming an incineration system is included is summarized in Table 48 The total average annual cost including amortization of capital and operation and maintenance is about $3,704,000, or about $26 per ton of solid waste.

The municipal sewage treatment plant sludge management plan is set forth in Table 49. The capital investment cost of implementing the sludge management plan over the 20-year implementation period is estimated to be $300,000--entirely for storage facilities and land application equipment. Upon full implementation of the plan, the average annual operation and maintenance cost of the recommended plan is estimated to be $340,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill. Of this total, $120,000, or 35 percent, would be for the disposal of sludge in landfills; $130,000, or 38 percent, would be for transportation and use of a storage lagoon for dewatered sludge followed by land application; and $90,000, or 27 percent, would be for disposal of partially dewatered sludge by land application.

The average annual cost of carrying out the recommended sludge management plan, including the construction of new facilities and the operation and maintenance of those facilities, may be expected to total $390,000, or about $60 per dry ton of municipal sewage treatment plant sludge handled. Based on the anticipated design year resident population of the plan area, the total average annual cost would be about $3.00 per capita.

## ABILITY OF THE RECOMMENDED PLAN TO MEET THE AGREED-UPON OBJECTIVES

In the most basic sense, planning is a rational process for establishing and meeting objectives. The 10 solid waste management objectives presented in Chapter I of this report were, accordingly, developed and adopted by the Technical Advisory and Intergovernmental Coordinating Committee. These objectives provided the basis for the design and evaluation of alternative solid waste and municipal sludge management plans.

The recommended plan meets the objectives by providing a flexible, cost-effective, integrated, environmentally sound, long-term solution to the solid waste and municipal sewage treatment plant sludge disposal needs of the study area. The plan calls for a high level of recycling to recover reusable materials. The plan recommends a shift to the use of a significant portion of the sludge generated in the County for land application purposes. In addition, the landfill capacity required to dispose of that portion of the solid waste stream that is not recycled, as well as the sludge generated in Kenosha County, is also provided for in the plan. Furthermore, the plan includes auxiliary provisions to recover energy contained in solid waste by incineration should conditions evolve over the plan period which would make that alternative cost competitive. A summary of the agreed-upon solid waste management objectives is set forth in Table 50, together with comments on the extent to which the recommended solid waste management plan meets those objectives.

## Table 48

## SUMMARY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS OF THE SOLID WASTE MANAGEMENT PLAN FOR KENOSHA COUNTY WITH INCINERATION OF A PORTION OF THE SOLID WASTES: 1990-2010

| Plan Subelement | Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Storage | $ - -[a] | $ - -[a] |
| II. Source Separation | | |
| Residential Solid Waste Recycling | $ 270,000 | $ 235,000[b] |
| Curbside Collection of Newsprint | 15,000 | 20,000[c] |
| Composting | 105,000 | 50,000 |
| Household Toxic and Hazardous Waste Management | - - | 30,000 |
| III. Collection | $ - -[a] | $ - -[a] |
| IV. Transportation | $ - - | $ 660,000 |
| V. Transfer | $ 150,000 | $ 65,000 |
| VI. Solid Waste Landfill Disposal | $ - - | $1,720,000[b] |
| VII. Waste to Energy Incineration[d] | | |
| Equipment | $ 5,597,000 | $ - - |
| Construction | 1,914,000 | - - |
| Land Acquisition | 200,000 | - - |
| Engineering, Environmental Studies, and Contingencies | 8,119,000 | - - |
| Operation and Maintenance | - - | 520,000 |
| Ash Transport and Disposal | - - | 135,000 |
| Less Average Annual Revenue | - - | -460,000 |
| Subtotal | $15,830,000 | $ 185,000 |
| Total | $16,370,000 | $2,965,000[e] |

NOTE: The total average annual cost approximates $3,704,000, or about $26 per ton of solid waste handled. This assumes amortization of the capital cost component at a 6 percent interest rate over 20 years.

[a]No costs are included, since this plan subelement was not reevaluated and costs are expected to remain similar to present costs.

[b]Includes no credit from sale of recyclable material since it was assumed that revenues would be used as incentive for volunteer organizations to assist in operation.

[c]Includes a credit of $15,000 per year from revenue produced by sale of collected newsprint.

[d]Incinerator assumed to be constructed in the year 2000. Operation and maintenance costs include 10 years of cost spread over 20 years to provide an average cost for the 20-year plan period.

[e]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in this plan.

Source: SEWRPC.

## Table 49

## SUMMARY OF CAPITAL AND OPERATION AND MAINTENANCE COSTS OF THE RECOMMENDED MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE MANAGEMENT PLAN FOR KENOSHA COUNTY: 1990-2010

| Plan Subelement | Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Landfill Disposal | $ -- | $120,000[a] |
| II. Transportation | $ -- | $ 90,000 |
| III. Commercial Sanitary Lagoon Disposal | $ -- | $ 40,000 |
| IV. Land Application Storage Facilities and Application Equipment | $500,000 | $ 90,000 |
| Total | $500,000 | $340,000 |

NOTE: The total average annual cost approximates $390,000, or about $60 per dry ton and $24 per wet ton of municipal sewage treatment plant sludge. This assumes amortization of the capital component at 6 percent over a 20-year period.

[a]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility included in this plan.

Source: SEWRPC.

### PLAN IMPLEMENTATION

While the recommended solid waste and municipal sewage treatment plant sludge management plan for Kenosha County is designed to attain the adopted solid waste management objectives, the plan is not complete in a practical sense until the steps required to implement it--that is, to convert the plan into action policies and programs--have been specified. This section, accordingly, is intended as a guide for use in the implementation of the Kenosha County solid waste management plan.

Before identifying specific plan implementation responsibilities, it is useful to consider certain basic concepts and principles that relate to implementation of the recommended solid waste and municipal sewage sludge management plan. One of the basic principles adhered to was the use of existing institutional structures, and, wherever possible, the plan implementation recommendations have been based upon, and related to, the existing governmental structure and existing governmental programs. In addition, the plan implementation recommendations were predicated upon existing enabling legislation. There appears to be no need to utilize the flow control legislation which now exists, making implementation of the solid waste flow control practical. Another important concept in implementation is the importance of formal plan adoption. As an initial step in the plan implementation process, the affected units and agencies of government should formally endorse, adopt, or acknowledge the recommended solid waste and municipal sewage treatment plant sludge management plan. Such formal endorsement, adoption, or acknowledgement by local legislative bodies and local, areawide, and state agencies serves to signify agreement with the recommendations contained in the plan.

## Table 50

## ABILITY OF THE RECOMMENDED KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN TO MEET ESTABLISHED OBJECTIVES

| Number | Objective Description | Degree to Which Objective is Met |
|---|---|---|
| 1 | The development of a solid waste management system which will effectively protect the public health and welfare and quality of life within Milwaukee County | Met |
| 2 | The development of a solid waste management system which will effectively protect the quality of the groundwater and surface water resources and minimize the possibility of pollution and depletion | Met |
| 3 | The development of a solid waste management system which will be properly related to the natural resources and which will enhance the overall quality of the environment | Met |
| 4 | The development of a solid waste management system which will effectively serve existing and future land uses and promote implementation of sound land use planning concepts and zoning practices | Met |
| 5 | The development of a solid waste management system which will accommodate existing and future residential, commercial, institutional, and industrial development | Met |
| 6 | The development of a solid waste management system which will maximize the recovery and utilization of both material and energy resources contained in the solid waste stream | Partially Met |
| 7 | The development of a solid waste management system which will be compatible with the waste management plans of the adjoining counties and which will be adaptable to development of a regional solid waste management plan | Met |
| 8 | The development of a solid waste management system which will meet pertinent local, state, and federal regulations | Met |
| 9 | The development of a solid waste management system which will efficiently and effectively meet all of the other stated objectives at the lowest cost possible | Met |
| 10 | The development of a solid waste management system which will be flexible and readily adaptable to changing needs | Met |

Source: SEWRPC.

The implementation of the recommended plan is not expected to pose significant problems since it is, in part, the continuation of ongoing activities, However, the implementation of the recommended plan will require the cooperative actions of local units of government, individual citizens, and private enterprise since there are modifications to and expansions of the existing system. The plan represents a long-term solution to both solid waste and sewage sludge management problems, and full implementation will have to extend over many years. It is recognized that the viability of each of the components of the plan is specifically related to many factors, including energy costs, availability of local funds, interest rates, market value of recyclables, cost of alternative disposal methods, and pending state and federal regulations and policies. All of these factors are dynamic in nature, and subject to both long-term and short-term changes. Because of the relationship of the plan components to these constantly changing conditions, it is recommended that the plan be carried out in a phased manner involving several critical decision points during the implementation period, as shown in Figure 19. At each decision point in the implementation process, an evaluation of conditions can be made prior to proceeding with the next phase. Conditions such as energy cost, current value and trends in value for recyclables, and cost for alternative methods of solid waste and sewage sludge disposal, as well as availability of local funds and current interest rates, should be evaluated at these decision points in order to determine whether or not to proceed with subsequent steps and whether or not the plan implementation schedule should be accelerated or decelerated. By utilizing this phased approach, it will be possible to proceed with the plan implementation in a manner that will minimize uncertainty and risk.

## Kenosha County

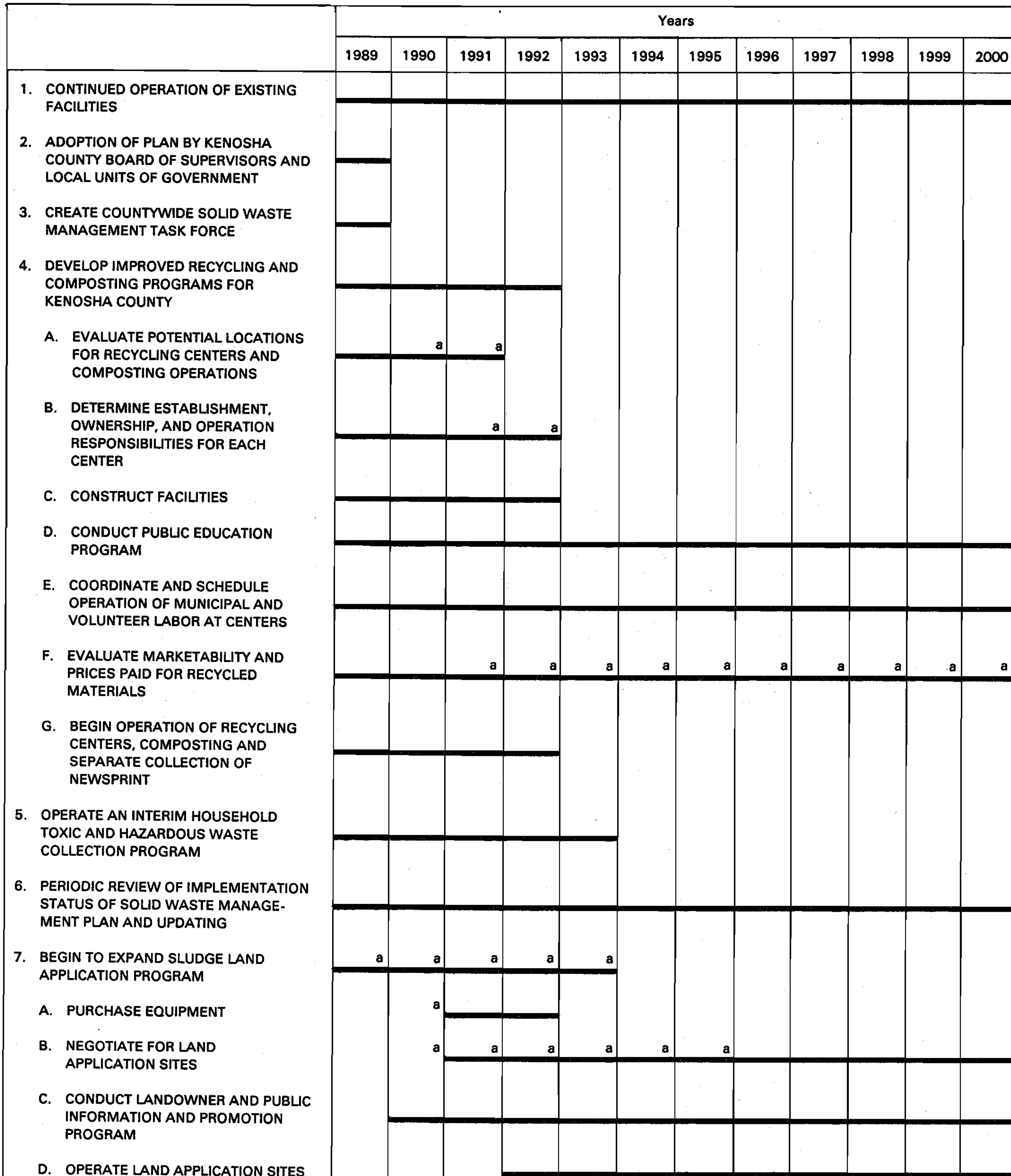
1. It is recommended that the Kenosha County Board of Supervisors formally adopt the Kenosha County solid waste and municipal sewage treatment plant sludge management plan by resolution upon a report and recommendation by the Land Use Committee, and the Extension, Education and Conservation Committee.

2. It is recommended that the Kenosha County Board of Supervisors, whose authority to plan, organize, finance, and implement solid waste programs is predicated on Chapter 30 of the Wisconsin Statutes, assume primary responsibility for overseeing implementation of the recommended solid waste management plan. Accordingly, the overall management and administration of the plan implementation program should be directed by a standing committee of the County Board with assistance from a newly created countywide task force. It is recommended that this task force be appointed to assist in overseeing and monitoring solid waste management activities, with that task force consisting of one representative from each of the local units of government and a representative of the County Board and of the county staff, with advisory task force participation by the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension. The standing County Board committee and the newly created task force would be responsible for the following:

   a. Reviewing, adopting, and maintaining current the recommended solid waste and municipal sewage treatment plant sludge management plan.

## Figure 19

## SUMMARY OF IMPLEMENTATION SCHEDULE FOR THE KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN




NOTE: This proposed implementation schedule represents a point of departure for intergovernmental negotiations and actions by local units of government.

*[a]Decision point where the evaluation of the market value of recyclables, construction and operation and maintenance costs, and sludge landfill and land application costs would be reviewed to determine the current degree to which solid waste recycling operations and sludge land application should be carried out. Schedule would be subject to revision at each decision point.*

*Source: Kenosha County Office of Planning and Development and SEWRPC.*

b. Coordinating and promoting the implementation of the various components of the recommended solid waste and sewage sludge management plan with the state and local units and agencies of government concerned.

c. Providing coordination and public education assistance to source separation and recycling centers.

Local Units of Government

1. It is recommended that the governing bodies of the City of Kenosha, the Kenosha Water Utility, and the villages and civil towns within Kenosha County adopt the Kenosha County solid waste and municipal sewage treatment plant sludge management plan by resolution after a report and recommendation by local plan commissions.

2. It is recommended that the City and the villages and the towns work cooperatively with the County, each other, local nonprofit groups, and private, profit-oriented recycling firms to develop the recommended source separation and recycling center operations, the curbside newsprint collection system, and the household toxic and hazardous waste management program.

3. It is recommended that the City and the villages and the towns work cooperatively with the County and each other to develop the vegetative debris composting operations.

4. It is recommended that the City, the villages, and the towns, as appropriate, use the recommended transfer stations for the consolidation of residential solid wastes.

5. It is recommended that the municipal operators of existing landfills serving selected communities continue to operate such facilities to dispose of limited quantities of solid wastes in an environmentally safe manner until they are properly closed and abandoned.

Private Sector

1. It is recommended that, as appropriate, the private collection system operators in the County continue to work cooperatively with the local units of government to improve the efficiency of present storage, collection, and transportation systems.

2. It is recommended that private, profit-oriented recycling firms and private nonprofit organizations in the County work cooperatively with the local units of government to develop and operate a system of source separation and recycling centers, and the toxic and hazardous waste management program.

3. It is recommended that the private operators of existing landfills serving the County continue to provide that service.

4. It is recommended that the private operators of the existing storage lagoon continue to provide sludge disposal service for that portion of the County that generates liquid sludge.

### Wisconsin Department of Natural Resources

1. It is recommended that the Wisconsin Department of Natural Resources approve the Kenosha County solid waste and municipal sewage treatment plant sludge management plan and utilize the plan as a basis for its review of planned and expanded solid waste management facilities in the County and environs.

### University of Wisconsin-Extension

1. It is recommended that the University of Wisconsin-Extension provide the public information and education assistance needed for plan implementation.

## SUMMARY

This chapter has presented a recommended solid waste and municipal sewage treatment plant sludge management plan for Kenosha County and the recommended means and associated costs of implementation. The plan was formulated to meet a set of adopted solid waste and sewage sludge management objectives which were designed to address existing and probable future solid waste management needs in the study area. The quantities of solid waste to be handled and disposed of under the major components under existing and planned conditions are shown in Table 51.

The recommended plan consists of seven components. The first component provides for continuation of the use of the pre-collection storage systems in the County for solid waste. The second component provides for source separation and a recycling program whereby residents would: 1) transport, in cooperation with limited municipal collection of recyclables, previously source-separated paper, glass, and metals to one of 12 proposed local recycling centers in the County; 2) transport vegetative debris to one of seven recommended composting sites, in cooperation with a municipally operated compost collection system in the more-urbanized areas; 3) cooperate in a separate newsprint collection program; and 4) participate in a household toxic and hazardous waste management program. The third, fourth, and fifth components consist of the continued use of the existing collection, transportation, and transfer systems. The sixth component calls for the continued use of existing landfill facilities in and around the County for the disposal of unrecyclable materials, and a portion of the municipal sewage treatment plant sludge generated in Kenosha County. A potential contingent plan component is the construction of an incinerator facility to burn solid wastes to produce steam at some future date should conditions regarding energy and landfill cost change appreciably, and if a customer is found for the steam energy produced.

In addition to describing each of the foregoing components of the plan, this chapter presented information on the costs of implementing the plan, and the extent to which the recommended plan may be expected to achieve the solid waste and sewage sludge management objectives established as a basis for plan design and evaluation.

This chapter also provided a schedule for implementing the recommended solid waste management plan, and discussed the responsibilities of various units and agencies of government and the private sector in carrying out the plan.

## Table 51

### DISPOSITION OF SOLID WASTE STREAM IN KENOSHA COUNTY UNDER EXISTING (1984) AND RECOMMENDED PLAN CONDITIONS IN THE PLAN DESIGN YEAR (2010)[a]

| Waste Disposition | 1984 | | 2010 | |
|---|---|---|---|---|
| | Tons/Year | Percent of Total | Tons/Year | Percent of Total |
| Recycling | | | | |
| Residential | 900 | <1 | 12,900[b] | 5 |
| Commercial | 6,600 | 3 | 6,600[c] | 3 |
| Industrial | 110,000 | 43 | 110,000 | 40 |
| Construction and Demolition, Bulk, Trees and Brush | 5,900 | 2 | 5,900 | 2 |
| Subtotal | 123,400 | 48 | 135,400 | 50 |
| Incineration | | | | |
| Residential | - - | - - | - - | - - |
| Commercial | - -[c] | - - | - -[c] | - - |
| Industrial | - -[c] | - - | - -[c] | - - |
| Construction and Demolition, Bulk, Trees and Brush | - - | - - | - - | - - |
| Subtotal | - - | - - | - - | - - |
| Landfilling | | | | |
| Residential | 51,900 | 20 | 51,000 | 18 |
| Commercial | 23,600 | 9 | 27,000 | 10 |
| Industrial | 46,000 | 18 | 46,000 | 17 |
| Construction and Demolition, Bulk, Trees and Brush | 11,900 | 5 | 13,000 | 5 |
| Subtotal | 133,400 | 52 | 137,000 | 50 |
| Total | | | | |
| Residential | 52,800 | 20 | 63,900 | 24 |
| Commercial | 30,200 | 12 | 33,800 | 12 |
| Industrial | 156,000 | 61 | 156,000 | 57 |
| Construction and Demolition, Bulk, Trees and Brush | 17,800 | 7 | 18,900 | 7 |
| Total | 256,000 | 100 | 272,000 | 100 |

[a]The waste stream identified in this table does not include sludge from sewage and water treatment plants, and septic and holding tank wastes.

[b]Includes about 2,600 tons per year of yard waste which is expected to be removed from the waste stream by homeowners at the source.

[c]Small portions of the existing commercial and industrial solid waste stream are known to be internally incinerated at a number of generation sites. No quantitative estimates of such local incineration were made in the Kenosha solid waste study; however, review of questionnaire results indicates that very few industrial or commercial firms incinerate wastes; those that do incinerate a very small portion of their individual waste streams. In some cases these quantities were not reported separately and were included in the internally recycled material quantity estimates.

Source: SEWRPC.

It is recommended that the Kenosha County Board of Supervisors adopt the plan and designate a standing committee to oversee and monitor solid waste management activities in the study area, with assistance from a newly created countywide solid waste management task force. The task force could consist of one representative from each of the local units of government in the County and a representative of the County Board and of the county staff, with advisory members from the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension. In addition, it is recommended that the governing bodies and planning commissions of the City of Kenosha, the Kenosha Water Utility, and the villages in the study area adopt the plan and cooperate in its implementation.

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# Chapter X

# PUBLIC INVOLVEMENT

Public involvement was an important component of the Kenosha County solid waste management planning study from its inception. The emphasis on public involvement stemmed from the philosophy that an informed public, if given the opportunity, can and should contribute meaningfully to the identification of needs, the formulation of alternative plans, and the selection of a recommended plan to meet those needs. Public involvement also increases the probability that the recommended plan will be accepted and that timely implementation will be supported. Thus, public involvement is viewed as a two-way communication process in which the public is informed; in turn, such involvement helps to guide and shape the planning process.

The public involvement component of the Kenosha County solid waste plan was conducted by the Southeastern Wisconsin Regional Planning Commission staff in cooperation with the Kenosha County Department of Planning and Development. It consisted of three major elements. The elements included the formation of the Technical Advisory and Intergovernmental Coordinating Committee and the holding of eight public meetings of that Committee and the submission of the draft planning report as it was being prepared to the Advisory Committee for review and approval; the preparation of a SEWRPC newsletter summarizing the findings and recommendations of the study for public distribution; and the holding of two formal public hearings on the proposed plan and the alternatives thereto.

## ADVISORY COMMITTEE STRUCTURE

The Kenosha County Solid Waste Management Technical Advisory and Intergovernmental Coordinating Committee directed the conduct of the study. This Committee was composed primarily of local public officials, and provided a broadly based approach to the solid waste management planning effort. A full listing of the Advisory Committee membership is provided on the inside front cover of this planning report.

The Technical Advisory Committee met eight times throughout the conduct of the study. The Committee carefully reviewed all of the chapters of this report in draft form, making such changes as deemed necessary and desirable. Concerns expressed by the Advisory Committee members were addressed as the work proceeded, and the Committee was instrumental in the selection of the recommended plan. All of the Advisory Committee meetings were open to the public, and public participation was encouraged. Minutes of the meetings were prepared and made available for public review at the offices of the Kenosha County Department of Planning and Development and the Southeastern Wisconsin Regional Planning Commission. Meeting notices were posted in the Kenosha County Courthouse in accordance with normal county meeting notice procedures. Notices of, and agendas for, the meetings of the Advisory Committee were sent to local news media.

## INFORMATIONAL SUMMARIES

An issue of the Regional Planning Commission bimonthly Newsletter was used as a public information mechanism to convey to the general public a summary of the findings and recommendations of the Kenosha County solid waste management planning effort. This newsletter has a distribution of approximately 1,250 copies. Elected and appointed public officials, agency representatives, and interested citizens are the target audience for this publication. The issue devoted to the Kenosha County solid waste study was SEWRPC Newsletter Vol. 28, No. 4: July-August 1988. The article in this newsletter, entitled "Solid Waste Management Plan Completed for Kenosha County," described the organization of the study; the objectives of the study; the steps entailed in the preparation of the solid waste management plan; the study findings; and the preliminary plan recommendations.

## FORMAL PUBLIC HEARINGS

Two formal public hearings on a recommended plan for solid waste management in Kenosha County were held, one on Tuesday, October 25, 1988, at 7:30 p.m. in the County Board Room of the Kenosha County Courthouse; and one on Wednesday, October 26, 1988, at 7:30 p.m. in the Town Hall of the Town of Wheatland in New Munster. These hearings were designed to meet the requirements of Chapter NR 185.06(3) of the Wisconsin Administrative Code, and were attended by a total of 34 persons representing local units of government, private businesses and industrial groups, and concerned citizens. The public hearing was announced in news releases issued to area newspapers; the placement of a formal notice in the Kenosha News, the local newspaper of widest circulation; the posting of a notice at the Kenosha County Courthouse in accordance with normal county procedures; and the transmission of a notice of the meeting to all Advisory Committee members. Copies of selected newspaper articles dealing with the plan are presented in Appendix G.

Each of the hearings was conducted in two phases--the first being a presentation of the preliminary findings and recommendations of the county solid waste planning study, and the second being a period for public comment. The public hearing minutes are available for review at the Commission offices, and at the Kenosha County Office of Planning and Development. Appendix H presents all written comments submitted at the hearings.

To assist in the plan presentation, a summary of the findings and recommendations of the solid waste planning study was distributed at the public hearing to all attendees in the form of the aforereferenced Commission Newsletter. The summary statement included a description of the existing solid waste management situation in Kenosha County; the objectives of the study; the alternative solid waste management plans considered; and the preliminary plan recommendation.

The following summarizes the comments received at the hearing and the staff and Advisory Committee response thereto:

1. The Chairman of the Town of Bristol, Mr. Noel Elfering, indicated that he felt the plan was sound and that he generally supported it. He particularly indicated support for increased levels of recycling of materials. Mr. Elfering did raise one concern. He stated that his observations have indicated that there appeared to be a steady increase in truck traffic on USH 45, carrying solid waste from Illinois into Kenosha County through the Town of Bristol to the Waste Management, Inc., Pheasant Run landfill. He indicated that this trucking was becoming a traffic problem, and perhaps could impact significantly on available landfill capacities.

   With regard to the concern raised by Mr. Elfering, it is noted that the plan, as drafted, recommends continued landfilling over the 20-year plan period of about 130,000 tons per year of the solid waste and about 3,200 tons of the wastewater treatment plant sludges generated in Kenosha County. It was anticipated that this solid waste would be landfilled primarily at the Pheasant Run landfill operated by Waste Management of Wisconsin, Inc., in the Town of Paris. Other existing commercial general-use landfills outside Kenosha County may be expected to continue to receive limited amounts of solid wastes generated within the County during the plan design period. These landfills include: the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; and the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County. It is recognized that these commercial general-use landfills, as well as smaller special-use landfills located outside the County, may be used for the disposal of solid wastes generated within the County, with the selection of the specific sites for use based upon competitive market costs, as is presently the case.

   The capacity of the Pheasant Run landfill is estimated to be about 7,000,000 cubic yards as of 1987. The loadings to the landfill in 1987 were estimated to be 213,000 tons, or about 430,000 cubic yards. The current 1987 loading is about 10 percent less than the average annual loading of 470,000 cubic yards assumed by the landfill owner when the landfill plan of operation was developed. The same annual loading of 470,000 cubic yards was used to estimate the site life of the facility in the Kenosha County plan. Thus, the current loadings appear to be consistent with the loadings assumed in the development of the landfill, and would result in a site life of about 15 years. Since there is the potential for further expansion on adjacent lands, it appears that the plan recommendations in this regard are sound, assuming no significant additional increases in loadings from outside the County. There should be valid concern in this regard, however. Listed below are the quantities of solid waste disposed of at the Pheasant Run landfill during the past nine years:

1979 - 11,875 tons
1980 - 542 tons
1981 - 122 tons
1982 - 820 tons
1983 - 16,147 tons
1984 - 64,917 tons
1985 - 92,016 tons
1986 - 143,300 tons
1987 - 213,512 tons

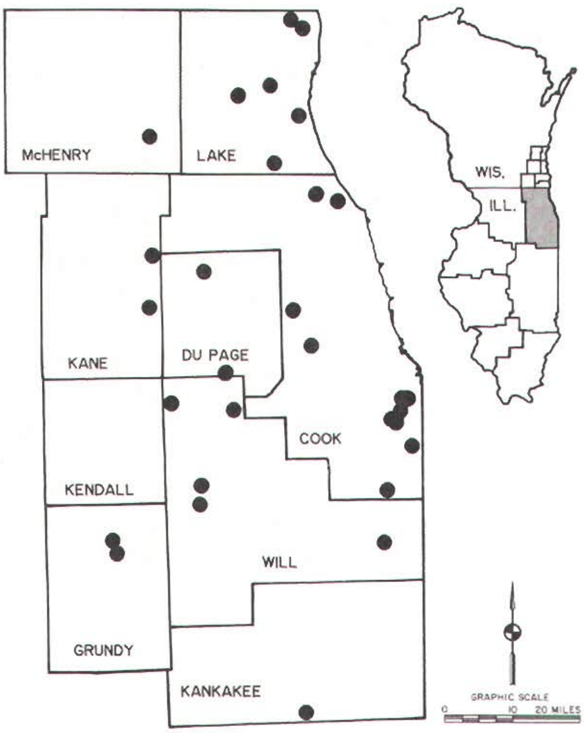
As can be noted, there has been a relatively rapid increase in the amounts. In 1984 the landfill operation review committee established to monitor operations--comprised of two representatives appointed by the Town, another citizen who resides near the landfill, and two representatives of the landfill owner-operator--approved a proposal by the landfill owners to add Lake and McHenry Counties in Illinois to the service area of the Pheasant Run landfill. This action was taken at the same time the landfill expansion was approved by the Town, and may be expected to increase the loadings on the landfill significantly. At the present time, there are six operating landfills in Lake County and one in McHenry County, Illinois, as shown on Map 45. The capacities of these landfills, and the estimated remaining site life as of April 1988, are set forth below.

| | | | Remaining Capacity | |
|---|---|---|---|---|
| County | Landfill Name | Landfill Type | Cubic Yards | Years |
| Lake | ARF Landfill | Commercial-General Use | 2,300,000 | 3 |
| Lake | Browning and Ferris | Commercial-General Use | 3,600,000 | 2 |
| Lake | Land and Lakes No. 8 | Commercial-General Use | 1,600,000 | 3 |
| Lake | Lake Bluff | Municipal-General Use | 1,100 | 5 |
| Lake | Lake County Grading | Private-Special Use | 1,000,000 | 6 |
| Lake | Zion | Municipal-General Use | 98,000 | 3 |
| McHenry | McHenry County | Commercial-General Use | 355,000 | 3 |
| | Total | | 8,954,100 | |

Discussions with representatives of the State of Illinois Environmental Protection Agency and the Wisconsin Department of Natural Resources (DNR) confirm that solid waste from Lake County is currently being disposed of at the Pheasant Run landfill. The amount concerned, however, is not available from the DNR records. While some solid waste is exported from Lake County to Kenosha County, in 1988 Lake County was still a net importer of solid waste, an important source of those imported wastes being Cook County. Importantly, in this respect, the siting of new landfills or the major expansion of existing landfills is, and may be expected to remain, difficult in Illinois since the landfill operators require approval by the local unit of government in which the operation is or is proposed to be located. In view of this approval process, the potential for expansion of the existing landfills or the development of new landfills in northeastern Illinois

## Map 45

### LANDFILLS OPERATING IN EASTERN ILLINOIS




Source: Illinois Department of Energy and Natural Resources and Illinois Environmental Protection Agency.

is limited. Thus, there may be increased pressures to utilize landfills in the State of Wisconsin, particularly in Kenosha County.

It is recommended that this situation be carefully monitored by the county solid waste management task force proposed to be created, with assistance from the Wisconsin Department of Natural Resources. It is recommended that the Department expand its data collection efforts to provide reliable information on the amounts of solid waste received from out of state. Such information could then be reviewed annually to ascertain the need to seek corrective actions or provide for modifications to the county plan in a timely manner.

2. A citizen of the City of Kenosha, Mr. Robert K. Rutherford, a member of the Community Focus Committee established by the City, indicated two concerns with regard to the existing and planned solid waste management systems. He indicated that apparently many of the waste collection operators and landfills were not accepting used tires, or in some cases were charging an additional fee for acceptance of tires. He indicated that this was resulting in a litter problem, with tires being discarded along the street and highway rights-of-way. He noted that such littering promoted a very poor image of the Kenosha area. He also indicated that he felt that recycling by source separation would not result in adequate quantities of materials being recycled, and that a more realistic means of providing for recycling would be to provide for an intermediate post-collection recycling or sorting step which would receive the unseparated solid waste and separate out the various recyclable fractions.

With regard to the first comment, it is noted that it is becoming increasingly more difficult and costly to dispose of used tires. Discarded tires originate from a variety of sources, including scrap yards, commercial sales outlets, reprocessors, and all types of tire users. Generally, the majority of the tires requiring disposal are from automobiles. Truck, bus, and other more costly, specially designed heavy equipment tires are usually retreaded and reused. Disposal of discarded tires is a significant problem. It is estimated that 100,000 tires are discarded in Kenosha County annually. Whole tires do not compact well in landfills and have a tendency to "float" to the surface; shredding is impeded by the wire reinforcement contained in many tires, and can only be accomplished with relatively costly equipment; open burning results in noxious smoke, odor, and air pollution problems; and reclaiming is often more expensive than the manufacturing of new tires.

Recycled rubber from tires can be ground and mixed with asphalt and used for paving. This use is still in the experimental stages. A pilot project involving such use was constructed by the Wisconsin Department of Transportation on a 1.0-mile segment of STH 142 in Kenosha County. The Pheasant Run landfill located in the Town of Paris does not landfill tires at the present time, but does accept tires separately which are stock piled for a fee. Currently, the charge is $0.85 for an automobile tire and $3.00 for a truck tire. These tires are then taken to the Waste Management landfill in the City of Franklin, where a shredding system is in operation to shred the tires. The shredded material is subsequently transported to an industry in the Green Bay area, where the shredded tires are used as a fuel.

In 1988, the State Legislature placed a $2.00 per tire tax on all new tires, with the revenue to be used both for the disposal of used tire stockpiles and for demonstration projects designed to find long-term uses for recycled tires. In 1987 a proposal was advanced by a private operator to construct a specially designed incinerator in the City of Milwaukee to burn tires, the heat generated being used to produce steam to heat buildings in the central business district of Milwaukee. That system did not receive the needed approval from the City of Milwaukee.

Waste Management of Wisconsin, Inc., will accept used tires for shredding and disposal at an established fee at its Metro landfill site in the City of Franklin. Thus, at the present time, there is a means of properly disposing of tires. It appears that in the long term, the used tire disposal problem may be resolved through the development and siting of new facilities that will serve areas larger than Kenosha County. In the interim, it is recommended that the local communities promote and enforce ordinances prohibiting littering and provide for the institution of a separate seasonal collection of materials such as used tires which pose special disposal problems, and which could result in litter. Such collection could be coupled with a separate charge. In addition, it is recommended that the communities provide drop-off locations for used tires where the tires can be deposited for a service fee.

With regard to the suggestion that the plan provide for a centralized post-collection solid waste separation facility, it is noted that such an alternative was considered by the Technical Advisory and Intergovernmental Coordinating Committee. That alternative is discussed on pages 146 and 147 of this report. It had been found that few such systems are in operation within Wisconsin. The City of Milwaukee had worked with a private firm to put in place the Americology facility. The $18 million plant was designed to process 100 percent of the City of Milwaukee's residential waste, with the recovery of ferrous metals, aluminum, corrugated paper, newspaper, and glassy aggregate, and the production of a high-quality, refuse-derived fuel (RDF). This RDF was to be burned at the Wisconsin Electric Power Company Oak Creek power station. The plant provided RDF to the Oak Creek power plant under a short-term agreement with the Wisconsin Electric Power Company. Since this was the chief source of revenue to pay for the operating expenses of the plant, purchase of this material was an integral part of the continued operation of the facility. After initiating the burning of RDF at the Oak Creek facility, which was designed to burn coal, the walls of the boilers became coated with heavy accumulations of slag, making operation and maintenance of the boilers very difficult. Numerous attempts were made to solve this problem. No solutions were found. Consequently, the contract between Americology and the Wisconsin Electric Power Company was not renewed. The unavailability of a reliable, long-term customer for the refuse-derived fuel generated at the plant, combined with a softening in energy prices and the adverse impact of inflation on operating cost, resulted in the closing of the Americology facility in 1982. The plant is not currently operated, but the grounds are used as a transfer station for refuse by the City of Milwaukee. The City of Madison does shred solid waste and then removes ferrous metals prior to using the combustible fraction as an incinerator fuel. Furthermore, during the past year, post-collection systems have been developed in the State of Minnesota. However, such systems were implemented only after legislation was passed requiring recyclables to be kept out of landfills. This resulted in the tipping fees rising substantially to amounts two to three times those currently in effect in Kenosha County. The type of recycling system proposed relies heavily on hand labor for separation. Mechanical separation systems have not yet been proven cost-effective and reliable. In view of these considerations, it is recommended that the recycling program be initiated, as originally proposed, using pre-collection source separation on a voluntary basis. It is proposed that the county solid waste management task force, recommended to be established, monitor the effectiveness of the recommended program over time and keep advised of any post-collection programs that are developed in the State. The plan could then be refined in this respect should experience, such as poor levels of participation in source separation, dictate; or should such refinement be warranted owing to the demonstration of cost-effective and reliable mechanized separation equipment technology.

3. A citizen of the City of Kenosha, Mr. John E. Kennedy, representing the Lundell Manufacturing Company, reported on how he had farmed in the County for several years and found that there was a significant need in the agricultural community for humus-type or soil conditioner material. Therefore, he urged the reuse of the compost and municipal

sludge materials generated in the urban areas, and indicated that a potential outlet for those materials would be agricultural lands in the County.

Mr. Kennedy indicated that there was a substantial amount of materials in solid waste that could be effectively recycled. He indicated that at current market prices there would be about $1,600 worth of plastic, $9,600 worth of aluminum, and $1,600 worth of steel and tin in a ton of garbage. In addition, he noted that the cardboard and paper could be converted to pellets which could be burned as a fuel product. He indicated that the firm he represents does produce a system which separates these materials and processes the pelletized combustible materials. He further indicated that the system could be installed and eventually developed into a system which would have a net operating profit. He suggested that representatives of the County and communities consider alternative means of reclamation and disposal of solid waste. This resident concluded by emphasizing the importance of not wasting the humus-type materials such as sludges and compost, and reiterated that such materials should be recycled to the land, and that the remaining materials should be recycled using mechanized facilities such as the one manufactured by the firm he represented.

Mr. Kennedy's recommendation to use the compost and sludge to improve agricultural land generally supports the recommendations of the plan to develop compost systems, and to utilize municipal wastewater treatment plant sludges for agricultural fertilizers or soil conditioners. Mr. Kennedy's second recommendation--to implement a system whereby post-collection material recovery and recycling would be implemented--was considered by the Advisory Committee in response to previous testimony. The Committee considered such an alternative in the plan formulation and concluded that, at the present time, it would be better to rely on source separation systems in an attempt to achieve a moderate level of recycling at a low cost. Mechanized post-collection separation, while desirable in that it would result in a much higher level of recycling, was not included in the plan because of the high capital and operating costs entailed; because of the uncertainty of offsetting revenues given the variability of the markets for recycled materials; and because no such systems currently have an operating history in the State of Wisconsin which could be relied upon to demonstrate their reliability and effectiveness. As such systems become operational in other areas, reconsideration of this alternative on at least a demonstration scale could be considered. At the present time, it appears that the trend, consistent with the recommendations of the Wisconsin Department of Natural Resources, is to utilize the low-level technology systems providing for source separation supported by strong public information and education programs.

4. A Kenosha citizen and a representative of the Kenosha League of Women Voters, Ms. Diane Kastelic, made several recommendations regarding the proposed solid waste management plan for Kenosha County. These included a recommendation that the existing household toxic and hazard waste program be expanded. She indicated that the League of Women

Voters had participated in such programs in Kenosha County and in other areas of the State, and that these programs provided a valuable, needed service. Second, it was recommended that a pilot project be implemented to provide for curbside pickup of source-separated recyclable materials. She indicated that experience elsewhere had indicated that without pickup service of the recyclable materials, the participation in, and quantities made available for, recycling would be limited. Thirdly, she noted that it was her understanding that northeastern Illinois landfill capacities were rapidly being depleted and that within a short time there would be no available landfill capacity in that area. She indicated this could escalate the costs and reduce the capacity for landfilling in Kenosha County and other areas of southeastern Wisconsin. Finally, she recommended that it would be necessary to initiate creative public information, education, and promotion programs in order to obtain the levels of recycling recommended.

With regard to Ms. Kastelic's recommendations concerning household toxic and hazardous waste collection and disposal and curbside collection of recyclables, these recommendations generally support the recommendations contained in the preliminary plan. That plan includes a household toxic and hazardous waste collection and disposal program, and recommends a demonstration curbside collection program for recyclables. The concern expressed by Ms. Kastelic over the probable increase in solid waste loadings on the landfills in Kenosha County from sources in Illinois is a valid one, as noted under the response to Mr. Elfering's comments. Such concern does reinforce the need to provide as high a level of recycling as practical within the County. With regard to the implementation of creative public information, education, and promotion programs on recycling, such programs will indeed have to be instituted as part of the plan implementation activities and have now been highlighted as an important consideration for the task force recommended to be established to guide the implementation of the solid waste management program in Kenosha County.

5. A citizen of the City of Kenosha, Ms. Kay Wade, indicated that she strongly supported recycling. She strongly recommended that the recycling efforts in the County be expanded. In order to do that, she indicated it would be important to make recycling as convenient as possible and ideally mandatory.

   These recommendations of Ms. Wade generally support the preliminary plan recommendations. The only exception, in this respect, was the suggestion that the source separation recycling be made mandatory. This issue was discussed at great length at several of the Advisory Committee meetings and it was concluded that it would be a better to rely initially on public information, education, and promotion programs to implement a voluntary program. Should such an approach prove to be unsuccessful, the alternative of a mandatory program could be considered.

6. Another citizen of the County and a reporter for the Kenosha News, Mr. Joseph Van Zandt, suggested that the recommendations contained in the plan and the requirements recently imposed by the State to eliminate the disposal of yard wastes from landfills could result in a significant increase in the burning of such materials--primarily leaves --and he suggested that this could result in an air pollution problem. In this respect, it was noted by the Advisory Committee that the recommendations in the plan for composting of yard waste to avoid landfilling of such wastes was in accord with a recently enacted state mandate. Thus, the Committee could not change the plan in that respect.

   With regard to the air quality concerns, it was noted that local ordinances--even in the City of Kenosha--do permit burning at least during some times of the year. It was acknowledged that this did create a potential for air pollution and the plan was amended to specifically indicate this potential problem and suggest that monitoring of this situation be conducted by the recommended task force, with subsequent modification of the local ordinances to ban burning as may be found necessary.

7. Ms. Olga B. Hoffman, the President of the Village of Paddock Lake, complimented the Advisory Committee for its efforts and reported that the Village had recently proceeded to form a five-member committee to promote recycling within the Village. She reported that the Village has also encouraged the private contract hauler serving the Village to employ the provision of composting or recycling services. She indicated that education was found by the Village's Committee to be one of the primary needs in developing a recycling program. She noted there would be a need to secure sites for composting and recycling facilities and there would be costs involved in securing such sites, equipping the sites as necessary, and promoting the composting and recycling operations. She indicated that she and other members of the community had a strong interest in carrying out composting and recycling programs, and she urged the County and the State to help local communities to implement such programs, including the provision of financial assistance.

   In response to these comments, the Advisory Committee noted that one of the first steps in implementing the plan would be to establish a county solid waste management task force which would include representatives from all of the local units of government within the County. It was further noted that the costs for recycling and composting operations had been assigned in the plan primarily to the local units of government. Assistance in the provision of necessary public education and information programs was envisioned to be provided by the University of Wisconsin-Extension service.

8. A resident of the Town of Wheatland, Mr. Gerald D. Luke, noted that his automobile service business was no longer able to readily dispose of tires in the County without paying special charges. He noted that

this was becoming an increasing problem, and his business now returns used tires to the owner of a vehicle receiving new tires. He indicated that this problem could become significant in that people may discard tires along the roadways and on other public properties.

The Advisory Committee response to these comments are set forth above, under the response to the comments made by Mr. Rutherford.

9. Mr. Ronald Schuler, the operator of a private solid waste collection service in the County, asked whether the plan specifically recommended whether the composting and recycling locations should be privately owned and operated, or operated by the municipalities or the County.

   The plan recommends that flexibility be maintained with regard to the ownership and operation of the recycling and composting sites and facilities. It was recommended that the municipalities assume the lead responsibility for the provision of these facilities. However, the facilities could be operated by private, for-profit and private, not-for-profit organizations, with municipalities contracting for the services needed.

10. Mr. William Arb, a Trustee of the Village of Paddock Lake, raised two concerns. The first dealt with the potential problems in siting a composting facility in that residents may not want the facility located in proximity to their homes. Second, he noted that recycling would not be effective if people had to haul recyclables long distances.

    With regard to siting, it was noted that compost facility sites would most likely have to be located in areas somewhat remote from the residential areas in the same manner as other public works facilities are usually sited. It was noted that the facilities may have to be located near the outskirts of the incorporated areas and perhaps on land already used for other public works functions. With regard to haul distances, the plan recommends that individual community recycling centers be developed, rather than a limited number of more centralized facilities, to keep haul distances as short as practicable.

11. Two citizens, Ms. Anna S. Turek and Mr. Leonard L. Herrmann, wrote to comment on the plan, indicating that the separation of solid waste, including yard wastes, at the individual home sites would present major problems if that material would have to be transported by the individuals to recycling centers or compost sites. These individuals indicated that many people in the community are elderly and could not practically be expected to transport the separated wastes. One of the writers indicated she had no automobile available.

    In this respect, the plan does recommend that in the urban areas the communities collect separated yard wastes during those times of the year when substantial quantities are generated. The plan also recommends that pilot programs be conducted for the separate collection of other recyclable materials, and that the effectiveness of such curbside collection be evaluated as part of the plan implementation activities.

12. A citizen of the City of Kenosha, the Reverend Jack A. Ottoson, wrote to indicate his support for increased recycling. He strongly urged the County to implement a higher level of recycling.

    This letter generally supports the plan recommendations.

13. Ms. Margaret Gertz, President of the Kenosha League of Women Voters, wrote expressing three concerns. First, she supported the proposed toxic and hazardous waste collection and disposal program. She suggested this program be given stronger emphasis and questioned the estimates of the amounts of material to be collected. Second, she noted the landfill capacity within the County being absorbed by wastes moving from northeastern Illinois, and the potential for increased tipping fees. Third, she indicated that voluntary recycling was only a first step, and suggested that the county plan include a recommendation for a pilot project providing for a separate collection of recyclables. Ms. Gertz also extended the offer of assistance from the League of Women Voters in the area of recycling.

    With regard to the first concern expressed by Ms. Gertz, the plan recommends at least one annual collection at two locations of household toxic and hazardous materials. It was estimated that this effort would cost $30,000 and would collect 2,500 to 3,500 gallons of material. Currently, there is one collection per year at one location in the City of Kenosha, resulting in about 1,900 gallons of material being collected. Thus, the plan does recommend expansion of the existing system. The county solid waste management task force proposed to be created could, based upon evaluation of actual experience, recommend a further expansion of the program.

    The Advisory Committee response to the second concern expressed by Ms. Gertz is set forth in part above in the response to the comments of Ms. Kastelic. Further, it was noted that a demonstration collection program for recyclables was recommended in the plan to be carried out in part of the City of Kenosha.

    The Advisory Committee response to the third concern expressed by Ms. Gertz was set forth above in the response to the comments by Ms. Kastelic.

The Advisory Committee carefully considered the oral and written comments submitted at the public hearings on the preliminary plan, and accordingly made the following revisions to the recommended plan.

1. It is recommended that the proposed county solid waste management task force work with the Wisconsin Department of Natural Resources to monitor the transport of solid waste generated out of state into Kenosha County. It is further recommended that the Wisconsin Depart-

ment of Natural Resources revise its solid waste data collection requirements to obtain the needed interstate transport information from all landfill operators.

2. It is recommended that the local municipalities adopt and enforce ordinances prohibiting littering and provide centers for the drop-off of materials such as used tires which cannot be readily disposal of in the conventional solid waste stream. The separate drop-off centers should be financed at least in part with service fees.

3. It is recommended that the local units of government monitor the air quality problems which may arise from the increased burning of yard wastes that may occur as a result of the prohibition of landfilling of such wastes. If significant problems are found, consideration should be given to restricting or prohibiting any open burning of yard wastes.

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# Chapter XI

# SUMMARY

## INTRODUCTION

Solid waste management is becoming a matter of increasing concern to local public officials and citizens. This concern is due, in part, to the growing amount of solid waste to be disposed of, the associated rapidly rising costs, and the growing awareness of the need to process and dispose of these wastes in an environmentally safe manner.

The term "solid waste" refers to all solid materials discarded by residents, commerce, and industry. It includes materials ranging from old refrigerators to household food wastes, from demolition debris and construction wastes to scrap metals and wastepaper. In addition to materials such as sewage sludges, it may also include toxic and hazardous substances.

In 1960 the total amount of residential and commercial solid waste generated in the United States was about 2.7 pounds per person per day. By 1970, this figure had risen to about 3.5 pounds per person per day, and by 1980 to 3.9 pounds per person per day. It is estimated that in 1984, the total amount of residential solid waste generated in Kenosha County stood at 2.3 pounds per person per day, or about 52,000 tons per year. Furthermore, about 82,000 tons, or about 3.7 pounds per person per day, of residential, commercial, industrial, and construction and demolition wastes, bulks wastes, and trees and brush were generated in 1984. In all, about 134,000 tons of solid wastes, or 6.0 pounds per capita per day, were generated in 1984. The collection, transportation, and disposal of these wastes in Kenosha County cost about $39 per ton, or a total of about $5.3 million per year.

Proper long-range planning can minimize the costs associated with the management of these wastes, as well as assure protection of the overall quality of the environment. This is especially important in Kenosha County because of the large quantities of wastes generated, the growing concern about the availability, cost, and environmental problems related to the use of landfills for the long-term disposal of solid wastes, and the potential to make productive use of this resource.

Under a countywide solid waste management study, a practical, long-range plan for solid waste management can be developed which considers solid waste as a potential resource rather than as just a disposal problem. The solid waste management alternatives available offer choices which can minimize the long-term solid waste problems of the County, while maximizing long-range resource recovery benefits. The current solid waste management practices in the County should lend themselves to improvement through a positive, comprehensive countywide approach.

The development of a county solid waste management plan, as outlined in a project description prepared by the Commission in May 1984, was approved by the Kenosha County Board in June 1984. A Wisconsin Fund grant application was submitted on June 29, 1984, pursuant to Chapters NR 185 and 186 of the Wisconsin Administrative Code. A state grant was received on August 29, 1984, and work was initiated on the study in March 1985. To provide for the more active participation of the interests concerned, the study was conducted under the guidance of a Technical Advisory and Intergovernmental Coordinating Committee created by the County Board.

The primary purpose of the plan preparation effort was to provide an assessment of solid waste management needs and to develop a strategy for meeting those needs to the year 2010 while providing for the protection of public health and the environment.

## INVENTORY AND ANALYSES

The man-made and natural features which together form the environment of Kenosha County are important considerations in solid waste management planning. An understanding of these features, in addition to a knowledge of the existing solid waste sources, the quantity and character of the solid wastes generated, and the existing solid waste management systems, is essential to sound solid waste management planning.

### Population and Economic Activity

The geographic area considered in the Kenosha County solid waste management study was defined as all of Kenosha County, which has an areal extent of about 278.4 square miles. A total of 12 general-purpose local units of government are located within the study area, including one city, three villages, and eight towns. Kenosha County is located in southeastern Wisconsin and is part of the highly urbanized seven-county Southeastern Wisconsin Region. The County is bounded by the rapidly expanding northeastern Illinois metropolitan regional area on the south and the largely rural Walworth County to the west, and an integral part of the greater Milwaukee area, Racine County, forms the northern boundary.

### Land Use

The type, intensity, and spatial distribution of the various urban and rural land uses are important determinants of the solid waste management needs of an area. As of 1980, urban land uses comprised a total of 49 square miles in the County, or 17 percent of the total area of the County, with residential land use comprising 24 square miles, or 49 percent of the total urban land uses and 9 percent of all land uses in the County. Transportation land use was the next most predominant urban land use, constituting about 15 square miles, or 31 percent of the urban land uses and about 5 percent of the total land uses in the County. The remaining urban land uses--commercial, industrial, governmental and institutional, and recreational--made up about 10 square miles, or 20 percent of the urban land uses and about 3 percent of the total land uses in the County. Rural land use still occupied about 230 square miles, or about 83 percent of the total area of the County in 1980. The predominant rural land use was agriculture, encompassing about 168 square miles, or about 73 percent of the rural land uses and about 60 percent of all the land uses in the County. The remaining rural land uses--surface waters, wetlands, woodlands, and other open land--made up about 62 square miles, or 27 percent of the rural land uses and 23 percent of all the land uses in the County.

## Public Utility and Transportation Systems

Urban development is highly dependent upon the public utility systems and transportation networks which serve the various urban land uses with power, light, communications, water, and sewerage, and with person and goods transport. Public utility and transportation systems are of particular importance to solid waste management planning owing to their impact on solid waste quantities, the need for and cost of transporting solid waste, and the constraints which the location of these systems may place on the siting of solid waste management facilities. Such systems are of indirect concern in solid waste management planning because of their influence on land use development. Of particular importance to solid waste management planning is the consideration of sanitary sewerage, because treatment facilities generate solid waste in the form of sludge, and because landfill leachate treatment and disposal may involve a municipal sewage treatment facility. Transportation systems in the County also have a direct impact on solid waste management. Vehicle vertical clearances and weight limits on various types of roadways had to be taken into consideration during the review of alternative transportation systems to determine the most feasible, cost-effective means for transporting the solid waste to disposal facilities. In addition, the locations of the nine airports and landing strips in the County were reviewed with regard to landfill siting restrictions near airports.

## Natural Resource Base

The natural resource base is an important factor shaping the economic base of Kenosha County, and an important determinant of the development potential of the County. Accordingly, the natural resource base must be carefully considered in any solid waste management planning effort to ensure the environmentally safe and economically sound processing and disposal of solid wastes. The principal elements of the natural resource base pertinent to solid waste management planning that were evaluated under the study were climate, topography, geology, soils, vegetation, fish and wildlife habitat, and groundwater and surface water resources. The resulting data were utilized in the evaluation of areas that may be suitable for the siting of solid waste disposal facilities.

Climate has a significant impact on the operation of landfills. Snow cover, low temperatures, and frost penetration can all affect the operation of solid waste disposal facilities during winter. Glaciation has largely determined the topography, geology, and soils of the County. The principal topographic features in the County include ground moraines, outwash terraces, steep escarpments along Lake Michigan, wetlands, streams, and lakes. Bedrock formations underlying the unconsolidated surface deposits consist of dolomitic limestone, shale, sandstone, and crystalline rocks. The diverse nature of the soils found in Kenosha County is indicated by the results of the detailed operational soil surveys which have been completed for the entire County under the regional planning program. Those results are documented in SEWRPC Planning

Report No. 8, Soils of Southeastern Wisconsin. Suitability ratings of the various soils for landfill construction are available which, together with the detailed soils maps, provide an important basis for the evaluation of potential landfill sites. Definitive knowledge of the topography, geology, and soils is particularly important to an evaluation of the suitability of potential landfill sites.

The most important elements of the natural resource base of Kenosha County occur in a roughly linear pattern in the landscape termed environmental corridors. These corridors contain the best remaining woodlands, wetlands, wildlife habitat areas, surface waters and associated undeveloped shorelands and floodlands, areas of organic soils, areas containing rough topography and significant geological formations, existing and potential park and open space sites, historic sites and structures, and scientific and natural areas. In all, about 27,970 acres, or about 16 percent of the County, have been classified as primary environmental corridors. The preservation of these corridors in essentially natural, open space uses will do much to protect the overall quality of the environment, to avoid the creation of serious and costly environmental problems such as flooding and water pollution, and to avoid the creation of developmental problems such as failing foundations for roads and structures, excessive stormwater infiltration into sewer systems, and wet basements.

Air quality is an important determinant of the overall quality of life in an area, and has important direct and indirect effects on the economic development of an area. Solid waste management facilities need to be planned and designed to maintain and protect existing air quality. The federal government has established ambient air quality standards which are intended to protect human health and the public welfare by preventing damage to vegetation and real and personal property, and improving visibility. These standards have been set for the following pollutants: particulate matter; sulfur oxides as measured by sulfur dioxide; carbon monoxide; nitrogen dioxide; ozone; and lead. Based upon these standards, nonattainment areas--that is, areas having ambient air quality conditions which do not meet the prescribed standards--have been identified. In 1980, upon adoption of the regional air quality management plan, all of Kenosha County was designated as an ozone nonattainment area. In addition, a small portion of Kenosha County--that portion of the City of Kenosha bounded by 67th Street, 39th Avenue, 52nd Street, and Lake Michigan--was designated as a secondary nonattainment area for particulate matter. There was no change in these air quality nonattainment designations for Kenosha County as of 1985.

## Solid Waste Sources, Quantity, and Character

A knowledge of the characteristics, amount, and sources of solid waste is essential to the development of an efficient and environmentally sound solid waste management plan. The solid wastes generated in Kenosha County in 1984 that were considered in the development of the management plan were categorized as residential, commercial, and special, and totaled about 134,000 tons, or 6.0 pounds per capita per day. Of this total, about 11,925 tons, or 0.5 pound per capita per day, were classified as special wastes. Special wastes generally included bulk materials such as appliances and furniture, construction and demolition debris, and trees and brush. It should be noted that the above quantities do not include approximately 850 tons of residential, 110,000 tons of industrial, and 6,600 tons of commercial solid wastes which are estimated to be recycled annually. Paper, comprising about 53,716 tons, or 40 percent of the total, was estimated to constitute the largest portion of the solid waste stream in 1984, with metal and food each representing 9 percent of the waste stream, and construction and demolition debris, glass, and plastics each comprising from 5 to 6 percent of the total solid waste stream. The remaining components of the solid waste load, including wood, yard wastes, textiles, and bulk and unclassified materials, made up about 21 percent of the total solid waste stream.

The seasonal variation of solid waste is a significant factor in Kenosha County. The highest amounts are generated in the months of May, June, July, and October, about 12,000 tons per month. The lowest amounts are generated in the months of December, January, February, and March, about 10,000 tons per month.

Sewage or wastewater treatment sludge is another category of special solid waste. There were 11 public and eight privately owned sewage treatment plants located in Kenosha County in 1985. The names and locations of these plants are indicated on Map 4 in Chapter II. Based upon data obtained from these treatment facilities, it is estimated that 6,200 tons per year of sewage sludge on a dry-weight basis were generated by these facilities, with over 90 percent being generated by the City of Kenosha wastewater treatment facility. In addition to sewage treatment plant sludges, about 1,800 cubic yards of grit, grease, and screenings are generated at public sewage treatment plants and require disposal.

It is important to note that the present policies of the Wisconsin Department of Natural Resources (DNR) generally prohibit the disposal of sludges in landfills unless the facility is engineered with a clay liner and a leachate collection and treatment system. Further, in landfills used for the disposal of a combination of residential, commercial, and industrial wastes, the quantity of sludge that is landfilled cannot exceed 10 percent of the waste deposited. In addition, the sludge must have a solids content of at least 40 percent. Sludge generated in the City of Kenosha sewage treatment plant has a solids content of 40 percent or more following treatment and partial dewatering. Sludges generated at the other facilities in the County have a solids content substantially less than 40 percent following processing.

It was estimated that in 1984, 7,560 septic tank systems, 190 mound systems, and 535 holding tanks were in operation in Kenosha County. Based upon data contained in the adopted regional sludge management plan, it is estimated that these onsite sewage disposal systems produce 135 tons of solids per year on a dry-weight basis and 270 tons per year on a wet-weight basis. It is generally recommended that septic and holding tank wastes be disposed of by discharge to a municipal sewerage system for treatment at a public sewage treatment plant.

## Existing Solid Waste Management Systems

Solid waste management functions include storage, source separation, collection, transportation, transfer, processing, and disposal. The transportation and disposal system for solid waste in Kenosha County is summarized on Map 24 in Chapter II.

Storage of solid waste is defined as the temporary holding of the material in containers either prior to collection, or following collection at a regular transfer or processing station. Proper storage is an important element of an efficient collection system. Most private residents in the study area utilize standard leak-proof, galvanized metal or heavy-duty plastic trash cans, mobile carts, or heavy-duty plastic bags. In addition to these individual containers, larger, bulk portable containers designed for mechanized collection are used at most commercial and industrial establishments, and in some multifamily residential areas.

Source separation and recycling programs can be divided into pre-collection, whereby recyclable goods are separated prior to recycling, and post-collection, which requires removal of recyclable items after they have been mixed with the rest of the solid waste stream. Solid wastes are recycled in several ways within the County. The most significant are the recycling programs that are routinely carried out by many of the industries in the County. The industrial wastes recycled in the County total about 110,000 tons, or 70 percent of the total of such wastes produced, and include paper and cardboard, scrap aluminum, scrap steel, oil and grease, chemicals, and plastics. Similarly, it is estimated that 6,600 tons, or about 22 percent, of the commercial wastes generated are recycled. These wastes are recycled both by internal manufacturing processes and by transportation to recycling centers, both within and outside the County. A second type of recycling that is practiced in the County is source separation by citizens of paper, aluminum, glass, and oil, with collection by local community groups. Most of these recycling activities are carried out by private nonprofit groups such as local service clubs, scout groups, and high school classes. Another type of source separation recycling that is conducted in the County is the separation of bulky "white goods," such as discarded stoves and refrigerators. This separation is done both by individuals prior to collection and by landfill operators following receipt of collected solid wastes. In all, it is estimated that 900 tons, or about 2 percent, of the residential solid wastes generated in Kenosha County are recycled. Importantly, three household hazardous waste collections have been conducted in the County since 1985.

Collection and transportation of solid wastes includes the gathering or picking up of solid wastes from the various sources and the hauling of these wastes to the locations where the contents of the collection vehicles are emptied. Within the study area, solid wastes are collected and transported by municipal and private collection services, individual residents, commercial establishments, and industries. The only municipally operated collection and transportation service in the County is in the City of Kenosha. Private collection and transportation contractors haul residential wastes in the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and in eight townships. Most residents of the Towns of Brighton, Bristol, Paris, Salem, Somers, and Wheatland haul their own refuse to either a transfer station or a landfill, in addition to areas that are served by private collection contractors who make arrangements with individual residents. There are 44 licensed private collection services that serve residential, commercial, and industrial waste generators.

Transfer and transportation of solid wastes refers to the means, facilities, and equipment used to transfer wastes from small collection vehicles to larger vehicles and to transport the wastes to either processing centers or disposal sites. Transfer stations are an important aspect of solid waste management efforts in Kenosha County. There are five transfer stations operated in the County. They are owned and operated by municipalities and the private sector. These five transfer stations serve as temporary storage and consolidation points for all or part of the residential and some commercial refuse collected in the City of Kenosha, and the Towns of Brighton, Salem, Somers, and Wheatland. It is estimated that 43,900 tons, or 77 percent, of the residential solid wastes generated annually in Kenosha County are transported to one of these five transfer stations.

Processing of solid waste refers to the transformation of the physical or chemical characteristics of solid waste by mechanical, chemical, or biological processes. Processing is practiced either to improve the efficiency of hauling and disposal of wastes, to recover recyclable materials, or to convert the waste to intermediate products or to energy by incineration or biodigestion. This processing involves the use of chippers to reduce the volume of trees and brush, with subsequent disposal in landfills or compost piles. Processing of residential, commercial, and industrial solid wastes that are recycled also occurs. Further, two active small-scale incinerators are known to be operated in the County by private concerns.

Disposal of the majority of solid wastes in the study area is accomplished by landfilling. As of 1984, there were nine licensed active landfills receiving wastes from Kenosha County. Of these nine sites, six are located within Kenosha County.

Most of the municipal sewage treatment plant sludge generated in the County is disposed of at the Pheasant Run landfill in the Town of Paris. Limited amounts of sludge are hauled by a private contractor and disposed of at a temporary storage lagoon and land-applied at sites in Kenosha or Walworth County.

Utilizing the inventory data collected, the costs of existing solid waste management in the County were estimated. The cost in 1984 for the collection, transportation, and disposal of residential, commercial, and industrial wastes in the study area was estimated to be $5.3 million, or about $39 per ton and about $44 per capita per year.

## ANTICIPATED GROWTH AND CHANGE

The Kenosha County solid waste management planning effort is intended to identify the solid waste management needs of the County through the year 2010, and to propose the best means of meeting future as well as existing needs. Formulation of such a long-range solid waste management plan requires information regarding future population, household numbers, and employment levels in the study area in order to assess the probable quantity, character, and spatial distribution of the solid wastes generated.

Traditionally, long-range system planning has involved the preparation of a single forecast of levels of population, economic activity, and land use demand, and the use of this forecast in the design, test, and evaluation of alternative system plans. This approach works well in periods of relative stability, when historic trends in the factors underlying and influencing changes in population and economic activity levels can reasonably be expected to extend over the plan design period. During periods of major changes in social and economic conditions, a different approach to long-range system planning becomes necessary.

Under this approach, the development, test, and evaluation of alternative plans is based not upon a single most probable forecast of future conditions, but rather upon a number of futures chosen to represent a range of conditions that may be expected to occur over the plan design period. The purpose of this approach is to permit the evaluation of alternative plans over a variety of possible future conditions so as to identify those alternatives that perform well under a wide range of such conditions. The alternative futures used under this approach are selected to represent the reasonable extremes of a range of conditions on the assumption that alternative plans which perform well under the extremes of a range will also perform well at intermediate points in the range. In this way, plans that can be expected to remain viable under greatly varying future conditions can be identified. The Commission utilized the "alternatives futures" approach to develop the series of projections presented herein. Using this approach, three alternative future scenarios were postulated, two intended to identify extremes and one intended to identify an intermediate future--that is, a future that lies between the extremes. Critical social and economic factors that could be expected to have an impact on mortality, fertility, and migration rates over the next 25 years within the United States, the State, and the Region were examined, and a reasonably extreme range of values was established for each component of population change by logically linking various rates of component change to the critical social and economic factors. This provided "most reasonably optimistic" and "most reasonably pessimistic" scenarios of population change by combining all factors that were internally consistent and that would create favorable conditions for economic and population growth within the Region, and by similarly combining all factors that would create unfavorable conditions for economic and population growth within the Region.

## Population, Households, and Employment Utilized in Alternative Plan Design

Following review of potential future conditions, it was concluded that the development of alternative solid waste management plans should be based upon the intermediate future population and employment levels. Using this alternative, the solid waste management plan would be based upon a year 2010 resident county population of about 123,300 persons, a level slightly above the 1987 resident population level, but a reasonable indication of future conditions given efforts to halt the continued decline of population levels in the County. Under this assumed condition, approximately 50,500 households, an increase of about 14 percent over 1987 levels, were anticipated in the County for the year 2010.

## Solid Waste Types, Quantities, and Sources Utilized in Alternative Plan Design

Estimates of the quantities of solid wastes that may be expected to be generated in the study area through the year 2010 were developed. The estimates were based upon anticipated solid waste generation rates and assumed future population and economic activity levels under moderate growth, centralized land use pattern conditions. About 149,000 tons per year of solid waste may be expected to be generated within the study area by the year 2010. This represents an increase of about 16,000 tons per year, or 12 percent, over the 1984 average annual solid waste load. Residential and commercial solid wastes would increase to about 90,000 tons per year, or 19 percent over 1984 levels; industrial waste loads would remain at about 46,000 tons per year; and special wastes would increase to about 13,000 tons per year, or by 8 percent. The composition of the solid waste stream has been assumed to be about the same as in 1984.

The monthly variation of solid wastes and the combustibility of solid wastes are important considerations in the development and evaluation of solid waste management alternatives. Generally, the greatest quantities of solid wastes are generated during the summer and fall, with lesser amounts produced in the winter. For example, in May, June, and October solid waste quantities are projected to be 112 percent, 111 percent, and 107 percent, respectively, of the monthly average, while in February, March, and December, solid waste quantities are projected to be about 88 percent, 90 percent, and 93 percent, respectively, of the monthly average. However, if only residential solid wastes are considered, solid waste quantities are anticipated to range from about 124 percent of the monthly average in May, to about 77 percent of the monthly average in February. The heating value of the total solid waste stream was estimated to be 4,500 British thermal units (BTU's) per pound, with a moisture content of 27 percent by weight and an ash content of 22 percent by weight.

## LANDFILL, INCINERATOR, AND SLUDGE DISPOSAL SITING ANALYSIS

A sanitary landfill is a necessary component of any county solid waste management system. Even alternative solid waste management systems incorporating a high degree of resource recovery, including incineration of waste for the generation of energy, require landfill disposal of incinerator ash and of materials which cannot be removed from the waste stream and otherwise recycled. Landfill disposal is also required as a backup system during periods when the resource recovery systems are not operational. Another aspect of the Kenosha County solid waste management planning effort is the consideration of an alternative solid waste management plan using incineration of combustible wastes. Accordingly, the planning effort included an analysis designed to identify areas having high, moderate, and low potential for landfill siting, and also included an incinerator siting analysis. As previously discussed, the disposal of sewage treatment plant sludge is of particular concern in Kenosha County. Accordingly, a generalized siting analysis for areas suitable for land application of sewage treatment plant sludge was also conducted.

The general siting analysis consisted of an evaluation of the available data on the cultural and natural resource base of the planning area in relation to pertinent environmental protection, engineering, and regulatory criteria. The criteria utilized in the analysis were based upon the requirements of Chapters NR 140, NR 180, NR 185, and NR 204 of the Wisconsin Administrative Code; the adopted Kenosha County Sanitary Code and Private Sewage System Ordinance; and other pertinent engineering and transportation requirements for the initial screening of potential landfill or incinerator sites. The information from the analyses was utilized in considering the feasibility of the landfill, incineration, and sludge land application components of the alternative plans as described in Chapters V and VII of this report.

The system level planning and siting analyses are designed to be followed by more site-specific analyses of the best sites within Kenosha County. The findings of this report were limited to the results of the general system level analyses.

The criteria applied in the landfill siting analysis were categorized as relating to geology, topography, soils, groundwater, surface water, environmentally significant areas, urban land uses, transportation routes, and historical and archaeological sites. In some cases, application of the criteria precluded use of a proposed landfill site, while in other cases, it limited the site's potential. For the purposes of the general siting analysis, the criteria were applied in a conservative manner in order not to categorically eliminate sites that may have potential for landfill development when further evaluated on a site-specific basis.

The criteria applied in the incinerator siting analysis were categorized as relating to existing urban land uses, location of transfer stations, transportation routes, potential energy users, historic sites, and air quality. As in the landfill siting analysis, application of criteria may sometimes preclude use of a proposed incinerator site, while in other cases it may only limit the site potential.

The criteria applied in the sewage treatment plant sludge land application analysis can be categorized as relating to geology, topography, soils, groundwater, surface water, urban land uses, transportation routes, and location of sewage treatment plants. For the purpose of this general siting analysis, the criteria were applied in a conservative manner, given the need for additional site-specific evaluations. The present sludge land application regulations contained in the Kenosha County Sanitary Code and Private Sewage System Ordinance and in Chapter NR 204 of the Wisconsin Administrative Code make no distinction for the characteristics of the sludge. The high solids content--about 40 percent--and the high lime content--20 percent by weight with a pH of about 11 to 12--of the sludge generated at the Kenosha Water Utility appear to reduce the pollution potential of the sludge produced. In particular, the high pH essentially eliminates pathogenic organisms from the sludge. However, at this time the regulations for land application give no special consideration to these characteristics.

After applying each category of criteria for siting either a landfill, an incinerator, or a site for land application of sludge, composite maps were prepared. Three suitability classifications were used in determining the suitability of a site for a landfill or for land application of sludge. Approximately 278 square miles, or the total area of the County, were initially considered for landfill development in the study area. As shown on Map 32 in Chapter IV, approximately 167 square miles, or 60 percent, were categorized as having no or low potential for landfill siting. In some areas in this category, it might be possible to site a special-use landfill for incineration of fly ash but not a general-use landfill. In addition, approximately 76 square miles, or 27 percent of the total area of the County, were classified as having a moderate potential for landfill siting. This potential, however, is somewhat limited, as any sites located in these areas may be expected to require more intensive engineering and entail higher site development costs. Finally, about 37 square miles, or 13 percent of the County, were classified as having a high potential for landfill siting.

The suitability of areas for land application of sewage treatment plant sludge is shown on Map 33 in Chapter IV. Approximately 174 square miles, or 63 percent, were categorized as having no potential for land application of sewage treatment plant sludge. The large extent of this area is attributable primarily to the extent of urban areas and areas characterized as having a depth to groundwater of less than three feet. In addition, about 68 square miles, or 24 percent of the County, were categorized as having a moderate potential for land application of sludge. Finally, approximately 36 square miles, or 13 percent of the County, were categorized as having a high potential for land application of sludge.

The analyses for land application of sludge were based solely upon physical criteria and did not take into account landowner or operator concerns and preferences. The Kenosha Water Utility reports that in some instances, landowners or operators do not allow application of sludges on only portions of a field, but rather want entire fields conditioned uniformly. Thus, while the physical criteria may indicate a portion of a field to have a high potential for land application of sludge, the field may not be available without difficult-to-make special arrangements if other parts of the field are not suitable for land application. Thus, while 36 square miles, or 13 percent of the County, were categorized as having a high potential for land application, only a portion of that area may actually be available without meeting the desires of landowners and operators for uniform conditioning of fields through special arrangements or additional incentives.

With regard to incinerator siting, eight sites were determined to have a high enough potential to warrant further consideration, as shown on Map 34 in Chapter IV. A more detailed analysis of these sites is necessary to determine their cost-effectiveness and overall feasibility.

## ALTERNATIVE SOLID WASTE MANAGEMENT PLANS CONSIDERED FOR RESIDENTIAL, COMMERCIAL, AND INDUSTRIAL SOLID WASTE

Eight major alternative and three accessory alternative solid waste management plans were formulated and evaluated. Each of the major alternatives considered was designed to accommodate the total residential, commercial, industrial, and special waste streams anticipated to be generated in Kenosha County through the year 2010. On the average, this quantity was estimated to be 142,000 tons of solid waste per year. The evaluation of each alternative considered the technical feasibility, regulatory compliance, practicality of implementation, social acceptance, and economics. Costs included in the alternative analysis do not include the cost for collection of solid wastes, which is expected to be the same under each alternative.

## Alternative Plan 1

The first alternative plan consists of the continued use of the entire existing solid waste management system, including existing storage, collection, and transfer station systems, and the establishment of a countywide residential recycling program. Unrecycled residential, commercial, and industrial solid wastes would be disposed of primarily at four existing commercial general-use landfills, and three small municipally owned and operated landfills, located within and adjacent to Kenosha County. This alternative includes provision for the improvement of existing facilities anticipated to continue operating through the plan period, but which are not now in compliance with state solid waste management regulations. The total average annual cost of capital and operation and maintenance under Alternative Plan 1 is $3,139,000, or about $22 per ton of solid waste.

## Alternative Plan 2

The second alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes primarily at a single, existing, commercial general-use landfill located within the County. The total average annual cost of capital and operation and maintenance is $3,199,000, or about $23 per ton of solid waste.

## Alternative Plan 3

The third alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; and disposal of unrecycled solid wastes primarily at two existing commercial general-use landfills, one of which is located within the County. The total average annual cost of capital and operation and maintenance is $3,157,000, or about $22 per ton of solid waste.

## Alternative Plan 4

The fourth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator with a capacity of 250 tons of solid waste per day and designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid wastes at one existing commercial general-use landfill located within the County. The total average annual cost of capital and operation and maintenance under Alternative Plan 4 is $4,322,000, or about $30 per ton of solid waste.

## Alternative Plan 5

The fifth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at one incinerator with a capacity of 250 tons of solid waste per day and designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes at one existing commercial general-use landfill. The total average annual cost of capital and operation and maintenance under Alternative Plan 5 is $4,966,000, or about $35 per ton of solid waste.

## Alternative Plan 6

The sixth alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators with a combined capacity of 300 tons per day and designed for steam generation; and disposal of the remaining unrecycled and unincinerated solid waste at one existing commercial general-use landfill. The total average annual cost of capital and operation and maintenance under Alternative Plan 6 is $5,914,000, or about $42 per ton of solid waste.

## Alternative Plan 7

The seventh alternative plan consists of the continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; combustion of a portion of the unrecycled solid wastes generated in the County at two separate incinerators with a combined capacity of 300 tons per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid waste at one existing commercial general-use landfill. The total average annual cost of capital and operation and maintenance under Alternative Plan 7 is $6,838,000, or about $48 per ton of solid waste.

## Alternative Plan 8

The eighth alternative plan consists of continued use of the existing solid waste storage, collection, and transfer station systems supplemented by two additional transfer stations; initiation of a countywide residential solid waste recycling program; conversion of a portion of the unrecycled solid wastes generated in the County into refuse-derived fuel (RDF); incineration of the refuse-derived fuel at one incinerator with a capacity of 200 tons of processed solid waste per day designed for electric power generation; and disposal of the remaining unrecycled and unincinerated solid wastes and refuse-derived fuel process residue at one existing commercial general-use landfill. The total average annual cost of capital and operation and maintenance is $4,660,000, or about $33 per ton of solid waste.

It was determined that three additional solid waste management alternatives may be applicable for disposal of a portion of the solid wastes generated in Kenosha County. These alternatives have been termed "accessory" because generally they will not result in the disposal of large quantities of solid wastes and, in most instances, would be carried out in conjunction with one of the "major" alternatives for conventional solid waste disposal.

## Accessory Alternative 1--High Level of Residential Solid Waste Recycling

Under Accessory Alternative 1, a high level of residential solid waste recycling would be initiated using the same 10 recycling centers included in each of the eight major alternatives. However, this accessory alternative would result in the recycling of 6,000 tons of material annually, rather than 3,000 tons as under the major alternatives. The increased amount of recycling would result from the implementation of an extensive information and education program; longer hours of operation for the recycling centers; greater use of municipal staffing for supplying volunteer labor to the stations and for conducting "drives" for recyclables; the provision of separate pickup of recyclables; and the provision of economic incentives, i.e., paying for recyclables. The total average annual cost of capital and operation and maintenance under Accessory Alternative 1 is $260,000, or about $43 per ton of recycled solid waste.

## Accessory Alternative 2--Separate Collection and Recycling of Newsprint

Under Accessory Alternative 2, a separate curbside collection program to collect and recycle newsprint would be initiated. All collection vehicles, including those that are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes. This separate collection of newsprint is anticipated to result in the recovery and recycling of 1,000 tons per year. This quantity would be over and above the newsprint recycled at the drop-off recycling centers established countywide or in community programs already in effect. The gross average annual cost of capital and operation and maintenance under Accessory Alternative 2 is $36,300, or about $36 per ton. Assuming there is a market for this material, a revenue of about $15,000 per year could be expected, which could be used to offset the operational costs. This would result in a net cost of about $20,000 per year, or about $20 per ton.

## Accessory Alternative 3--Composting

Under Accessory Alternative 3, a comprehensive program for the composting of vegetative debris contained in residential solid wastes, including grass clippings, leaves, and brush, would be implemented. Approximately 6,300 tons of yard wastes and trees and brush are anticipated to be generated annually in the County during the plan period. The establishment of composting operations in each of the municipalities in the County is anticipated to result in 1,200 tons being composted, or about 20 percent of the yard wastes generated. The materials would be delivered by individual residents to one of seven composting sites in the County. The gross average annual cost of capital and operation and maintenance under this alternative is $51,000, or about $42 per ton of composted solid waste.

An option under this alternative is the provision of a separate collection of yard waste materials in the more urbanized areas of the County. Thus, in addition to the establishment and operation of seven composting sites, a separate pickup of yard waste materials would be implemented in the City of Kenosha, the Villages of Paddock Lake, Silver Lake, and Twin Lakes, and portions of the Towns of Pleasant Prairie and Somers. It was assumed that such pickup would be conducted by the municipalities, which would, in some cases, provide the service through a private collection firm as is done under the present solid waste collection system. For costing purposes, it was assumed that this collection would be conducted at weekly or biweekly intervals during the six-month period from mid-April through mid-October, with the collection being made using additional storage racks on the existing collection vehicles, supplemented by separate collections in open trucks rather than packer trucks during peak periods. Under this option, the gross average annual cost of capital and operation and maintenance is estimated to be $90,000, or about $75 per ton of composted solid waste.

## ALTERNATIVES PERTAINING TO MUNICIPAL SEWAGE TREATMENT PLANT SLUDGE

Five alternative municipal sewage treatment plant sludge plans were formulated and evaluated. The evaluation assumed that existing processing and stabilization and digestion systems would be used. However, under certain alternatives, the existing systems and processes had to be modified to be consistent with the disposal method described under each alternative. Each alternative was designed to accommodate the municipal sludge generated in the study area through the year 2010. On the average, this quantity is estimated to be 6,500 dry tons per year.

### Alternative Plan 1

The first alternative plan consists of landfilling the majority of the municipal sewage treatment plant sludge generated from the eight public sewage treatment plants, with disposal of limited amounts of sludge at a commercial storage lagoon prior to being applied to agricultural land. The estimated total annual cost for the development of the sludge management facilities proposed under Alternative 1 is $355,000, or about $55 per dry ton based upon a $15-per-wet-ton landfill charge. Under current charges, which are about $7.00 per wet ton, the total cost of this alternative is about $35 per dry ton of sludge.

### Alternative Plan 2

Alternative Plan 2 consists of incinerating the majority of the municipal sewage treatment plant sludge generated in the study area, with disposal of limited amounts of sludge by landfilling or in a commercial storage lagoon prior to being applied to agricultural land. Sludge from the City of Kenosha and Town of Pleasant Prairie sewage treatment plants would be transported to an incinerator located in the City of Kenosha. Sludge generated at the remaining plants would be transported to a private, commercially operated storage lagoon or the Pheasant Run landfill. The total average annual cost of capital and operation and maintenance under Alternative Plan 2 is $414,000, or about $64 per dry ton of sludge, under an option whereby an incinerator is constructed for conventional solid waste disposal and also used for incineration of sludges. The total average annual cost would be $738,000, or about $114 per dry ton of sludge, if a separate incinerator were constructed to burn only sludge.

## Alternative Plan 3

Alternative Plan 3 consists of the processing of the majority of municipal sewage treatment plant sludge generated in the study area at a compost facility, with limited amounts to be applied to agricultural land, or landfilled. The sludge generated at all of the facilities would be transported and processed at six composting facilities, where it would be composted by the aerated windrow composting method. The composted sludge would be available for sale and for use by local units of government or residents as a soil conditioner, or would be spread on agricultural land. Limited quantities of sludge would be disposed of by landfilling when composting operation requirements or climatic conditions precluded the use of these systems. The total average annual cost of capital and operation and maintenance under Alternative Plan 3 is $838,000, or about $129 per dry ton of sludge. Without consideration of revenue from the sale of compost, the net unit cost is $140 per dry ton of sludge.

Under this plan, six composting centers would be established. Another option that could be considered is the provision of only one composting site in the area east of IH 94 which would be used for composting of sludges generated at the City of Kenosha and Town of Pleasant Prairie sewage treatment plants. Sludge disposal at the remaining plants would be disposed of as described under Alternative Plan 1. Under this option, the total average annual cost of capital and operation and maintenance is $424,000, or about $65 per dry ton of sludge. Without consideration of the revenue from the sale of composted sludge, the net unit cost is estimated to be $76 per dry ton of sludge.

## Alternative Plan 4

Alternative Plan 4 consists of the spreading of the majority of the municipal sewage treatment plant sludge generated in the study area on approved agricultural land application sites, with limited amounts to be landfilled during periods when climatic or site conditions preclude the use of approved sites for land application of sludge. However, no landfilling was assumed for those plants with storage capacity in sludge drying beds or, in the case of the City of Kenosha, in a domed storage building. The total average annual cost of capital and operation and maintenance under Alternative Plan 4 is $328,000, or about $50 per dry ton of sludge.

## Alternative Plan 5

Alternative Plan 5 consists of the processing of a portion of the municipal sewage treatment plant sludge generated in the study area to manufacture a fertilizer or soil conditioner product, with limited amounts being applied to agricultural land, or landfilled. Municipal sludge generated at the City of Kenosha sewage treatment plant would be processed to produce a soil conditioner product for commercial uses. Sludge generated at the remaining plants would be transported to either a private, commercially operated storage lagoon or the Pheasant Run landfill.

The cost of this type of operation would be dependent upon the processing site, location, available equipment, market conditions, and marketing system in place.

## RECOMMENDED PLAN

The selection of the recommended plan and the means to implement it followed an extensive review by the Technical Advisory and Intergovernmental Coordinating Committee of the technical feasibility, economic viability, environmental impacts, potential public acceptance, and practicality of the various alternative solid waste management plans considered, as well as of the degree to which the various alternatives met the adopted solid waste management objectives. In addition, the plan recommendations reflect comments and suggestions from private citizens and public officials received during the public hearings held on the plan. The public involvement component of the solid waste management study is summarized later in this chapter.

### Plan Components

The recommended plan consists of six solid waste management functions--storage, source separation, collection, transportation, transfer, and disposal. In addition, a contingent recommendation providing for the processing of solid waste by incineration is made--the implementation of which will be dependent upon future conditions regarding energy users, energy costs, general price inflation rates, and landfill costs. The recommended plan is designed to accommodate the total solid waste and municipal sewage treatment plant sludge loadings expected to be generated within the County through the year 2010. The recommended plan is shown graphically on Map 44 in Chapter IX.

A description of each of the components of the recommended plan and the associated institutional arrangements for ownership and operation is presented below:

Storage: The first component of the recommended solid waste management plan is the storage system. Proper storage practices are an important element of an efficient collection system. Under the recommended plan, it is envisioned that most residents in residential areas would utilize either standard, leak-proof, galvanized metal or heavy-duty plastic trash cans with a 20- to 32-gallon capacity and equipped with tight-fitting lids, wheeled carts with a capacity of 75 to 90 gallons, or heavy-duty plastic bags. Large, portable bulk containers designed for mechanized collection should continue to be used at most commercial and industrial establishments, and in some multifamily residential areas. Conversion to larger, individual portable containers for mechanized collection appears to be gaining wider acceptance in many communities. However, consideration of such changes is recommended to be based upon local decision-making, considering cost, labor, and environmental concerns.

The storage systems are envisioned to continue to be owned and operated by the individual solid waste generators, municipal solid waste collection services, and private solid waste collection firms. It is recognized that there may be a shift over time from the use of small containers owned by individuals to the use of larger municipally owned but still individual residence containers suitable for mechanized hoisting into collection trucks.

Source Separation: The second component of the recommended solid waste management plan is a source separation program. The program would consist of four elements: 1) a voluntary residential solid waste recycling program whereby residents would transport materials such as paper, glass, metal, plastic, and waste oil to a recycling center; 2) a voluntary curbside collection program for newsprint, whereby municipal and private solid waste collection vehicles would be equipped with special racks for the temporary storage and transport of separated newsprint; 3) a mandatory composting program for the processing of yard wastes; and 4) a voluntary household toxic and hazardous waste management program.

Residential Solid Waste Recycling--The first element of the source separation component is a residential solid waste recycling program whereby recyclable materials consisting primarily of paper, glass, aluminum, other metals, and plastics would be transported by individuals to one of the 12 recommended local recycling centers. In this regard, it should be noted that the Technical Advisory and Intergovernmental Coordinating Committee concluded that 12 recycling centers should be included in the recommended plan. Under the alternative plans, only 10 centers were envisioned. Those 10 centers included six recycling facilities required under Chapter 144 of the Wisconsin Statutes, of which two would be located in the City of Kenosha, one in the Town of Pleasant Prairie, and three at the municipally owned and operated landfills located in the Village of Twin Lakes and the Towns of Bristol and Randall. In addition, the alternative plans envisioned continual operation of two existing facilities--one located at the Waste Management of Wisconsin, Pheasant Run landfill in the Town of Paris and one located in the Town of Somers--and the development of two new facilities in the Villages of Paddock Lake and Silver Lake, respectively. In addition, the Advisory Committee recommended that recycling centers be established at the existing transfer stations operated in the Towns of Brighton and Wheatland. In making this revision, the Committee noted that these recycling centers could be initiated with minimal facilities, including primarily segregated containers for recyclables. The Committee noted that these two locations would be logical since many town residents bring solid waste to these transfer stations, and there would thus be no added transportation costs if recyclable materials were separated and transported at the same time.

It is estimated that with full implementation throughout the County and with a relatively high level of participation in the recycling program, 6,000 tons of material would be recycled per year, or about 10 percent of the estimated average annual residential solid waste quantity and about 4 percent of the total average solid waste quantity.

The recommended plan envisions a flexible approach to ownership and operation of the recycling centers, with a combination of private, profit-oriented business, private nonprofit organizations, and individual municipalities assuming the primary functions. It was judged by the Technical Advisory and Intergovernmental Coordinating Committee that it would be desirable for the individual municipalities to be given the lead role in operating the recycling centers, including operational management. Because of the potential profit involved in recycling, private ownership is considered viable, but is recommended only where the recycling center can be located at the site of an existing or new commercial recycling business. This is expected to result in private ownership of two to four of the recommended 12 recycling centers. For all of the other recycling centers, it is recommended that the individual municipalities assume the responsibility for ownership either by direct ownership or by contract with a private owner-operator.

Operation by private, for-profit businesses would be viable for sites owned by already operating or new commercial recycling businesses. In other cases, it is recommended that the municipalities assume responsibility for the operation of the centers either by direct operation or by contract with a private owner-operator. It was recommended that the municipalities consider obtaining operational assistance from nonprofit volunteer groups, but that the operation not be contingent upon such groups providing the primary source of labor and management. It was also recommended by the Committee that overall county coordination of the recycling programs be the responsibility of a countywide task force to be established by the County and the communities. That task force would be made up of one representative from each community; one representative of the county staff; one representative of the County Board; a possible representative from a landfill; and advisory members from the DNR and the University of Wisconsin-Extension program. That task force would take the lead in providing, on a countywide basis, organizational assistance and recyclable material marketing. Public education and information is recommended to be carried out through the county University of Wisconsin-Extension office.

Curbside Collection of Newsprint--The second element of the source separation component is a separate curbside collection for newsprint. Collection vehicles, including those that are municipally and privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid wastes for transport to a recycling station or storage location. This separate collection program is anticipated to result in the recovery and recycling of 1,000 tons of newsprint annually. This quantity would, be weight, be about 2 percent of the average annual residential solid waste stream and less than 1 percent of the total waste stream. The newsprint recycled under this program would be over and above the newsprint recycled at the 12 drop-off recycling centers to be established.

This program for separate collection of newsprint is considered an optional plan element recommended to be implemented in all areas where applicable. In certain areas where vehicle maneuverability and size may be restricted because of narrow alleys, such a program may not be practical. Decisions regarding such a program should be made in conjunction with other collection system evaluations. Collection vehicles in areas where this component is implemented, including both those that are municipally and those that are privately owned and operated, would be equipped with special racks or brackets to temporarily store separated newsprint collected along with other residential solid waste for transport to the recycling centers or storage locations.

The facilities necessary for the collection of newsprint would be owned and operated by a combination of municipalities and the private sector. The material could either be transported to any of the 12 recycling centers described under the recycling component above, or be taken directly to an existing commercial recycling operator that purchases newsprint.

Composting--The third element of the source separation component is a program whereby vegetative debris generated from residential and institutional sources, including grass clippings, leaves, and brush, would be composted. The composting program is anticipated to result in the removal of 4,800 tons of material from the solid waste stream, of which about one-half, or 2,400 tons per year, is expected to be collected at seven community composting sites. The other one-half of the yard waste is expected to be disposed of on site by the use of individual compost systems or equipment such as mulching lawnmowers. This 4,800 tons per year represents a larger amount than included in the alternative evaluation in order to reflect the impact of legislation passed in 1988 which will ban the disposal of yard wastes in landfills after 1992. This quantity, by weight, would be nearly 80 percent of the average annual quantity of vegetative debris generated, about 8 percent of the total residential waste quantity, and about 3 percent of the total solid waste stream. The material would be transported in the more urbanized areas by individuals supplemented by the municipalities or private contractors using segregated racks during low-volume periods and special supplemental collections during peak periods. Because of the cost involved in collecting the yard wastes separately and in operating the compost system, it is recommended that this plan element include a strong public education and information component to encourage leaving as much of the material--such as grass clippings--on site as practical. In the rural or low-density developed areas, materials would be expected to be handled on site or transported by individual residents. In the case of debris generated on publicly owned parklands, parkways, or green spaces, transportation would be by county-operated or municipally operated vehicles to one of the seven processing sites situated throughout the County. As a matter of convenience, most of the sites are recommended to be located adjacent to the recycling centers. Two sites would be located in the City of Kenosha, and one site each located in the Towns of Pleasant Prairie and Somers and in the Villages of Paddock Lake, Silver Lake, and Twin Lakes. It is recommended that a flexible approach be taken with regard to the ownership and operation of the composting sites, with the municipalities selecting between the options of municipal ownership and operation and private, for-profit ownership and operation. Overall coordination would be provided by the proposed solid waste management task force noted above. Public education and information is recommended to be carried out by the county University of Wisconsin-Extension office.

<u>Household Toxic and Hazardous Waste Management</u>--The fourth element of the source separation component is a household toxic and hazardous waste management program. This program would consist of annual "special collections" at at least two locations whereby residents would bring materials containing toxic and hazardous substances to a pre-arranged location on specific dates for disposal. In addition, the program would consist of a comprehensive information and education effort to inform citizens of the types of substances which can be disposed of under these special collections, and of alternatives to household products currently used. Approximately 2,500 to 3,500 gallons of material is expected to be collected annually under this program. The associated information and education program would also likely reduce, to an undetermined extent, the amount of such substances that are used and eventually discarded.

This recommendation is considered an interim component recommendation pending development of programs at a regional or state level for disposal of such materials from residential sources, as well as commercial and industrial sources. Thus, it is further recommended that a plan be developed for the disposal of all toxic and hazardous waste. However, that plan should have a geographic area greater than the County and should be conducted at the regional or state level.

The necessary facilities for collection and temporary storage would be located on municipally owned property. Because of the very specialized nature of collecting, packaging, transporting, and disposing of toxic and hazardous wastes, it is recommended that this program be coordinated and administered countywide by the Kenosha Water Utility, the staff of which has experience in conducting these collections and handling special materials. It is recommended that the Kenosha Water Utility coordinate the efforts with the local units of government, and that the public information and education program be coordinated by the Utility, the local units of government, and the University of Wisconsin-Extension. In addition, it is recommended that assistance in promoting the program be sought from community groups such as the League of Women Voters--who have assisted in promoting this type of program in the past. A private, for-profit firm would also be engaged to assist in the operation and disposal of selected materials.

Collection and Transportation: The third and fourth components of the recommended solid waste management plan are the collection and transportation systems. The recommended plan envisions the collection function to continue to be carried out in a manner similar to the existing system, which involves the use of municipally and privately owned and operated collection vehicles.

Decisions pertaining to the collection and transport of solid wastes would continue to be made by local officials and the private collection industry, with the necessary equipment and facilities to be owned and operated by a combination of municipalities and private operators. It is recognized that there may be some changes from municipal to private ownership and operation based upon individual municipal cost and service evaluations. Thus, a flexible ownership and operation approach including either option is recommended.

Transfer: The fifth component of the recommended solid waste management plan is the use of transfer stations for the consolidation of solid waste. Upon full implementation of the recommended plan, approximately 47,000 tons, or about 74 percent, of the anticipated average annual residential solid waste quantity will be transferred at one of five existing and two proposed transfer stations.

The facilities necessary for the transfer of solid wastes are recommended to continue to be owned and operated by a combination of municipalities and private operations.

Disposal: The sixth component of the recommended solid waste management plan is the disposal system, which is applicable to both solid wastes and municipal sewage treatment plant sludge. This component is an integral part of the overall management system recommended for the study area in that it provides for the disposal of the unrecycled portion of the solid waste stream, and for a portion of the dewatered sludge generated by municipal sewage treatment plants.

The recommended plan envisions that about 51,000 tons per year, or about 80 percent of the currently unrecycled residential solid waste generated annually, and about 137,000 tons per year, or about 92 percent of the total currently unrecycled solid wastes generated annually, would be disposed of by landfilling. When considering the entire solid waste stream including wastes currently recycled, this 137,000 tons represents about 50 percent of the total. In addition, it is recommended that a portion of the municipal sludge generated be landfilled. The quantity of sludge to be landfilled will vary with the cost of landfilling and of other options, as well as with changing regulations. Under current conditions, it is expected that 6,000 dry tons per year, or nearly 95 percent of the sludge, will be landfilled. However, over the plan period, it is recommended that the sludge disposal system include provisions for increased use of land application, or, alternatively, compost or soil conditioner production to reduce the reliance on landfill disposal. In this regard, it is recommended that ultimately about 3,400 dry tons per year, or about 50 percent of the sludge expected to be generated annually by the year 2010, be disposed of by land application or by compost or soil conditioner production. The land application of 3,400 tons of sludge per year will require the use of about 600 acres of land at the application sites. The recommendations include specific provisions for each municipal sewage treatment plant to provide for backup storage, land application facilities, and landfill capacity for disposal during periods when the primary sludge management option is disrupted.

The unrecycled solid wastes and the aforementioned portion of the municipal sludge are recommended to continue to be landfilled primarily at one existing commercial, general-use landfill. It is expected that most of this material will be landfilled at the Pheasant Run landfill operated by Waste Management of Wisconsin, Inc., in the Town of Paris. In addition, it is recognized that the small, municipally owned landfills in the Village of Twin Lakes and the Towns of Bristol and Randall will continue to accept wastes until they are abandoned at some point in the plan design period when it is expected that new state and federal regulations will make continued operation uneconomical. Other commercial general-use landfills outside Kenosha County may be expected to continue to receive limited amounts of solid wastes generated within the County during the plan design period. These landfills include: the Browning and Ferris landfill in the Town of Benton, Lake County, Illinois; the Greidanus Enterprises landfill in the Town of Darien, Walworth County; and the Land Reclamation, Ltd., landfill in the Town of Mt. Pleasant, Racine County. It is recognized that these commercial general-use landfills, as well as smaller special-use landfills outside the County, may be used for the disposal of solid wastes, with the specific sites being selected based upon competitive market costs, as is presently the case.

With regard to the disposal of sewage treatment plant sludges by landfilling and land application, the Technical Advisory and Intergovernmental Coordinating Committee noted that new U. S. Environmental Protection Agency rules are currently being prepared which may have an impact on the plan recommendations. The draft rules list 28 sludge pollutants which municipalities must monitor. They also set standard management practices for the five most common sludge use and disposal practices: land application, distribution and marketing, dedicated sludge landfill, sewage sludge surface disposal, and incineration. Examples of management guidelines include applying sludge no closer than 30 feet to a stream; providing product labels, directions, and warnings when marketing sludge as fertilizer; and monitoring dedicated sludge landfills for methane gas. A review of the draft rules indicates that the primary intent is to promote environmentally beneficial use of municipal sludge with emphasis on quality monitoring and improvement. Review of the draft rules also indicates that the recommendations for continuing to landfill a portion of the sludge would not likely be impacted, since the regulations deal with special dedicated sludge landfills and not landfills that primarily dispose of conventional solid waste and limited amounts of sludge. Furthermore, the proposed rules appear to encourage land application of sludge as is recommended in the county plan for a portion of the sludge. It is recommended that the large commercial landfills continue to be owned and operated by the private owners, with the smaller landfills to be owned and operated on an interim basis by the Village of Twin Lakes and the Towns of Bristol and Randall.

For the sludge land application component, it is recommended that the City of Kenosha and the Villages of Paddock Lake and Twin Lakes, which currently possess facilities and vehicles for transporting and storing dewatered sludge, utilize the individual municipality operation option, in combination with private ownership of the land application sites. It is recommended that these municipalities consider ownership of land application equipment, with private property owners continuing to own the application sites. Further, continued ownership and operation of the private sanitary service is recommended. It is also recommended that this service be allowed to provide a temporary storage and land application service for the other sewage treatment plant currently operating in Kenosha County. However, it is recommended that each municipal sewage treatment plant develop in the early stages of the plan period an alternative means of sludge storage and land application which would be municipally owned and operated. Such a system could be used as a backup system to the privately owned and operated storage lagoon and land spreading system. A flexible operation arrangement relying primarily on the individual municipality with the possible cooperative input of the landowner, depending upon the circumstances at each site, is recommended. Sludge would be handled at the site either by the municipal employees or by the landowner or his employees. This system flexibility appears necessary for the proper negotiations between the municipality and the landowner. Finally, it is recommended that private sanitary service contractors under contract to the various plant operators maintain the responsibility for transport of liquid sludge and disposal of such sludge on approved agricultural lands, and for the temporary storage at a centralized liquid storage facility.

Processing: The seventh component of the recommended solid waste management plan is a contingent recommendation that would be implemented only if certain conditions were to change in the County which would make incineration favorable economically when compared to other alternatives. These changes were discussed in Chapter VII and would include the availability of a viable long-term user for the steam which could be generated, and a relatively rapid escalation in energy costs and/or landfill disposal costs. Under certain circumstances, incineration may be expected to become practical with respect to costs in about 10 years. The plan under these circumstances would recommend construction of one modular incinerator designed ultimately to generate steam and possibly to cogenerate steam and electricity. More detailed investigations would be needed as part of the required facility planning effort and environmental impact analysis before the specific location of the incinerator could be determined.

The recommended plan envisions that the ownership of the incinerator system would be, in part, dependent upon the users served. However, it was concluded by the Advisory Committee that since a portion of the solid wastes generated in one major city and two townships would likely be processed at the incinerator, a combination of ownership and operation options may be most equitable. These include ownership and operation by the City of Kenosha, and ownership and operation by the City of Kenosha and the Towns of Pleasant Prairie and Somers. Under each of these options, a partnership arrangement with a private, profit-oriented owner and/or operator would be possible.

## Cost Analysis

In order to assist public officials and concerned citizens in evaluating the financial feasibility of the recommended solid waste and municipal sewage treatment plant sludge management plan, a schedule of capital and operation and maintenance costs was prepared. This schedule includes costs for both the publicly and privately owned and operated solid waste and municipal sewage sludge management functions identified in the plan recommendations. Summary costs for all the components of the recommended plan over the 20-year implementation period, expressed in 1987 dollars, are summarized in Table 47 in Chapter IX.

The capital cost of implementing the recommended management plan for conventional solid waste is estimated at $540,000 over the 20-year plan implementation period. Upon full implementation, the average annual operation and maintenance cost of the recommended plan is estimated to be $3,130,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill.

The average annual cost of carrying out the recommended solid waste management plan, including the capital cost of the construction of new facilities and the operation and maintenance of those facilities, may be expected to total $3,180,000, or $22.40 per ton of solid waste. Based on the anticipated design year resident population of the plan area, the total average annual cost would be about $26 per capita. If the cost of collection is added to these costs, the average annual cost is expected to be $6,100,000, or about $43 per ton.

The average annual cost of carrying out the recommended municipal sewage treatment plant sludge management plan is set forth in Table 49 in Chapter IX. The capital investment cost of implementing the sludge management plan over the 20-year implementation period is estimated to be $500,000 for storage facilities and land application equipment. Upon full implementation of the plan, the average annual operation and maintenance cost of the recommended plan is estimated to be $340,000. This cost includes a landfilling capital cost component which was assumed to be incurred incrementally over the life of each landfill. The average annual cost of carrying out the recommended sludge management plan, including the construction of new facilities and the operation and maintenance of those facilities, may be expected to total $390,000, or about $60 per dry ton of municipal sewage treatment plant sludge handled. Based on the anticipated design year resident population of the plan area, the total average annual cost would be just over $3.00 per capita.

## ABILITY OF THE RECOMMENDED PLAN TO MEET THE AGREED-UPON OBJECTIVES

In the most basic sense, planning is a rational process for establishing and meeting objectives. The 10 solid waste management objectives presented in Chapter I of this report were, accordingly, developed and adopted by the Technical Advisory and Intergovernmental Coordinating Committee. These objectives provided the basis for the design and evaluation of alternative solid waste and municipal sludge management plans.

The recommended plan meets the objectives to the extent practicable by providing a flexible, cost-effective, integrated, environmentally sound, long-term solution to the solid waste and municipal sewage treatment plant sludge disposal needs of the study area. The plan calls for a high level of recycling to recover reusable materials. The plan recommends an eventual shift to the use of a significant portion of the sludge generated in the County for land application or other reuse alternatives. In addition, the landfill capacity required to dispose of that portion of the solid waste stream that is not recycled, as well as the sludge generated in Kenosha County, is also provided for in the plan. The plan does not provide for energy recovery of steam or electricity generated by burning solid waste under near-term future conditions. However, an auxiliary provision is included to recover energy should conditions change significantly over the plan period, making that alternative cost competitive.

## PLAN IMPLEMENTATION

While the recommended solid waste and municipal sewage treatment plant sludge management plan for Kenosha County is designed to attain the adopted solid waste management objectives, the plan is not complete in a practical sense until the major steps required to implement it--that is, to convert the plan into action policies and programs--have been specified. Therefore, the recommended plan has specified the actions that should be taken by Kenosha County, the local units of government in the County, the private sector, and state agencies in order to implement the plan.

It is recommended that the Kenosha County Board of Supervisors adopt the plan and designate a committee to oversee and monitor solid waste management activities in the study area. In addition, it is recommended that the governing bodies and planning commissions of the City of Kenosha, the Kenosha Water Utility, and the villages and towns in the study area adopt the plan and cooperate in its implementation. The lead implementation role for the ownership and operation of the recycling centers and compost facilities is recommended to be the responsibility of the individual municipalities. In this regard, it should be noted that the cost of ownership and operation of these facilities is expected to be greater than the costs for landfilling at this time. Thus, this plan element will likely involve some increased expenditures by local units of government.

Important new recommendations provide for the overall management and administration of the plan implementation program to be directed by a standing committee of the County Board, with assistance from the newly created countywide solid waste management task force. This task force could consist of one representative from each community in which a recycling and compost center is recommended to be operated, one representative of the county staff, representatives of the County Board, a possible representative from a landfill, and advisory members from the Wisconsin Department of Natural Resources and the University of Wisconsin-Extension program.

In addition, it is recommended that the Kenosha Water Utility take the lead responsibility for implementing a countywide household hazardous waste collection and disposal program.

The University of Wisconsin-Extension is recommended to be the lead agency in the public involvement, education, and information program needed to implement the plan.

The plan represents a long-term solution to both solid waste and sewage sludge management problems, and full implementation will have to extend over many years. The availability of each of the components of the plan is specifically related to many factors, including availability of local funds, interest rates, market value of recyclables, cost of alternative disposal methods, and pending state and federal regulations and policies. All of these factors are dynamic in nature and subject to both short-term and long-term changes. Because of the relationship of the plan components to these constantly changing conditions, it is recommended that the plan be reevaluated and refined regularly. The timing of the major plan elements is shown in Figure 19 in Chapter IX. At each decision point in the implementation process, an evaluation of up-to-date conditions can be made to determine if the next phase should be implemented at that time.

## PUBLIC REACTION

Two formal public hearings on a recommended plan for solid waste management in Kenosha County were held, one on Tuesday, October 25, 1988, at the Kenosha County Courthouse, and one on Wednesday, October 26, 1988, in the Town Hall of the Town of Wheatland in New Munster. These hearings were designed to meet the requirements of Chapter NR 185.06(3) of the Wisconsin Administrative Code, and were attended by a total of 34 persons representing local units of government, private businesses and industrial groups, and concerned citizens. A summary of and response to the public hearing comments is provided in Chapter X.

The Advisory Committee carefully considered the oral and written comments submitted at the public hearings on the preliminary plan, and based upon that consideration, made the following revisions to the recommended plan.

1. It is recommended that the proposed county solid waste management task force work with the Wisconsin Department of Natural Resources to monitor transport of solid waste generated out of state into Kenosha County. It is further recommended that the Wisconsin Department of Natural Resources revise its solid waste data collection requirements to obtain the needed interstate transport information from all landfill operators.

2. It is recommended that the local municipalities adopt and enforce ordinances prohibiting littering and provide centers for the drop-off of

materials such as used tires which cannot be readily disposed of in the conventional solid waste stream. The separate drop-off centers should be financed at least in part with service fees.

3. It is recommended that the local units of government monitor the air quality problems which may arise from the increased burning of yard waste that may occur owing to the prohibition of landfilling of yard wastes. If significant problems are found, consideration should be given to restricting or prohibiting any open burning of yard wastes.

## CONCLUSION

The solid waste and municipal sewage treatment plant sludge management plan for the Kenosha County study area presented herein sets forth the recommended means, costs, and implementation methods for meeting the existing and forecast year 2010 solid waste management needs of the study area. The plan is the result of an extensive effort by the Technical Advisory and Intergovernmental Coordinating Committee for the Kenosha County Solid Waste Management Planning Program and the staffs of the Kenosha County Department of Planning and Development and the Southeastern Wisconsin Regional Planning Commission. Adoption and implementation of this plan will provide for the sound management of solid waste in the study area in an efficient, environmentally safe, and cost-effective manner, and will at the same time result in the recovery of valuable recyclable materials which would have otherwise required landfilling. The recommendations in this report provide Kenosha County with a comprehensive, long-term solution to the county solid waste management problem.

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# APPENDICES

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## Appendix A

## KENOSHA COUNTY TECHNICAL ADVISORY AND INTERGOVERNMENTAL COORDINATING COMMITTEE

| | |
|---|---|
| Wayne E. Koessl<br>Chairman | Supervisor, Kenosha County |
| Sheila M. Siegler<br>Vice-Chairman | Clerk, Town of Wheatland; and Commissioner, Southeastern Wisconsin Regional Planning Commission |
| Ronald J. Frederick | Treasurer, Kenosha County |
| Donald K. Holland | Administrator, City of Kenosha |
| Earl W. Hollister | Former Supervisor, Kenosha County |
| George E. Melcher | Director, Kenosha County Office of Planning and Development |
| O. Fred Nelson | Manager, Kenosha Water Utility |
| Fred C. Schmalfeldt | Supervisor, Kenosha County |
| Thomas W. Terwall | Chairman, Town of Pleasant Prairie |
| August Zirbel, Jr | Chairman, Town of Paris |

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# Appendix B

## SUMMARY OF EXISTING ZONING BY MINOR CIVIL DIVISION IN KENOSHA COUNTY: 1985

| Generalized Zoning Category | City of Kenosha | | | Village of Paddock Lake | | | Village of Silver Lake | | | Village of Twin Lakes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total |
| Residential | | | | | | | | | | | | |
| High Density[a] | RS-3 RD RM-1 RM-2 RG-1 RG-2 | 3,948 | 36.8 | Rm-1 | 3 | 0.3 | A Residence B Residence | 620 | 70.4 | Residential Multiple Dwelling | 2,329 | 58.2 |
| Medium Density[b] | RS-1 RS-2 | 2,124 | 19.8 | Rs-1 Rs-2 Rs-3 | 424 | 37.8 | -- | -- | -- | -- | -- | -- |
| Low Density[c] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Suburban Density[d] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Rural Estate[e] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Mobile Home | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Subtotal Residential | -- | 6,072 | 56.6 | -- | 427 | 38.1 | -- | 620 | 70.4 | -- | 2,329 | 58.2 |
| Commercial | B-1 B-2 B-3 | 986 | 9.2 | B-1 | 61 | 5.5 | Business | 85 | 9.7 | Commercial | 179 | 4.5 |
| Industrial | M-1 M-2 | 1,369 | 12.7 | -- | -- | -- | Industrial | 15 | 1.7 | Industrial | 32 | 0.8 |
| Governmental and Institutional | I-P[g] | 2,117 | 19.7 | I-1 | 57 | 5.1 | -- | -- | -- | -- | -- | -- |
| Recreational | -- | -- | -- | P | 24 | 2.1 | -- | -- | -- | Recreational Park | 158 | 3.9 |
| Extractive | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Lowland Conservancy | FW | 168 | 1.6 | C | 75 | 6.7 | Floodway Conservancy Floodplain | 152 | 17.3 | Conservancy Floodway Floodplain Conservancy | 276 | 6.9 |
| Upland Conservancy | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Agricultural | | | | | | | | | | | | |
| Minimum Parcel Size of Less than 5 Acres or Minimum Parcel Size Not Specified | -- | -- | -- | -- | -- | -- | -- | -- | -- | Agricultural[h] | 41 | 1.0 |
| Minimum Parcel Size of 10 Acres | -- | -- | -- | A-A | 339 | 30.2 | -- | -- | -- | -- | -- | -- |
| Minimum Parcel Size of 35 Acres | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Subtotal Agricultural | -- | -- | -- | -- | 339 | 30.2 | -- | -- | -- | -- | 41 | 1.0 |
| Water | -- | 20 | 0.2 | -- | 138 | 12.3 | -- | 8 | 0.9 | -- | 987 | 24.7 |
| Unzoned | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total | -- | 10,732 | 100.0 | -- | 1,121 | 100.0 | -- | 880 | 100.0 | -- | 4,002 | 100.0 |

| Generalized Zoning Category | Town of Brighton | | | Town of Bristol | | | Town of Paris | | | Town of Pleasant Prairie[i] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total |
| Residential | | | | | | | | | | | | |
| High Density[a] | -- | -- | -- | -- | -- | -- | -- | -- | -- | R-9 R-10 R-11 | 65 | 0.3 |
| Medium Density[b] | -- | -- | -- | R-4 R-6 | 153 | 0.7 | -- | -- | -- | R-4 R-5 R-6 R-8 | 4,926 | 21.5 |
| Low Density[c] | R-2 | 16 | 0.1 | R-2 R-3 | 80 | 0.3 | -- | -- | -- | R-2 R-3 | 417 | 1.8 |
| Suburban Density[d] | -- | -- | -- | -- | -- | -- | Country Home | 453 | 2.0 | -- | -- | -- |
| Rural Estate[e] | R-1 | 19 | 0.1 | R-1 | 2 | --[f] | -- | -- | -- | R-1 | 99 | 0.4 |
| Mobile Home | -- | -- | -- | R-12 | 2 | --[f] | -- | -- | -- | R-12 | 122 | 0.5 |
| Subtotal Residential | -- | 35 | 0.2 | -- | 237 | 1.0 | -- | 453 | 2.0 | -- | 5,629 | 24.5 |
| Commercial | -- | -- | -- | B-1 B-3 | 13 | 0.1 | Service Center | 191 | 0.8 | B-1 B-2 B-3 B-4 | 385 | 1.7 |
| Industrial | -- | -- | -- | M-1 M-2 | 31 | 0.1 | Industrial | 52 | 0.2 | M-1 M-2 | 1,027 | 4.5 |
| Governmental and Institutional | I-1 | 3 | --[f] | I-1 | 4 | --[f] | Government | 32 | 0.1 | I-1 | 541 | 2.4 |
| Recreational | PR-1 | 763 | 3.3 | PR-1 | 46 | 0.2 | -- | -- | -- | PR-1 | 691 | 3.0 |
| Extractive | M-3 | 6 | --[f] | M-3 | 86 | 0.4 | -- | -- | -- | M-3 | 375 | 1.6 |
| Lowland Conservancy | C-1 | 703 | 3.1 | C-1 | 1,481 | 6.4 | Conservancy | 544 | 2.4 | C-1 | 3,018 | 13.1 |
| Upland Conservancy | C-2 | 121 | 0.5 | C-2 | 226 | 1.0 | -- | -- | -- | C-2 | 677 | 2.9 |
| Agricultural | | | | | | | | | | | | |
| Minimum Parcel Size of Less than 5 Acres or Minimum Parcel Size Not Specified | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Minimum Parcel Size of 10 Acres | A-2 | 136 | 0.6 | A-2 | 642 | 2.8 | Agricultural | 21,725 | 94.5 | A-2 | 3,070 | 13.4 |
| Minimum Parcel Size of 35 Acres | A-1 | 1,203 | 5.2 | A-1 A-4 | 1,912 | 8.2 | -- | -- | -- | A-1 A-4 | 7,548 | 32.9 |
| Subtotal Agricultural | -- | 1,339 | 5.8 | -- | 2,554 | 11.0 | -- | 21,725 | 94.5 | -- | 10,618 | 46.3 |
| Water | -- | 213 | 0.9 | -- | 188 | 0.8 | -- | -- | -- | -- | -- | -- |
| Unzoned | -- | 19,815 | 86.2 | -- | 18,356 | 79.0 | -- | -- | -- | -- | -- | -- |
| Total | -- | 22,998 | 100.0 | -- | 23,222 | 100.0 | -- | 22,997 | 100.0 | -- | 22,961 | 100.0 |

# Appendix B (continued)

| Generalized Zoning Category | Town of Randall | | | Town of Salem | | | Town of Somers | | | Town of Wheatland | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total | Local Zoning District | Acres | Percent of Total |
| Residential | | | | | | | | | | | | |
| High Density[a] | R-9 | 5 | --[f] | -- | -- | -- | R-9<br>R-10<br>R-11 | 70 | 0.3 | -- | -- | -- |
| Medium Density[b] | R-4<br>R-5<br>R-6<br>R-8 | 368 | 3.2 | Residential A<br>Residential B | 4,092 | 19.3 | R-4<br>R-5<br>R-6<br>R-8 | 502 | 2.4 | R-4<br>R-5 | 251 | 1.6 |
| Low Density[c] | R-2<br>R-3<br>R-7 | 763 | 6.7 | -- | -- | -- | R-2<br>R-3<br>R-7 | 1,628 | 7.7 | R-2<br>R-3<br>R-7 | 644 | 4.2 |
| Suburban Density[d] | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Rural Estate[e] | R-1 | 443 | 3.9 | -- | -- | -- | R-1 | 220 | 1.0 | R-1 | 43 | 0.3 |
| Mobile Home | -- | -- | -- | -- | -- | -- | R-12 | 80 | 0.4 | R-12 | 38 | 0.2 |
| Subtotal Residential | -- | 1,579 | 13.8 | -- | 4,092 | 19.3 | -- | 2,500 | 11.8 | -- | 976 | 6.3 |
| Commercial | B-1<br>B-2<br>B-3 | 35 | 0.3 | Commercial | 1,034 | 4.9 | B-1<br>B-2<br>B-3 | 232 | 1.1 | B-1<br>B-2<br>B-3 | 60 | 0.4 |
| Industrial | M-1<br>M-2 | 25 | 0.2 | Industrial | 2,082 | 9.8 | M-1<br>M-2<br>A-3 | 177 | 0.8 | M-1<br>A-3 | 34 | 0.2 |
| Governmental and Institutional | I-1 | 134 | 1.2 | -- | -- | | I-1 | 891 | 4.2 | I-1 | 31 | 0.2 |
| Recreational | PR-1 | 581 | 5.1 | Recreational | 871 | 4.1 | PR-1 | 752 | 3.5 | PR-1 | 434 | 2.8 |
| Extractive | M-3 | 163 | 1.4 | -- | -- | -- | M-3 | 12 | 0.1 | M-3 | 95 | 0.6 |
| Lowland Conservancy | C-1 | 1,021 | 9.0 | -- | -- | -- | C-1 | 721 | 3.4 | C-1 | 2,475 | 16.1 |
| Upland Conservancy | C-2 | 998 | 8.7 | -- | -- | -- | C-2 | 388 | 1.8 | C-2 | 1,091 | 7.1 |
| Agricultural | | | | | | | | | | | | |
| Minimum Parcel Size of Less than 5 Acres or Minimum Parcel Size Not Specified | -- | -- | -- | Agricultural[j] | 11,320 | 53.5 | -- | -- | -- | -- | -- | -- |
| Minimum Parcel Size of 10 Acres | A-2 | 1,555 | 13.6 | -- | -- | -- | A-2 | 4,833 | 22.7 | A-2 | 2,144 | 13.9 |
| Minimum Parcel Size of 35 Acres | A-1<br>A-4 | 4,889 | 42.9<br>42.9 | -- | -- | -- | A-1<br>A-4 | 10,759 | 50.6 | A-1 | 7,814 | 50.7 |
| Subtotal Agricultural | -- | 6,444 | 56.5 | -- | 11,320 | 53.5 | -- | 15,592 | 73.3 | -- | 9,958 | 64.6 |
| Water | -- | 429 | 3.8 | -- | 1,771 | 8.4 | -- | -- | -- | -- | 263 | 1.7 |
| Unzoned | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Total | -- | 11,409 | 100.0 | -- | 21,170 | 100.0 | -- | 21,265 | 100.0 | -- | 15,417 | 100.0 |

[a] Requires less than 6,000 square feet of lot area per dwelling unit.

[b] Requires 6,000-19,999 square feet of lot area per dwelling unit.

[c] Requires 20,000 square feet to 1.4 acres of lot area per dwelling unit.

[d] Requires 1.5 to 4.9 acres of lot area per dwelling unit.

[e] Requires 5 acres or more of lot area per dwelling unit.

[f] Less than 0.1 percent.

[g] The City of Kenosha I-P Institutional-Park District is intended to provide areas for both institutional and recreational uses. For purposes of this analysis, the I-P Institutional-Park District has been included in the "Governmental and Institutional" zoning category.

[h] No minimum farm parcel size is specified for the Agricultural District in the Village of Twin Lakes zoning ordinance. Uses of the Residential District and other uses are permitted.

[i] The Kenosha County Zoning Ordinance includes a UHO Urban Land Holding Overlay District which indicates that the land is expected to undergo urban development in accordance with the underlying zoning district, but that such development is not permitted at the present time because of one or more deficiencies, such as the lack of essential services or the need to provide access to land-locked areas. New uses are not permitted in such areas until the overlay district is removed. The UHO Urban Land Holding Overlay District has been applied to certain areas zoned for future urban use in the Town of Pleasant Prairie--including about 2,390 acres, or 42 percent, of town land placed in residential zoning districts; and about 30 acres, or 8 percent, of town land placed in business districts.

[j] No minimum farm parcel size is specified for the Agricultural District in the Town of Salem zoning ordinance. Uses are restricted to general farming. No more than two single-family dwellings, each used in connection with the farm, are permitted.

Source: SEWRPC.

# Appendix C

## QUESTIONNAIRES USED IN INVENTORY OF LOCAL UNITS OF GOVERNMENT, INSTITUTIONS, COMMERCIAL ESTABLISHMENTS, AND INDUSTRIES

H0109-W
5/16/85

KENOSHA COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY KENOSHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

MUNICIPAL SOLID WASTE SURVEY
(June 1985)

City/Village/Town of ______________________ Date ______________
Information Prepared By ____________________ Title ______________

To obtain information which can be used by local units of government in Kenosha County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all communities. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Please provide the following information when known or when an estimate can be made:

1. How much solid waste is produced in your community?
   Residential ________ tons/year   Industrial ________ tons/year
   Commercial ________ tons/year   Other ______ _____ tons/year
   Total ________ tons/year

   Number of tires collected for disposal. ________ Number/year

2. Is source separation practiced? If so, check the type of materials separated and if known, the quantity of each material per year.

   __ Newspaper _____ tons/year   __ Glass _____ tons/year
   __ Aluminum _____ tons/year   __ Motor Oil _____ tons/year
   __ White Goods _____ tons/year   __ Other __________ _____ tons/year
   __ Tires _____ number/year

3. Does your community use composting and/or mulching to dispose of yard wastes such as grass clippings, leaves, brush, etc.?

   Amount composted/mulched: __________ tons/year
   Compost/mulch pile location: ______________________________

4. List all recycle or salvage operations, including community-sponsored programs, accepting waste materials from your community.
   Name and address: ______________________________
   ______________________________
   Types of Material Accepted: ______________________________

5. Location and type of waste oil collection center, if present: ______________
   ______________________________

6. What type of solid waste collection service is used?

| Residential wastes: | Amount |
|---|---|
| __ Municipal collection service (only) | _____ tons/year |
| __ Privately-owned collection service (only) | _____ tons/year |
| __ Combination of both | _____ tons/year |
| **Multifamily residential wastes:** | |
| __ Municipal collection service (only) | _____ tons/year |
| __ Privately-owned collection service (only) | _____ tons/year |
| __ Combination of both | _____ tons/year |
| **Industrial wastes:** | |
| __ Municipal collection service (only) | _____ tons/year |
| __ Privately-owned collection service (only) | _____ tons/year |
| __ Combination of both | _____ tons/year |
| **Commercial wastes:** | |
| __ Municipal collection service | _____ tons/year |
| __ Privately-owned collection service | _____ tons/year |
| __ Combination of both | _____ tons/year |

7. Frequency and method of collection (check all that apply):

| Residential | | Commercial | | Industrial | |
|---|---|---|---|---|---|
| Frequency | Method | Frequency | Method | Frequency | Method |
| __ weekly | __ curbside | __ weekly | __ curbside | __ weekly | __ curbside |
| __ twice-weekly | __ backyard | __ twice-weekly | __ backyard | __ twice-weekly | __ backyard |
| __ monthly | __ cart | __ monthly | __ cart | __ monthly | __ cart |
| __ twice-monthly | __ dumpster | __ twice-monthly | __ dumpster | __ twice-monthly | __ dumpster |
| __ other | __ other | __ other | __ other | __ other | __ other |

8. Days per week solid wastes are collected: ____________________

9. Are special pickups conducted for bulk items, furniture, brush, etc.? __________
Frequency ____________________

10. How many residences, commercial establishments, institutions, and industries are served by the municipal collection system?
Residences ______ Institutions ______ Commercial ______ Industries ______

11. What type of collection vehicles and how many vehicles of each type are used in your community for municipal collection services?

Vehicle Type and Capacity Number

______________________________________________

______________________________________________

______________________________________________

12. List all transfer stations or central collection stations utilized by your community.

Station Operator Address

______________________________________________

______________________________________________

13. List all licensed solid waste disposal sites utilized by your community.

| Landfill Operator | Location |
|---|---|
| | |
| | |

14. Please list the largest industrial, commercial, and institutional generators of solid waste in the municipality.

| Industrial | Commercial | Institutional |
|---|---|---|
| | | |
| | | |
| | | |

15. Please list the location and extent of the roadways within the municipality which have seasonal weight restrictions. ____________________

____________________

16. If a private collection service is utilized for residential waste collection, how is the community charged? Indicate the annual cost where applicable below.
______ $/year per user charged to community
______ $/year per user charged to individual user
______ $/year per ton__ or yard__ charged to community
______ $/year lump sum charge to community
______ $/year other (please specify) ____________________
Name and address of private contractor: ____________________
____________________

17. If used, what is the length of and expiration date of the contract governing private collection service? ____________________

18. What is the total annual cost of solid waste disposal in your community? List as much cost information as possible below.
What year are cost estimates based on? ____________

19. List the cost of collection, transport, and disposal, and if applicable, transfer. Please be sure to include saleries, fringe benefits, and equipment operation and maintenance costs. List subtotal cost if components are unknown.

| | |
|---|---|
| collection | $________/yr |
| transport | ________/yr |
| disposal | ________/yr |
| transfer | ________/yr |
| Subtotal | ________/yr |

| | | |
|---|---|---|
| List all administrative expenses | ________ | $/Year |
| Other expenses (please specify ____________ | ________ | $/Year |
| Total Annual Cost | ________ | $/Year |

20. Do the costs included in No. 9 include the cost for disposal of commercial solid wastes?
Yes__ No__. If not, list here if known. ________ $/Year

21. Do the costs included in No. 9 include the cost for disposal of industrial solid wastes?
Yes__ No__. If not, list here if known. ________ $/Year

22. If applicable, please list the cost per ton for disposal of municipally collected refuse at appropriate disposal site. $____________ per ton

23. Please provide a summary, by year, of total solid waste generated and collection and disposal costs over the last 5 years:

| | | | |
|---|---|---|---|
| 1980 $________ ________ tons/year | 1983 $________ ________ tons/year |
| 1981 $________ ________ tons/year | 1984 $________ ________ tons/year |
| 1982 $________ ________ tons/year | |

24. Please give an indication of the seasonal variation and any other fluctuations over the course of the year in solid waste production for your community.
    Weekly maximum quantity collected ______________________________
    Monthly maximum quantity collected ______________________________
    Weekly minimum quantity collected ______________________________
    Monthly minimum quantity collected ______________________________

25. Please list any zoning districts in which solid waste management facilities would be permitted by right or as a conditional use.
    ______________________________________________________________

26. Please note any comments or particular concerns that you may want to express regarding solid waste disposal in your community or the County.
    ______________________________________________________________
    ______________________________________________________________
    ______________________________________________________________

27. If available, please provide a map or written description of the areas collected and the end points for each collection route, as well as the location of the collection truck, starting and ending points. This information is intended to be used to assess the transportation costs of various alternatives.

Please return this questionnaire to:

Mr. Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53187

H0109-T

KENOSHA COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY KENOSHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

INSTITUTIONAL SOLID WASTE SURVEY QUESTIONNAIRE
July 1985

To obtain information which can be used by local institutions in Kenosha County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all industries. If possible, please fill out a separate questionnaire for each major site, facility, or plant at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Establishment Name ______________________________
Address ______________________________ Phone ______________
Information prepared by: ______________________ Title ______________
Please provide the following information: SIC Code ______________

1. Type of Institution ______________________________

2. Type of solid and liquid wastes produced ______________________

3. Total solid waste produced per year*

   cubic yards ________ tons ________

4. Total liquid waste produced per year*

   gallons ________ or pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your establishment ______________________________

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

   Landfill — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Landfill — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Incinerator — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Recycle/reuse — Percent of solid waste _____ Percent of liquid waste _____

   If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ______________________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990. ________________________________________

8. Transfer stations or central collection point for solid waste prior to hauling:

Owner/operator ________________________________________
Location ________________________________________
Is compactor used? ________________________________________
Total capacity of transfer station(s) ______________________________
Percent of waste generated which is processed at transfer station(s) __________
Hours of operation ________________________________________

9. Solid waste hauling

By owner ____________
By private collector or municipality ____________

Collection Frequency: ____________________
Name: ______________________________
Address: ______________________________

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

| | | Solid Wastes | Liquid Wastes |
|---|---|---|---|
| Collection: | Municipal waste collection | $ ________ | $ ________ |
| | Private contract hauler | ________ | ________ |
| Disposal: | Municipal landfill | ________ | ________ |
| | Private landfill | ________ | ________ |
| Administrative: | | ________ | ________ |
| Other (please specify): | | ________ | ________ |
| Total annual cost | | $ ________ | $ ________ |

11. What year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

$ __________ per ton
$ __________ per cubic yard
$ __________ other

13. Length of contract governing above charges __________ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

________________________________________
________________________________________
________________________________________
________________________________________

Please return this questionnaire to:

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

| Waste Types | Annual[b] Amount ($yd^3$ or tons) | Annual[b] Volume ($ft^3$ or gallon) | Waste Quantities[a] Methods of Disposal: Sanitary Landfill | Incinerator | Recycle Reuse | Other (specify |
|---|---|---|---|---|---|---|
| Solid Waste | | | | | | |
| Paper and paper products | | | | | | |
| Plastics ............... | | | | | | |
| Metals (specify type)... | | | | | | |
| Rags and cloth materials | | | | | | |
| Wood .................. | | | | | | |
| Rubber products ........ | | | | | | |
| Glass .................. | | | | | | |
| Toxic or hazardous wastes .............. | | | | | | |
| Foundry sand .......... | | | | | | |
| Tires .................. | | | | | | |
| Air or waste treatment sludges ............. | | | | | | |
| Other (specify)........ | | | | | | |
| Liquid Waste (Other than liquids disposed of as sewage) | | | | | | |
| Oils and greases ....... | | | | | | |
| Chemical sludges ....... | | | | | | |
| Solvents .............. | | | | | | |
| Other (specify) ........ | | | | | | |

[a] Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b] Please express waste amounts in appropriate category.

H0109-0

KENOSHA COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY KENOSHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

COMMERCIAL SOLID WASTE SURVEY QUESTIONNAIRE
(July 1985)

To obtain information which can be used by local industries in Kenosha County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all industries. If possible, please fill out a separate questionnaire for each major site, facility, or plant at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Establishment Name ______________________________
Address ______________________________ Phone ______________
Information prepared by: ______________________ Title ______________
Please provide the following information: SIC Code ______________

1. Type of Commercial Establishment ______________________________

2. Type of solid and liquid wastes produced ______________________________

3. Total solid waste produced per year*

   cubic yards ________ tons ________

4. Total liquid waste produced per year*

   gallons ________ or pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your establishment ______________________________

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

   Landfill — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Landfill — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Incinerator — Percent of solid waste _____ Percent of liquid waste _____
   Owner/operator: Name ______________________________
   Address ______________________________

   Recycle/reuse — Percent of solid waste Percent of liquid waste _____

   If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ______________________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990. ______________________________

8. Transfer stations or central collection point for solid waste prior to hauling:

   Owner/operator ______________________________
   Location ______________________________
   Is compactor used? ______________________________
   Total capacity of transfer station(s) ______________________________
   Percent of waste generated which is processed at transfer station(s) __________
   Hours of operation ______________________________

9. Solid waste hauling

   Collection Frequency: ______________

   By owner ___________
   By private collector or municipality __________

   Name: ______________________________
   Address: ______________________________

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

| | | Solid Wastes | Liquid Wastes |
|---|---|---|---|
| Collection: | Municipal waste collection | $ ________ | $ ________ |
| | Private contract hauler | ________ | ________ |
| Disposal: | Municipal landfill | ________ | ________ |
| | Private landfill | ________ | ________ |
| Administrative: | | ________ | ________ |
| Other (please specify): | | ________ | ________ |
| Total annual cost | | $ ________ | $ ________ |

11. What year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

   $ __________ per ton
   $ __________ per cubic yard
   $ __________ other

13. Length of contract governing above charges __________ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

   ______________________________
   ______________________________
   ______________________________
   ______________________________

Please return this questionnaire to:

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

| Waste Types | Annual[b] Amount ($yd^3$ or tons) | Annual[b] Volume ($ft^3$ or gallon) | Waste Quantities[a] Methods of Disposal Sanitary Landfill | Incinerator | Recycle Reuse | Other (specify |
|---|---|---|---|---|---|---|
| Solid Waste | | | | | | |
| Paper and paper products | ______ | ______ | ______ | ______ | ______ | ______ |
| Plastics ............... | ______ | ______ | ______ | ______ | ______ | ______ |
| Metals (specify type)... | ______ | ______ | ______ | ______ | ______ | ______ |
| Rags and cloth materials | ______ | ______ | ______ | ______ | ______ | ______ |
| Wood ................... | ______ | ______ | ______ | ______ | ______ | ______ |
| Rubber products ........ | ______ | ______ | ______ | ______ | ______ | ______ |
| Glass .................. | ______ | ______ | ______ | ______ | ______ | ______ |
| Toxic or hazardous wastes ............... | ______ | ______ | ______ | ______ | ______ | ______ |
| Foundry sand ........... | ______ | ______ | ______ | ______ | ______ | ______ |
| Tires .................. | ______ | ______ | ______ | ______ | ______ | ______ |
| Air or waste treatment sludges .............. | ______ | ______ | ______ | ______ | ______ | ______ |
| Other (specify)......... | ______ | ______ | ______ | ______ | ______ | ______ |
| Liquid Waste (Other than liquids disposed of as sewage) | | | | | | |
| Oils and greases ....... | ______ | ______ | ______ | ______ | ______ | ______ |
| Chemical sludges ....... | ______ | ______ | ______ | ______ | ______ | ______ |
| Solvents ............... | ______ | ______ | ______ | ______ | ______ | ______ |
| Other (specify) ........ | ______ | ______ | ______ | ______ | ______ | ______ |

[a]Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b]Please express waste amounts in appropriate category.

H0109-Q

KENOSHA COUNTY SOLID WASTE MANAGEMENT STUDY
BEING CONDUCTED JOINTLY BY KENOSHA COUNTY AND THE
SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

INDUSTRIAL SOLID WASTE SURVEY QUESTIONNAIRE
(July 1985)

To obtain information which can be used by local industries in Kenosha County to consider alternative solid waste management systems, you are being asked to provide the following information. Not all of this information will be available and some data will not be applicable to all industries. If possible, please fill out a separate questionnaire for each major site, facility, or plant at which solid waste is generated. In cases where questions are not applicable, please indicate "N/A". Should you have any questions concerning this matter, please contact Mr. Robert P. Biebel of the SEWRPC staff at (414) 547-6721.

Industry Name ____________________
Address ____________________ Phone ____________________
Information prepared by: ____________________ Title ____________________
Please provide the following information: SIC Code ____________________

1. Type of Industry ____________________

2. Type of solid and liquid wastes produced ____________________

3. Total solid waste produced per year*

   cubic yards ________ tons ________

4. Total liquid waste produced per year*

   gallons ________ pounds ________

5. Please describe the seasonal and/or annual variation in solid waste production for your industry ____________________

6. Type of solid waste disposal: (Please include all wastes, i.e., those hauled by owner, contractor, or both).

   Landfill Percent of solid waste _____ Percent of liquid waste ____
   Owner/operator: Name ____________________
   Address ____________________

   Landfill Percent of solid waste _____ Percent of liquid waste ____
   Owner/operator: Name ____________________
   Address ____________________

   Incinerator Percent of solid waste ____ Percent of liquid waste ____
   Owner/operator: Name ____________________
   Address ____________________

   Recycle/reuse Percent of solid waste ____ Percent of liquid waste ____

   If wastes are salvaged or recycled either internally or through a commercial operator, please list the name and location of recycling operation, the waste types, and quantity. ____________________

*Please fill out inventory sheets attached.

7. Please indicate your expected increase or decrease in solid waste production by the year 1990. ______

8. Transfer stations or central collection point for solid waste prior to hauling:

Owner/operator ______
Location ______
Is compactor used? ______
Total capacity of transfer station(s) ______
Percent of waste generated which is processed at transfer station(s) ______
Hours of operation ______

9. Solid waste hauling

Collection Frequency: ______

By owner ______
By private collector or municipality ______

Name: ______
Address: ______

10. Total solid waste disposal costs (dollars/year) including municipal collection programs and private contract solid waste hauling.

| | | Solid Wastes | Liquid Wastes |
|---|---|---|---|
| Collection: | Municipal waste collection | $ ______ | $ ______ |
| | Private contract hauler | ______ | ______ |
| Disposal: | Municipal landfill | ______ | ______ |
| | Private landfill | ______ | ______ |
| Administrative: | | ______ | ______ |
| Other (please specify): | | ______ | ______ |
| | Total annual cost | $ ______ | $ ______ |

11. Whate year are cost estimates based on? ______

12. Basis of charges from private contractors or municipal haulers:

$ ______ per ton
$ ______ per cubic yard
$ ______ other

13. Length of contract governing above charges ______ years.

14. Please indicate any concerns or thoughts you may want to express relating to solid waste disposal in the County or to the solid waste planning program.

______
______
______
______

Please return this questionnaire to:

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional Planning Commission
P.O. Box 769
Waukesha, Wisconsin 53186

SOLID WASTE QUANTITY INVENTORY SHEET

| | | | Waste Quantities[a] Methods of Disposal | | | |
|---|---|---|---|---|---|---|
| Waste Types | Annual[b] Amount ($yd^3$ or tons) | Annual[b] Volume ($ft^3$ or gallon) | Sanitary Landfill | Incinerator | Recycle Reuse | Other (specify |
| **Solid Waste** | | | | | | |
| Paper and paper products | | | | | | |
| Plastics .............. | | | | | | |
| Metals (specify type)... | | | | | | |
| Rags and cloth materials | | | | | | |
| Wood .................. | | | | | | |
| Rubber products ........ | | | | | | |
| Glass .................. | | | | | | |
| Toxic or hazardous wastes .............. | | | | | | |
| Foundry sand .......... | | | | | | |
| Tires .................. | | | | | | |
| Air or waste treatment sludges ............. | | | | | | |
| Other (specify)......... | | | | | | |
| **Liquid Waste** (Other than liquids disposed of as sewage) | | | | | | |
| Oils and greases ....... | | | | | | |
| Chemical sludges ....... | | | | | | |
| Solvents .............. | | | | | | |
| Other (specify) ........ | | | | | | |

[a]Please express units for each quantity entered on work sheet. Please use estimates if exact amounts are unknown.

[b]Please express waste amounts in appropriate category.

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# Appendix D

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## Appendix E

## UNIT COSTS UTILIZED IN DEVELOPMENT OF COST ESTIMATES FOR SOLID WASTE MANAGEMENT ALTERNATIVES[a,b]

I. Source Separation

A. Element 1: Recycling Centers

| | |
|---|---|
| Large Recycling Facilities | |
| 1. Recycling Center Capital Costs | |
| a. Building, office supplies, telephone, heated; no water or sanitary sewer | $ 7,500 per site |
| b. Fence and gate | 5,200 per site |
| c. Gravel surface | 1,600 per site |
| d. Electric service and telephone | 400 per site |
| e. Screening and signs | 600 per site |
| 2. Operation Equipment Capital Costs | |
| a. Containers | |
| 1) Two 8-yard$^3$ | 1,400 each |
| 2) Five 12-yard$^3$ | 1,800 each |
| Two semi-trailers | 2,500 each |
| Ten 55-gallon steel barrels | 10 each |
| b. Miscellaneous equipment/tools | 600 per site |
| 3. Operation and Maintenance (per year) | |
| a. Utilities | 400 per site |
| b. Advertising | 3,000 per site |
| c. Miscellaneous supplies and equipment | 700 per site |
| d. Coordination and operation | 8,700 per site |
| e. Transportation | 14,900 per site |
| Small Recycling Facilities | |
| 1. Recycling Center Capital Costs | |
| a. Building: small building for shelter, office supplies, telephone, heated; no water or sanitary sewer | 4,500 per site |
| b. Fence and gate | 4,000 per site |
| c. Gravel surface | 1,200 per site |
| d. Electric service and telephone | 400 per site |
| e. Screening and signs | 500 per site |
| 2. Operation Equipment Capital Costs | |
| a. Containers | |
| 1) Two 8-yard$^3$ | 1,400 each |
| 2) Two 12-yard$^3$ | 1,800 each |
| Six 55-gallon steel barrels | 10 each |
| One semi-trailer | 2,500 each |
| b. Miscellaneous equipment and tools | 500 per site |
| 3. Operation and Maintenance | |
| a. Utilities | 300 per site |
| b. Advertising | 2,000 per site |
| c. Miscellaneous supplies and equipment | 500 per site |

d. Coordination and operation — $ 6,800 per site
e. Transportation — 7,700 per site

B. Element 2: Curbside Newsprint Collection

1. Capital Cost
   a. Retrofit existing collection vehicles with racks — $ 500 per truck

C. Element 3: Composting

1. Site Size — 1.0 acre per 3,000-4,000 cubic yards of compost material

2. Site Work — Variable use $5,000 as average

3. Equipment — Assume equipment available for other uses--Shared cost $10,000 per site

| | Actual Costs |
|---|---|
| Front End Loader | $60,000 to 140,000 |
| Vacuum Leaf Collector | 60,000 to 100,000 |
| Chipper | 20,000 to 140,000 |
| Shredder | 50,000 to 120,000 |

4. Operation and Maintenance
   Without collection — $35 per ton
   With collection — 75 per ton

D. Element 4: Household Toxic and Hazardous Waste Collection

1. Operation and Maintenance Costs (costs based on one collection at two sites with a total of about 4,000 households participating) — $30,000 per collection

II and III. Collection and Transport

A. Trucking Operation Costs

1. 75- to 100-cubic-yard trailer — $ 60 per hour
2. 35- to 40-cubic-yard compactor — 55 per hour
3. 20- to 30-cubic-yard compactor — 55 per hour
4. 30-yard hauling truck — 60 per hour

IV. Transfer

A. Capital Costs

1. Small-capacity rural area stations — $75,000 per station
2. Large capacity — Cost is site-specific

B. Operation Costs

1. Small-capacity transfer facilities — $3.50 per ton of waste
2. Large-capacity transfer facilities — 3.00 per ton of waste

V. Disposal

| | |
|---|---|
| A. Landfill Capital, Operation and Maintenance (Includes cost for landfill disposal and construction of additional capacity over the plan period which is assumed to be constructed incrementally over the plan period) | $15 per ton of solid waste |
| B. Disposal of Municipal Sludge by Private Hauler | |
| 1. Transportation, storage at lagoon, and land application | $0.05/gallon |

---

[a]Cost expressed in terms of 1987 dollars.

[b]Sources used to develop unit cost include the following:

1. Robert Snow Means Company, Inc., Means Building Construction Cost Data 1985, 43rd Annual Edition.

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## Appendix F

## DETAILED COST ESTIMATES UTILIZED FOR EVALUATION OF SOLID WASTE MANAGEMENT ALTERNATIVES

### Appendix F-1

### ALTERNATIVE PLAN 1: CONTINUED USE OF EXISTING SOLID WASTE MANAGEMENT SYSTEM

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling | | |
| Capital - 10 @ $20,000 = $200,000 | $200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Solid Waste Transfer | $ -- | $ 107,000 |
| III. Solid Waste Transportation | $ -- | $ 729,000 |
| IV. Solid Waste Landfill Disposal at Large Commercial Use Landfills and Upgrade Three Existing Landfills | $180,000[a] | $2,085,000[b] |
| Total Cost | $380,000 | $3,106,000[c] |

NOTE: Unit Cost = $22.10 per ton of solid waste based upon amortization of the capital cost of $380,000 at 6 percent over 20 years plus the operation and maintenance cost.

[a]Cost for upgrading three existing small landfills, including groundwater monitoring well installation.

[b]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan. If present cost--about $10 per ton--is used, this cost becomes $1,390,000, and the total annual cost is $S2,464,000 and the unit cost is $17.18 per ton.

[c]Does not include annual amortized cost of $33,000.

Source: SEWRPC.

## Appendix F-2

### ALTERNATIVE PLAN 2: DISPOSAL OF SOLID WASTES AT A SINGLE EXISTING COMMERCIAL GENERAL-USE LANDFILL AND AT THREE EXISTING PRIVATE SPECIAL-USE LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling | | |
| Capital - 10 @ $20,000 = $200,000 | $200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Solid Waste Transfer | | |
| Capital - 2 @ $75,000 = $150,000 | $150,000 | $ -- |
| O & M | -- | 107,000 |
| III. Solid Waste Transportation | $ -- | $ 792,000 |
| IV. Solid Waste Landfill Disposal Commercial Use Landfills | $ -- | $2,085,000[a] |
| Total Cost | $350,000 | $3,169,000[b] |

NOTE: Unit Cost = $22.53 per ton of solid waste based upon amortization of the capital cost of $350,000 at 6 percent over 20 years plus the operation and maintenance cost.

[a]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

[b]Does not include annual amortized capital cost of $30,000.

Source: SEWRPC.

## Appendix F-3

## ALTERNATIVE PLAN 3: DISPOSAL OF SOLID WASTES AT TWO EXISTING COMMERCIAL GENERAL-USE LANDFILLS AND AT THREE EXISTING PRIVATE SPECIAL-USE LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling[a] | | |
| Capital - 10 @ $20,000 = $200,000 | $200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Transfer Facility | | |
| Capital - 2 @ $75,000 = $150,000 | $150,000 | $ -- |
| O & M | -- | 107,000 |
| III. Solid Waste Transportation | $ -- | $ 750,000 |
| IV. Solid Waste Landfill Disposal Commercial Use Landfills | $ -- | $2,085,000[a] |
| Total Cost | $350,000 | $3,127,000[b] |

NOTE: Unit Cost = $22.23 per ton of solid waste based upon amortization of the capital cost of $350,000 at 6 percent over 20 years plus the operation and maintenance cost.

[a]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

[b]Does not include annual amortized capital cost of $30,000.

Source: SEWRPC.

## Appendix F-4

### ALTERNATIVE PLAN 4: PROCESSING OF A PORTION OF THE SOLID WASTES AT ONE NEW INCINERATOR DESIGNED FOR STEAM PRODUCTION, WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling | | |
| Capital - 10 @ $20,000 = $200,000 | $ 200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Transfer Facility | | |
| Capital - 2 @ $75,000 = $150,000 | $ 150,000 | $ -- |
| O & M | -- | 38,000 |
| III. Solid Waste Transportation | $ -- | $ 598,000 |
| IV. Solid Waste Incineration | | |
| A. Equipment | $ 6,996,000 | $ -- |
| B. Construction | 3,315,000 | -- |
| C. Land Acquisition | 200,000 | -- |
| D. Engineering, Environmental, and Legal Costs; Contingency and Interest During Construction | 8,600,000 | -- |
| E. Facility Operation and Maintenance | -- | 1,399,000 |
| F. Ash Transport and Landfill Disposal | -- | 454,000 |
| G. Less Average Annual Revenue | -- | (1,285,000) |
| Subtotal | $19,111,000 | $ 563,000 |
| V. Solid Waste Landfill Disposal | $ -- | $ 1,245,000[a] |
| Total Cost | $19,461,000 | $ 2,629,000[b] |

NOTE: Unit Cost = $30.43 per ton of solid waste based upon amortization of the $19,461,000 plus the operation and maintenance cost.

[a]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

[b]Does not include annual amortized capital cost of $1,693,000.

Source: SEWRPC.

## Appendix F-5

### ALTERNATIVE PLAN 5: PROCESSING OF A PORTION OF THE SOLID WASTES AT ONE NEW INCINERATOR DESIGNED FOR ELECTRIC POWER PRODUCTION, WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling | | |
| Capital - 10 @ $20,000 = $200,000 | $ 200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Transfer Facility Construction | | |
| Capital - 2 @ $75,000 = $150,000 | $ 150,000 | $ -- |
| O & M | -- | 38,000 |
| III. Solid Waste Transportation | $ -- | $ 598,000 |
| IV. Solid Waste Incineration | | |
| A. Equipment | $ 7,550,000 | $ -- |
| B. Construction | 2,526,000 | -- |
| C. Land Acquisition | 200,000 | -- |
| D. Engineering, Environmental, and Legal Costs; Contingency and Interest During Construction | 8,400,000 | -- |
| E. Facility Operation and Maintenance | -- | 1,464,000 |
| F. Ash Transport and Landfill Disposal | -- | 454,000 |
| G. Less Average Annual Revenue | -- | (673,000) |
| Subtotal | $18,676,000 | $1,245,000 |
| V. Solid Waste Landfill Disposal | $ -- | $1,245,000[a] |
| Total Cost | $19,026,000 | $3,311,000[b] |

NOTE: Unit Cost = $34.97 per ton of solid waste based upon amortization of the capital cost of $19,026,000 plus the operation and maintenance cost.

[a]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

[b]Does not include annual amortized capital cost of $1,655,000.

Source: SEWRPC.

## Appendix F-6

### ALTERNATIVE PLAN 6: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS DESIGNED FOR STEAM PRODUCTION, WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling[a] | | |
| Capital - 10 @ $20,000 = $200,000 | $ 200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000[b] |
| II. Transfer Facility Construction | | |
| Capital - 2 @ $75,000 = $150,000 | $ 150,000 | $ -- |
| III. Solid Waste Transportation | $ -- | $ 500,000 |
| IV. Solid Waste Transfer | $ -- | $ 38,000 |
| V. Solid Waste Incineration | | |
| A. Equipment | $10,474,000 | $ -- |
| B. Construction | 3,584,000 | -- |
| C. Land Acquisition | 400,000 | -- |
| D. Engineering, Environmental, and Legal Costs; Contingency and Interest During Construction | 14,304,000 | -- |
| E. Facility Operation and Maintenance | -- | 2,270,000 |
| F. Ash Transport and Landfill Disposal | -- | 410,000 |
| G. Less Average Annual Revenue | -- | (1,285,000) |
| Subtotal | $28,762,000 | $ 1,395,000 |
| VI. Solid Waste Landfill Disposal | $ -- | $ 1,790,000[c] |
| Total Cost | $29,112,000 | $ 3,980,000 |

NOTE: Unit Cost = $46.03 per ton of solid waste.

[a]The recycling facility located at the Village of Twin Lakes landfill, although required under Chapter 144 of the Wisconsin Statutes, is anticipated to close soon after the landfill is abandoned. The Village of Twin Lakes will, however, incur capital and operating expenses while the facility is operational.

[b]Does not include annual amortized capital cost of $2,533,000.

[c]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility to be included in the plan.

Source: SEWRPC.

# Appendix F-7

## ALTERNATIVE PLAN 7: PROCESSING OF A PORTION OF THE SOLID WASTES AT TWO NEW INCINERATORS DESIGNED FOR ELECTRIC POWER PRODUCTION, WITH DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES AND INCINERATOR ASH AT EXISTING LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling[a] | | |
| Capital - 10 @ $20,000 = $200,000 | $ 200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000[b] |
| II. Transfer Facility Construction | | |
| Capital - 2 @ $75,000 = $150,000 | $ 150,000 | $ -- |
| III. Solid Waste Transportation | $ -- | $ 500,000 |
| IV. Solid Waste Transfer | $ -- | $ 38,000 |
| V. Solid Waste Incineration | | |
| A. Equipment | $13,240,000 | $ -- |
| B. Construction | 4,098,000 | -- |
| C. Land Acquisition | 200,000 | -- |
| D. Engineering, Environmental, and Legal Costs; Contingency and Interest During Construction | 14,984,000 | -- |
| E. Facility Operation and Maintenance | -- | 2,310,000 |
| F. Ash Transport and Landfill Disposal | -- | 410,000 |
| G. Less Average Annual Revenue | -- | (673,000) |
| Subtotal | $32,722,000 | $2,047,000 |
| VI. Solid Waste Landfill Disposal | $ -- | $1,790,000[c] |
| Total Cost | $33,072,000 | $4,560,000 |

NOTE: Unit Cost = $52.57 per ton of solid waste.

[a]The recycling facility located at the Village of Twin Lakes landfill, although required under Chapter 144 of the Wisconsin Statutes, is anticipated to close soon after the landfill is abandoned. The Village of Twin Lakes will, however, incur capital and operating expenses while the facility is operational.

[b]Does not include annual amortized capital cost of $2,877,000.

[c]This cost includes a landfilling capital cost component which is assumed to be made incrementally over the life of each landfill facility to be included in the plan.

Source: SEWRPC.

## Appendix F-8

### ALTERNATIVE PLAN 8: PROCESSING OF A PORTION OF THE SOLID WASTES INTO REFUSE-DERIVED FUEL, INCINERATION AT ONE NEW INCINERATOR DESIGNED FOR ELECTRIC POWER GENERATION, AND THE DISPOSAL OF UNINCINERATED AND UNRECYCLED SOLID WASTES, REFUSE-DERIVED FUEL RESIDUE, AND INCINERATOR ASH AT EXISTING LANDFILLS

| Plan Subelement | Initial Capital Costs | Average Annual Operation and Maintenance 1990-2010 |
|---|---|---|
| I. Residential Solid Waste Recycling | | |
| Capital - 10 @ $20,000 = $200,000 | $ 200,000 | $ -- |
| O & M - 10 @ 18,500 = 185,000 | -- | 185,000 |
| II. Transfer Facility Construction | | |
| Capital - 2 @ $75,000 = $150,000 | $ 150,000 | $ -- |
| O & M | -- | 38,000 |
| III. Solid Waste Transportation | $ -- | $ 697,000 |
| IV. Solid Waste Conversion to Refuse-Derived Fuel | $ 6,320,000 | $ 494,000 |
| V. Solid Waste Incineration | | |
| A. Equipment | $ 5,522,000 | $ -- |
| B. Construction | 1,711,000 | -- |
| C. Land Acquisition | 200,000 | -- |
| D. Engineering, Environmental, and Legal Costs; Contingency and Interest During Construction | 6,428,000 | -- |
| E. Facility Operation and Maintenance | -- | 880,000 |
| F. Ash Transport and Landfill Disposal | -- | 143,000 |
| G. Less Average Annual Revenue | -- | (1,100,000) |
| Subtotal | $13,861,000 | $ (77,000) |
| VI. Solid Waste Landfill Disposal | $ -- | $ 1,537,000[a] |
| Total Cost | $20,531,000 | $ 2,874,000[b] |

NOTE: Unit Cost = $32.94 per ton of solid waste based upon amortization of the capital cost of $20,531,000 at 6 percent over 20 years plus the operation and maintenance cost.

[a]Based upon a charge of $15 per ton. Costs assume increases over present charges in order to fully comply with all regulations and environmental controls. Costs include a landfilling component which is assumed to be made incrementally over the life of each landfill facility included in the plan.

[b]Does not include annual amortized capital cost of $1,786,000.

Source: SEWRPC.

## Appendix G

## NEWSPAPER ARTICLES PERTAINING TO KENOSHA COUNTY SOLID WASTE MANAGEMENT PLAN

# Solid waste plan begun

Managing solid waste in the county is a problem that may have a solution in the fall.

The county Solid Waste Management Planning Committee met Monday to discuss techniques for sludge and solid waste management proposed by the Southeastern Wisconsin Regional Planning Commission.

"Right now we're just beginning to touch on the options available," said Robert Biebel, SEWRPC representative.

In 1985 the County Board enlisted the help of SEWRPC to develop a long-range solid waste plan for the county through 2010. Such plans have already been developed for most counties in the state, said Biebel.

SEWRPC is drafting a preliminary proposal of 10 plans for management of residential, commercial and industrial solid waste, and six sewage plant sludge management plans.

Further analysis of the county's solid waste management needs by the committee and SEWRPC will narrow the list of 16 plans to those that more specifically fit Kenosha's needs. More information about physical operation, needs, costs and questions of county, municipal or private ownership and operation of solid waste facilities will be discussed.

Biebel said the committee will complete the plan and hold a public hearing by late summer.

KENOSHA NEWS
June 30, 1987

# County garbage plan to be aired

## *Two public hearings scheduled*

**By Dave Backmann**
Staff Writer

**Having your say on waste plan**

**The waste disposal plan, designed to meet the county's solid waste management needs through the year 2010, includes recommendations for voluntary separation of recyclable materials, which could become mandatory.**

☐ **Public hearings: 7:30 p.m. Tuesday** in Room 310 of the Courthouse, 912 56th St.,
**7:30 p.m. Wednesday** in the Wheatland Town Hall, 34315 Geneva Road (Highway 50) New Munster.

☐ **If you can't attend:** Summary copies of the plan are available at the Kenosha County Department of Planning and Development, in the Courthouse, and at the Wheatland Town Hall. Written comments may be submitted to the planning department or the Wheatland Town Hall through Nov. 9.

Because Wisconsin is running out of landfill space, that nightly chore of taking out the garbage is going to get more complicated in the next several years.

To learn how to deal with those complications, a county committee recommends citizens attend two public hearings next week.

Among issues to be discussed at the hearings are how Kenosha County residents can comply with a state law banning the disposal of grass clippings and leaves in landfills by 1992.

The hearings are scheduled for 7:30 p.m. Tuesday in Room 310 of the Courthouse, 912 56th St., and at 7:30 p.m. Wednesday in the Wheatland Town Hall, 34315 Geneva Road (Highway 50) New Munster.

Members of the county's Solid Waste Management Technical Advisory and Intergovernmental Coordinating Committee will explain a plan they have developed to meet changing state laws regarding solid waste disposal.

The plan, written over the past two years, is designed to meet the county's solid waste management needs through the year 2010. Plan recommendations, such as voluntary separation of recyclable materials, could become mandatory rules as state law changes.

For example, Senate Majority Leader Joseph Strohl, D-Racine, said Wednesday a mandatory recycling bill will be introduced to the Legislature next spring. The legislation would prohibit materials such as plastics, newsprint and aluminum cans from being buried in landfills.

The Kenosha County plan encourages residents to use mulching lawn mowers to chop up grass clippings and other yard wastes. Compost piles could be started in people's yards or hauled by residents to one of seven proposed compost areas throughout the county.

*"The plan really is saying, 'Let's try to get people to reduce their wastes through a voluntary approach.'"*

*Robert Biebel,*
*SWRPC staff*

General areas for community compost piles are recommended in the plan, but no actual sites are designated.

All other recommendations in the plan are voluntary programs including:

☐ Residential recycling of paper, glass, metal, waste oil and plastic. Citizens would transport these materials to one of 12 recycling centers countywide.

☐ Curbside collection of newsprint. Municipal and private waste collection vehicles would be equipped with special racks for temporary storage and transport of newsprint.

☐ Household management of toxic and hazardous wastes.

☐ Continued use of existing municipal and private garbage collection and transportation operations.

☐ Transferring solid wastes from one type of vehicle to another prior to disposal. This program includes building two new refuse transfer stations in Randall and Bristol and continuing to use the five existing transfer stations throughout the county.

George Melcher, Kenosha County Planning and Development director, said the plan sets no deadline for creating the programs other than to meet the 1992 mandate for yard wastes disposal.

City, town and village governments in Kenosha County will be asked to approve the plan in the coming months.

"The plan really is saying, 'Let's try to get people to reduce their wastes through a voluntary approach,' " said Robert Biebel, a Southeastern Wisconsin Regional Planning Commission staff member who helped write the plan.

Similar plans have been written for all other southeastern Wisconsin counties, he said.

The plan for Kenosha County differs from the others, Biebel said, because it calls for continued use of landfills like Pheasant Run in the town of Paris. Other counties are having to explore more costly alternatives such as incineration.

All residential refuse from the city of Kenosha has been trucked to Pheasant Run since 1986.

KENOSHA NEWS
October 20, 1988

# County garbage piling up

KENOSHA NEWS
October 26, 1988

## *Landfill may be filling sooner than expected*

**By Dave Backmann**
**Staff Writer**

The committee planning the future of garbage disposal in Kenosha County learned Tuesday the Pheasant Run landfill may be filling up sooner than expected and not many citizens may participate in voluntary recycling plans.

Since 1986, all of the city's residential refuse has been trucked to the Pheasant Run site near highways 45 and K in the town of Paris.

Bristol Town Chairman Noel Elfering told the Solid Waste Management Technical Advisory and Intergovernmental Coordinating Committee a line of trucks daily is hauling refuse to Pheasant Run from northeastern Illinois communities.

Diane Kastelic, representing the Kenosha League of Women Voters, also warned the committee that nearby Illinois communities will be without a landfill site in their own state within a year.

Their comments came at the first of two public hearings before the committee on how to manage solid waste disposal in Kenosha County for the next 20 years. A second hearing is scheduled for 7:30 p.m. Thursday in the Wheatland Town Hall.

Elfering and Kastelic said the incoming Illinois refuse may result in Pheasant Run filling up sooner than expected, causing a problem for Kenosha County.

Robert Biebel, a Southeastern Wisconsin Regional Planning Commission staff member, said he will find out if more Illinois refuse is coming into Pheasant Run than what Kenosha County planners had expected.

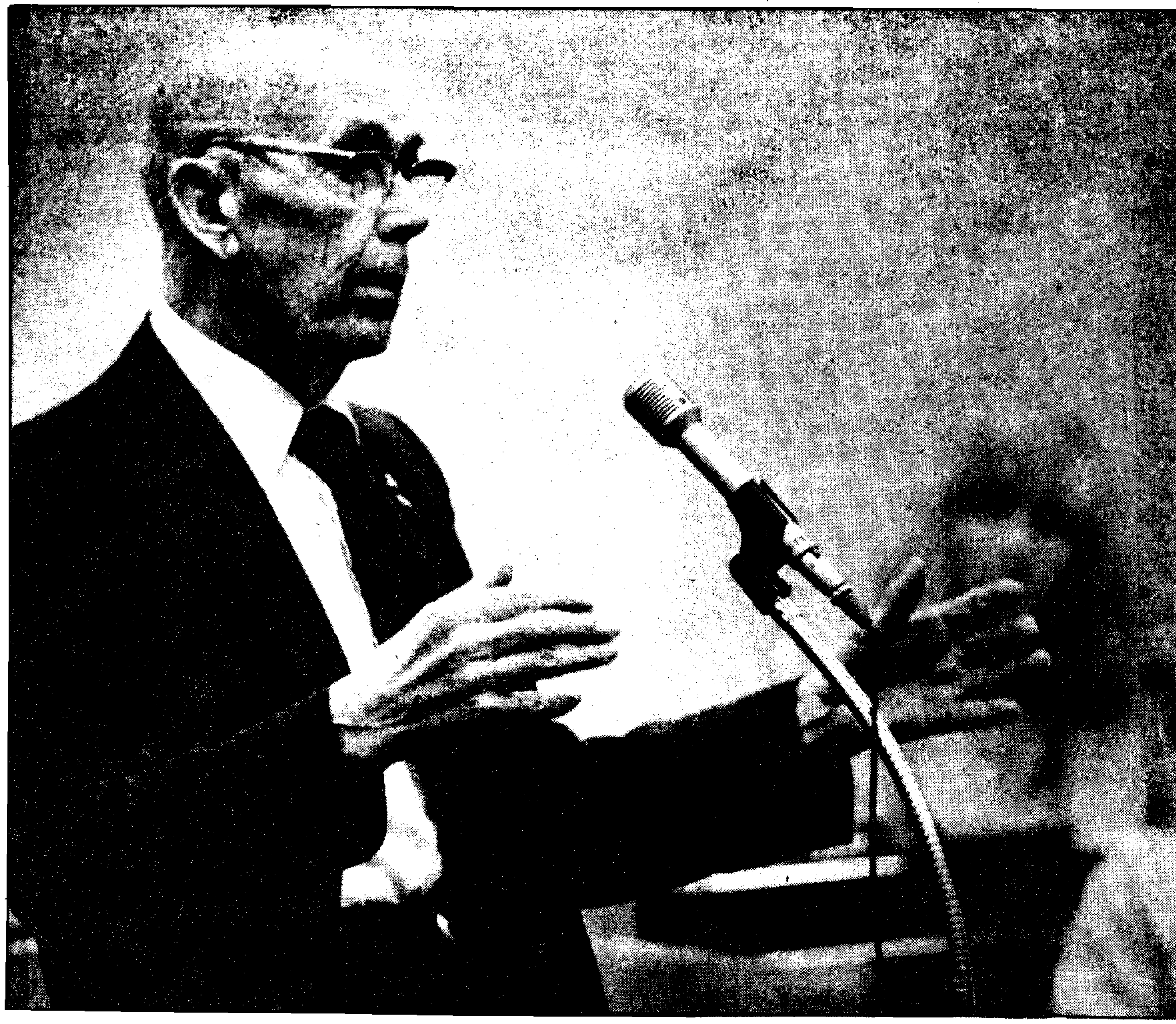
Refuse from Illinois has been hauled into Pheasant Run for several years, he said. If the level of Illinois refuse is increasing sharply, Kenosha County could be without a major landfill sooner than expected, he agreed.

Biebel said the Pheasant Run site life is more than 10 years.

George Melcher, Kenosha County Planning and Development director, said the owner of Pheasant Run, Waste Management Inc., Franklin, legally can accept garbage from Illinois.

Biebel noted that until 1986, Kenosha sent its residential refuse to the Browning and Ferris Inc. landfill near Zion, Ill.

Kastelic called for a pilot curbside refuse sorting program. Such a program would give the committee data on how many citizens will participate in a voluntary recylcing



Kenosha News photo by Paul Williams

**John Kennedy, representing an Iowa manufacturer, recommended a device for sorting recyclable materials**

program for glass, plastic and other materials.

Biebel admitted projections that 10 percent of citizens would participate voluntarily are probably too optimistic.

"For this (recycling) to be effective, we have to do something that will make it meaningful for the average person," said Kay Wade, 8231 43rd Ave.

She asked that action be taken quickly on recycling plans, that planning not stay in committee much longer.

The committee, chaired by County Board Supervisor Wayne Koessl, has been developing a preliminary waste management plan for two years. Information gathered at the public hearings will be included in a final plan, which all units of government in the county will be asked to adopt.

The committee's preliminary plan calls for voluntary recycling of household materials, but mandatory composting of yard wastes such as grass clippings.

# Sorting garbage may aid waste disposal

By Joe Van Zandt
Staff Writer

NEW MUNSTER — Persons at the second of two public hearings on a countywide plan for solid waste disposal were told Wednesday what most already knew: Without a coordinated program, we will soon be buried under a mountain of garbage.

That message was delivered by Robert Biebel, chief environmental engineer for the Southeastern Wisconsin Regional Planning Commission and by respresentatives of the Intergovernmental Coordinating Committee, who have worked for the past three years to develop a plan for attacking the problem.

Faced with state-mandated closing of remaining municipally operated landfills within two years and the filling up of the privately operated Pheasant Run Landfill in Paris within 10 years, Biebel said the committee considered but ruled out incineration as a practical alternative for waste disposal. That leaves separation of garbage into categories such as newsprint, glass and aluminum for recycling.

It won't be easy to get people to sort their garbage, nor will it be easy to enforce such a requirement, he said, but it is the only workable answer to disposing of the vast amount of garbage produced.

> *"One way or the other, a large part of the cost will wind up on the users."*
>
> *William Arb*
> *Paddock Lake trustee*

Included in materials to be recycled is yard waste, including grass clippings, dead leaves, even branches and limbs from trees and shrubs. State law will prohibit deposit of such materials in landfills starting Jan. 1, 1993. The committee will push for creation of large compost piles where such materials can be deposited by persons who don't have room or don't want compost heaps in their back yards.

If increased air pollution results from burning leaves and grass clippings rather than hauling them to a compost site, Biebel said, it will be up to local government to pass ordinances to prohibit open burning.

Eventually, he said, the committee would like to see a recycling center, including compost deposit sites, in every community in the county so that residents won't balk at having to drive many miles to get rid of their garbage and other junk.

Olga Hoffman, Paddock Lake Village president, asked where the money will come from to fund such an ambitious waste management program.

Responded Biebel, "Maybe there is a way for the state to help with funding but there is not much there right now."

William Arb, a Paddock Lake Village Board member, complained, "One way or the other, a large part of the cost will wind up on the users." He said the local governments can cope with the situation "if you give us a grant and expertise and a little time."

Arb also questioned the feasibility of developing huge composting sites throughout the county.

"We had a problem with the egg farm (in Bristol,)" said Arb. "Can you imagine what will happen with rows 40 feet wide, 12 feet high and a mile long?"

KENOSHA NEWS
October 27, 1988

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## Appendix H

### CORRESPONDENCE PERTAINING TO PUBLIC HEARINGS

Leonard L. Herrmann
6537 5th Avenue
Kenosha, WI 53140

October 21, 1988

County Planning Department
Courthouse
Kenosha, Wisconsin

KENOSHA COUNTY
RECEIVED
OCT 25 1988
Office of Planning and Development

Dear Sirs:

Concerning the Garbage Plan, separation of types of rubbish and the use of mulching lawn mowers is all right if it helps the environment, but citizens' obligation to haul rubbish to compost areas and recycling centers is absolutely ridiculous. The city already is saving enough money by requiring us to lug our rubbish to the curb.

I am a senior citizen who has no automobile and has never driven an automobile. With Social Security as my income it would be a terrible financial burden to hire a hauling truck every few weeks. Even people who have cars will not want to soil them with rubbish. Many will feel obliged to own a pick-up truck in addition to one or two cars.

What with traffic and the resulting pollution already overwhelming, why encourage or require the use of more vehicles? I thought we were trying to reduce pollution, not create it.

My final comment is that the city give more quality service and less quality education which does not amount to a hill of beans what with most students graduating pitifully deficient in easy things like spelling, grammar, and geography.

Cordially yours,
Leonard L. Herrmann

LORD OF LIFE LUTHERAN CHURCH
c/o Rev. Jack A. Ottoson
1435 39th Avenue
Kenosha, WI 53142
(414) 552-7993

KENOSHA COUNTY
RECEIVED
OCT 24 1988
Office of Planning and Development

Dear Sir or Madame,

I want to take a moment to respond to the recommendations involving voluntary seperation of re-cyclable materials. As long as I have been a resident of Kenosha (4 years) I have been re-cycling paper and oil products. I have appreciated a town where I can choose to re-cycle rather than waste valuable resources. My paper I give to the Shalom Center to help raise money for their cause and the oil I give to the city via their city garage oil collection tank.

I strongly urge you to consider the steps of further re-cycling waste as we can not afford to throw materials away at an ever increasing pace. Please add my name to those who see further re-cycling of county waste as a good decision.

Sincerely Yours
Pastor Jack Ottoson

Anna Turck
2514-Roosevelt Rd.
Kenosha, WI.
53140

KENOSHA COUNTY
RECEIVED
OCT 25 1988
Office of Planning and Development

Dear Sirs:

This plan is obsurd and is totally out of order. We have elderly in the community who are not able to drive or afford cars. We pay taxes for what now that we have to buy our own garbage to be disposed of. What are the garbage men getting paid for? Its ok to sort the garbage but the rest of the plan needs to be redone. If the elderly are not able to get their garbage taken away your asking for a sanitation problem, garbage built up in homes + yards. Also there are young people too who will not go through all this bother. You'll have a city full of rats and roaches. Kenosha county has some crazy ideas lately. The marina, cutting down salaries for those at brookside nursing home and applying that million dollars to administration + supervisory position. What about us who are trying to support our families. Your idea is as crazy as Mr. Collins is. He isn't saving us a dime. Now the city comes up with this garbage disposal idea. Good grief. Think about the consequences - rats, bugs, and people flushing toxic stuff down the toilets. Who knows what else. Wake up! You can come up with a better solution. Our elderly need to be thought of too. There is a better solution, put your heads together!

Anna S. Turck

(P.S.) Your plan breeds disease!!!

George E. Melcher
Director

KENOSHA COUNTY

OFFICE OF PLANNING & DEVELOPMENT

PRESERVATION • DEVELOPMENT • CONSERVATION

912 - 56th Street
Room 7 Courthouse
Kenosha, Wisconsin 53140
(414) 656-6550

November 1, 1988

RECEIVED
NOV 04 1988
SEWRPC

Robert P. Biebel
Chief Environmental Engineer
Southeastern Wisconsin Regional
Planning Commission
Post Office Box 1607
Waukesha, Wisconsin 53187-1607

Dear Mr. Biebel:

Please find enclosed a letter from Margaret Gertz, President of the Kenosha League of Women Voters, in response to the request for public comment on the proposed Kenosha Solid Waste Plan.

Sincerely,

John F. Roth

JOHN F. ROTH
Principal Planner

JFR:jbr
Enclosure

PLANNING • LAND USE MANAGEMENT & DEVELOPMENT • SANITATION

LAND CONSERVATION • FACILITIES MANAGEMENT • ECONOMIC DEVELOPMENT

October 26, 1988

KENOSHA COUNTY
RECEIVED
OCT 31 1988
Office of Planning and Developme

Kenosha County Department of Planning and Development
Solid Waste Planning Committee
Mr. Wayne Koessl, Chairman
192 56th Street
Kenosha, WI 53140

Dear Mr. Koessl:

This letter is written in response to the request for public comment on the Solid Waste Management Plan to be submitted to the County Board. The Kenosha League of Women Voters urges you to reconsider your position on the following issues:

1. **Household Toxic and Hazardous Wastes.**

We believe that Kenosha County must place an increased emphasis on the disposal of household hazardous wastes. The proposed annual collection option does not adequately address the problem that faces our county. These wastes propose a long range threat when they are landfilled incorrectly. Your study indicates that no Wisconsin landfill in our area knowingly accepts these wastes (Table 2, SWRPC Newsletter). Has the Committee determined the amount of these wastes currently being generated by Kenosha County residents? Does the 1500 to 2500 pound (SWRPC figure, p. 23) represent the amount generated? Based upon the most recent Kenosha Clean Sweep effort (actual figures for disposal are available from Kenosha's Environmental Control Commission) it would appear that we have exceed the poundage recommended.

We request that this committee increase efforts to enable households to adequately dispose of these dangerous wastes through quarterly collection programs. These efforts will help us to reduce the amount of waste inappropriately landfilled.

2. **Landfill Costs.**

As you are aware, our neighboring state of Illinois is rapidly running out of landfill space. The potential impact of this crisis has not been addressed by this study. The current low tipping charges will certainly attract significant interest from northern Illinois counties driving up costs. Is this information reflected in the cost estimates for future landfilling in our area?

We urge the Commission to reconsider cost estimates of the overall plan taking into consideration the current information available.

3. Household Recycling.

The demand for landfill space nationwide is rapidly increasing. Recycling represents a viable alternative for reducing the amount of landfill used. The composting law, which you have addressed, represents only one aspect of landfill waste reduction. Counties throughout the state and nation are enacting aggressive voluntary and mandatory household recycling programs to meet this challenge. The proposed voluntary recycling centers are, at best, a tentative first step. Must Kenosha County wait until we are forced to comply with the proposed state legislation for recycling household material?

The Kenosha League of Women Voters believes that Kenosha County should immediately begin a pilot project of household pickup for newspaper, aluminum, and glass for recycling. A pilot project would enable the county to more accurately assess the viability of voluntary programs. The City of Kenosha is a member of the Keep America Beautiful System, a non-profit recycling and community beautification corporation. This organization can provide a variety of sample plans from which the county could model a pilot project. These plans, provided for printing costs, have been tested in communities our size throughout the country. The success and/or failure of these plans has been documented. Your committee does not have to re-invent the wheel in this area.

We urge you to explore and recommend a more aggressive recycling program in your study.

The Kenosha League of Women Voters extends our assistance to the committee in the area of recycling study. We would be willing to explore additional options and provide your committee with information. We look forward to hearing from you.

Sincerely,

Margaret Gertz

Margaret Gertz
President of the
Kenosha League of Women Voters

6400c