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WASTEWATER MANAGEMENT STUDY FOR CHICAGO-SOUTH END OF LAKE MICHI--ETC(U)
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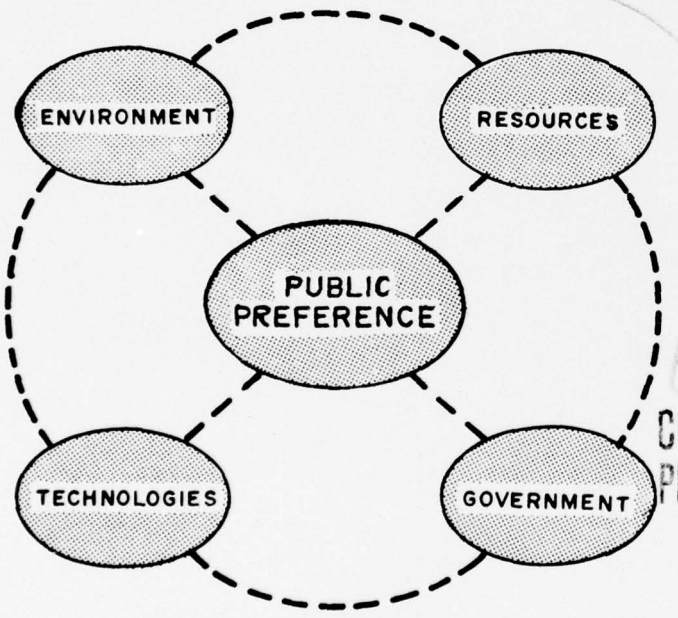
WASTEWATER MANAGEMENT STUDY FOR CHICAGO SOUTH END of LAKE MICHIGAN.



APPENDIX G.

VALUATION

410 079

DEPARTMENT OF THE ARMY
CHICAGO DISTRICT CORPS OF ENGINEERS
219 SOUTH DEARBORN STREET
CHICAGO, ILLINOIS 60604

JULY 1973

REPORT COMPOSITION

The survey report is divided into a Summary, and 9 Appendices. A charge for each appendix and summary report to cover the cost of printing will be required, should purchase be desired. The appendices each contain a different category of information. Alphabetically identified, the appendices are:

A. Background Information - This appendix includes the population and industrial projections, wastewater flows and the engineering data used as a basis for planning.

B. Basis of Design and Cost - This appendix contains the criteria and rationale used to design and cost the final alternative wastewater treatment system components.

C. Plan Formulation - The appendix presents the planning concepts and procedures used in developing the alternative wastewater management plans that were examined during the study.

D. Description and Cost of Alternatives - This appendix contains a cost description and construction phasing analysis for each of the final five regional wastewater management alternatives. Components of these alternatives are described in detail in Appendix B.

E. Social - Environmental Evaluation - This report provides an assessment of the social and environmental impacts likely to arise from the implementation of the final five alternatives.

F. Institutional Considerations - This report presents an assessment of the institutional impacts likely to arise from implementation of the final five alternatives.

G. Valuation - This appendix presents a broad evaluation of the implications and use potential inherent in the final five alternatives.

H. Public Involvement/Participation Program - This appendix documents the program used to involve the public in the planning process.

I. Comments - This appendix contains all of the formal comments from local, State and Federal entities as the result of their review of the other appendices and the Summary Report. Also capsulized are the views of citizens presented at public meetings.

The Summary document presents an overview of the entire study.

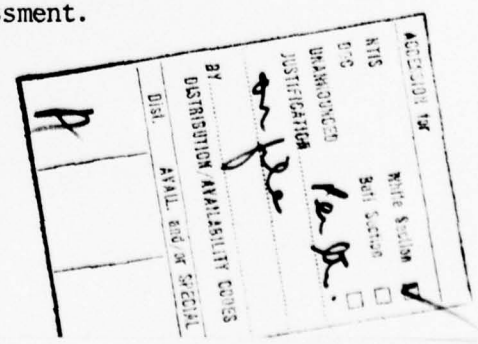
PREFACE

This appendix presents a broad evaluation of the relative impacts and effects attributable to the five alternative wastewater management systems considered for the Chicago-South End of Lake Michigan Area. These five alternatives were the product of an extensive plan formulation process that sought (1) to provide an array of alternatives responsive to the new national goal of eliminating pollutant discharges into area waterways; and (2) to provide an enhanced base from which the area's other water and related land resource needs could be effectively met.

The new national goal was established by the Congress when it enacted the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). The law also recognized the implicit failure of past actions based on a piece-meal approach to wastewater management. Accordingly a program mechanism was incorporated whereby populated areas with diverse and complex wastewater problems could take advantage of the economies of scale inherent in areawide provision of such services. It was within this context that the plan formulation process was structured; the objective being to provide an array of conceptually different alternatives and management options. At the same time each alternative was critically assessed to determine the implications to the social, environmental, economic, institutional and resource bases of the study area, the adjacent counties and the remaining portions of the States, Region and the Nation.

Consequently, the findings of the study constitute a framework within which the area's decision-makers can select a system compatible with the National and State water quality goals. Final decisions as to which of the five alternatives, if any, is best suited to the area and most acceptable to the residents is left to the State and local governments which now have that responsibility.

The comparative analysis presented herein is evaluated in relation to the functional components of a wastewater management system. The key system components included the functional requirements of the collection facilities, the treatment process and the handling and management aspects of residual wastes. Such ancillary factors as regionalization (economies of scale), water reuse to satisfy local requirements and synergistic resource philosophies are also pertinent considerations that provide a total framework for the decision-makers. Hence, the impact of each alternative has been evaluated in terms of its total resource implications. The concerns over the consumptive demands being placed on our nation's natural resources, energy, and tax dollars have to be carefully balanced against adopted environmental and social goals. Regional solutions to common problems and avoidance of irreversible commitments of our natural resources were guidelines which served as the framework for this assessment.



APPENDIX G - VALUATION

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SECTION I - INTRODUCTION

SCOPE OF STUDY

The wastewater management study for the Chicago-South End of Lake Michigan (C-SELM) Area was authorized by Congressional resolutions from both the House and Senate Public Works Committees dated 10 and 23 November 1971 respectively. Included in the language of the Senate resolution was the mission to "Evaluate general alternatives for the management of wastewater on a regional basis, including the elimination of pollutant discharges". Consequently the study was directed towards achieving two compatible goals, minimizing water quality degradation from waterborne wastes and maximizing the potential for the area's efficient reuse of the treated water.

REGIONAL OBJECTIVES

As with any other program involving water and related land resource development, this study was directed towards attainment of the multiple objectives cited by Congress. These objectives or national planning goals included the enhancement of the environment, social well-being, and the development of both the national and regional economies.

Before the study could be initiated, however, it was necessary to translate the goals into planning objectives. Since all or portions of the C-SELM area were included in both the Upper Mississippi River and Great Lakes Basins, use was made of recent studies completed for these two regions. These framework studies were the result of a cooperative effort undertaken by those Federal, State and Local agencies concerned with the region's resource management and development. Both studies established a framework for development based on identified needs. These need inventories reflected the basis for trade offs that in net effect would: (1) give a State-wide balance of water and related land resource development, (2) retain and emphasize an area's physical, cultural and aesthetic characteristics, and (3) provide the opportunity to apply multiple-use concepts and thereby utilize the available resource bases in an efficient and effective manner.

STUDY BASIS

The basic output of the study's planning effort was essentially responsive to the national objective of enhancing the environment. However, in improving the water quality of the area's waterways, specific improvements of bases (water and/or land) for improvements were provided that also would contribute to the remaining national objectives. These latter benefits would involve the need categories cited by the referenced regional studies. It was further recognized that the potential for

satisfying these needs would be inherent but to different degrees, in any of the alternatives- regardless of the treatment technology involved. What was significant and the main basis for differentiating between the alternatives were the impacts associated with the system components and the reuse opportunities made available.

Consequently the evaluations and comparisons were structured to obtain an objective analysis and selection of system components. To provide an effective framework for this approach required that the development of the alternatives be the basic study control elements; and that the total implications (including resource consumption) of the components and reuse options be the basis for critical differentiation.

STUDY AREA

The study area extends from the Wisconsin border through portions of Illinois and Indiana, around the southwestern and southern perimeter of Lake Michigan to the Michigan stateline. As such the wastewater management study included all or portions of four counties in Illinois and three counties in Indiana. Within these counties there are nearly 90 townships with a 1970 population of about 7-1/4 million people. Drainage within the approximate 2,600 square miles of the study area is generally to the Illinois River with the exception of those areas tributary to Lake Michigan.

The plan formulation of a wastewater management system, however, involved consideration of a much larger geographical area. In developing a wide array of alternatives, attention was directed to the various options available in designing the functional components of the systems. This, in turn, required consideration of planning concepts that would impact on sites outside the study area boundary. As a result a much larger area of influence was involved in the planning efforts; one generally encompassing the tier of counties adjacent to the C-SELM area. Included in the outlying area were some 12 counties, 8 of which were in Illinois; the remaining four in Indiana. Together these 12 counties have a land mass of some 6,930 square miles and a 1970 population of approximately 670,000. The C-SELM study area and outlying area of influence are shown in Figure G-I-1. Not shown are the more distant counties of Knox and Fulton Counties in Illinois and Clay County in Indiana where surface mines provide potential for effective recycling of the residual waste (sludge) by-products.

STUDY VALUE

The emerging concern for urban area problems, and in particular the concern for the growing problem of managing wastewaters, defined the context within which the study was conducted. The intent of the study was to identify and evaluate alternative wastewater treatment systems that could be incorporated into areawide or regional plans. The alternatives were designed to a water quality standard responsive to the new national goal of eliminating the discharge of pollutants into navigable waters by 1985. This goal was established by the Federal Water Pollution Control Act

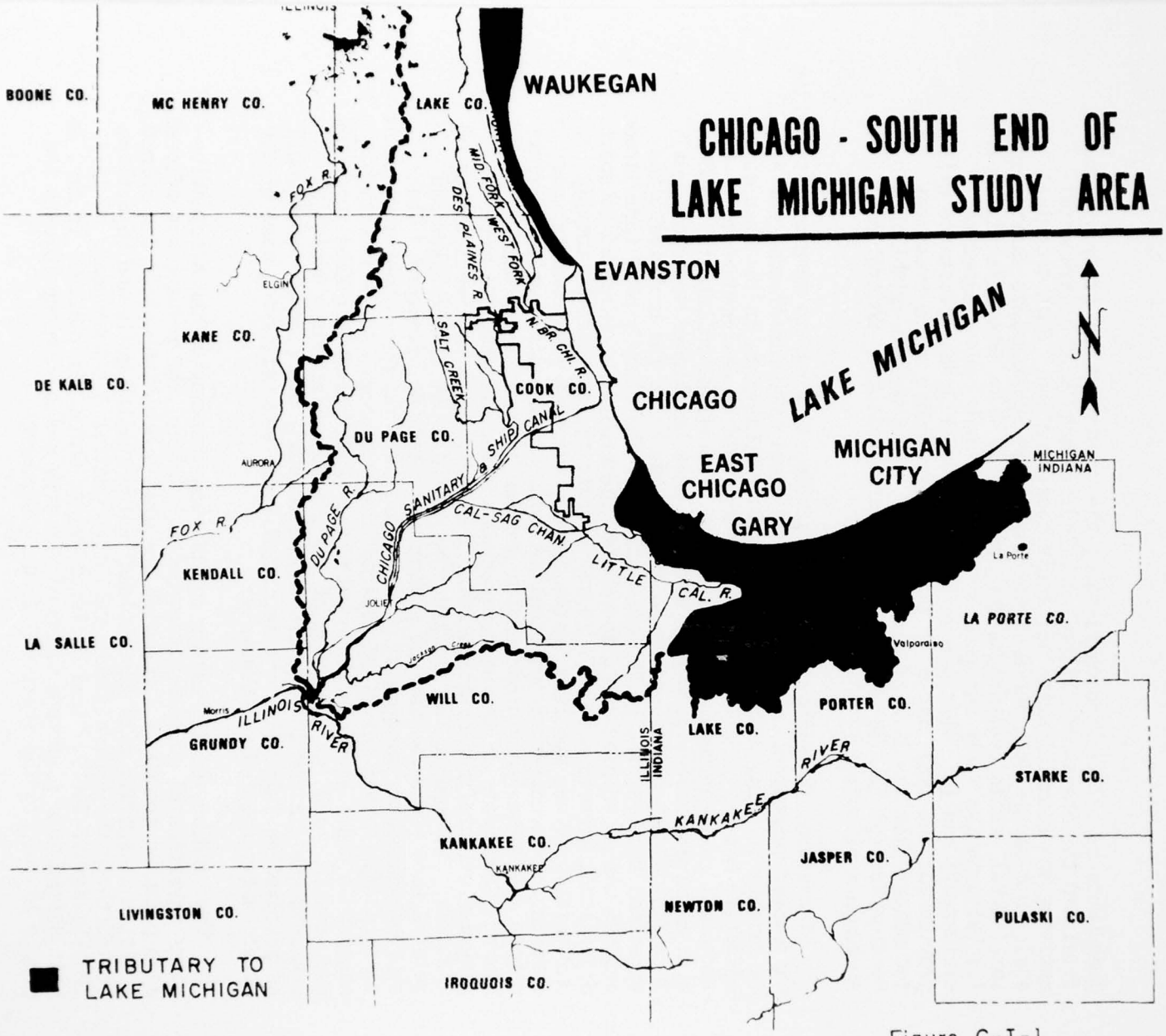

CHICAGO - SOUTH END OF
LAKE MICHIGAN STUDY AREA
WAUKEGAN
EVANSTON
LAKE MICHIGAN
CHICAGO
EAST CHICAGO
GARY
MICHIGAN CITY
MICHIGAN INDIANA
BOONE CO.
MC HENRY CO.
LAKE CO.
KANE CO.
DE KALB CO.
COOK CO.
DU PAGE CO.
KENDALL CO.
LA SALLE CO.
WILL CO.
GRUNDY CO.
LAKE CO.
PORTER CO.
LA PORTE CO.
STARKE CO.
KANKAKEE CO.
JASPER CO.
NEWTON CO.
PULASKI CO.
LIVINGSTON CO.
IROQUOIS CO.
FOX R.
DES PLAINES R.
MID FORK
WEST FORK
N. BR. CHI. R.
SALT CREEK
SHIP CANAL
CHICAGO SANITARY & SHIP CANAL
CAL-SAG CHAN.
LITTLE CAL. R.
DU PAGE R.
ILLINOIS RIVER
KANKAKEE RIVER
ILLINOIS INDIANA
ELGIN
AURORA
JOLIET
Morris
Valparaiso
La Porte
TRIBUTARY TO LAKE MICHIGAN

Figure G-I-1

Amendments of 1972. Upon completion, the results of the study will be furnished the States of Illinois and Indiana and local governmental entities and planning units for their consideration. Such technical assistance should help the designated agencies substantiate their request for federal grants beginning after June 30, 1974 by demonstrating that: (1) "alternative waste management techniques have been studied and evaluated"; and (2) "that the works proposed for grant assistance will provide for the application of the best practicable waste treatment technology over the life of the works---", requirements established by Section 201 (g) (2) (A) of the Federal Water Pollution Control Act Amendments of 1972.

Therefore, the primary objective of the study was to develop alternative wastewater management systems that would treat 1990 wasteloads, yet still be capable of being expanded to meet 2020 requirements in the most cost effective manner. The level of treatment would be designed to achieve a technical goal approaching "no discharge of critical pollutants" (NDCP) with major emphasis placed upon plans to meet the higher technical goal. In addition, system design was to provide the basis for maximizing the efficient reuse of the reclaimed resources. The study's plan formulation process was as complex and elaborate as the problem it intended to solve. Significant efforts were made to assure that the approach be totally uncommitted to any specific system aspect; and that environmental and institutional considerations, together with an extensive public participation and interagency coordination program be an integral part of the study. Components of the wastewater management alternatives were progressively refined by integrating the design with the requirements of the area. Throughout the process, the multiple-use of the water and related land resources was the predominent planning principle. The evolved wastewater management plans demonstrate (1) the manner and extent to which the area's water and related land resources can be effectively managed in order to meet future water uses and "waste"-oriented functions and services; and (2) the range of implications, including social, environmental, natural resources, institutional, and economic that would be involved in fulfilling the technical goals and satisfying some of the area's water-related requirements.

The findings of this study do not mean that any of the alternative plans investigated would be constructed. Rather, the results are offered as a planning framework from which the area's decision-makers can select a system consistant with the national water quality goals and objectives set forth in the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500). Final decisions as to which alternative, if any, is best suited to a particular part of the area and most acceptable to the people is left to the State and local governments.

SECTION II - WASTEWATER MANAGEMENT

WATER QUALITY TECHNICAL GOALS

To develop and evaluate alternative wastewater management systems responsive to the new water quality goals, the concept of "no discharge of critical pollutants" had to be defined. This meant establishing an effluent (treated discharge) water quality standard; one which would restore and preserve the integrity and use of the nation's waters. The standard would be representative of the NDCP goal for achieving a maximum but reasonable degree of water purity. Accordingly, a list of critical constituents and "acceptable" levels was prepared that was more detailed and more demanding than current standards. Selection of the constituents and the concentration levels was based on desirable standards for drinking water, irrigation and livestock waters, and aquatic habitat. These "effluent" standards actually represented a performance goal for the design of a treatment facility and characterized the output discharged into the receiving stream. The basis for establishing the standard is presented in Section II of Appendix C.

While the treatment goal is similar in intent to the national goal established by PL 92-500, the effluent standards are not the result of that legislation. Rather, these standards were established for this and other pilot studies authorized approximately one year prior to enactment of the law. Consequently, the specific water quality requirements do not represent federally accepted or adopted standards.

AVAILABLE TECHNOLOGIES

Once the treatment goal had been established, attention was directed to the methods by which this goal could be achieved. There are three basic technological approaches which can be used to attain the treatment standard. These are: (1) an advanced biological treatment plant system; (2) a physical-chemical treatment plant system; and (3) a land treatment system.

None of the three are new or unique in concept. The unit processes of each system can be found in various parts of the nation and the world. What is comparatively new is (1) the combination of these systems', unit processes to achieve treatment desired and (2) the scale to which these systems would be applied.

Most of the sewage treatment plants today either achieve or are being upgraded to provide secondary treatment of the wastewater prior to discharge into nearby water courses. Conventional biological treatment is the technology most widely used and it basically involves a two-step process.

The first step or primary treatment phase consists of some form of mechanical screening and holding basins to remove the trash and settleable solids. The last step or secondary treatment utilizes bacteria to consume the organic portions of the wastes. Prior to being discharged, the treated effluent is usually chlorinated for disinfection purposes.

The advanced biological treatment system involves the addition of various biological and chemical unit processes to the conventional biological treatment plant. The add-on unit processes are designed to achieve removal of specific constituents. On the other hand the physical-chemical treatment system uses the principles of physics and chemistry to accomplish the same functions that the bacteria and other components perform in biological design. Both of these "plant" technologies rely on incineration as an integral part of the process and internal recycling. The land treatment system also adds various biological and physical-chemical unit processes to the conventional biological treatment process. The wastewater having received the equivalent of conventional secondary treatment is sprayed on the soil by irrigation equipment for the final stage of purification. What is unique is that the biosystem of both the soil and cover crop provide the equivalent of the add-on unit process. Involved are the complex physical and chemical reactions in the soil, the biological processes of the soil's bacteria and fungi, and the natural crop uptake - all of which form the basis for designing the farmer's present fertility program and cropping practices.

In developing the design of the plant systems, certain basic assumptions were made. The most important related to the (1) sequential arrangements of the unit processes; and (2) design criteria for rating treatment performance under peak flow conditions. Similar design constraints were adopted in the land system for relating the application rates of the pre-treated irrigation water to the performance of the vegetative cover, soil column, and soil organisms. Detailed discussions of each technology, its processes and sequential arrangements, can be found in Appendix B.

POLLUTANT SOURCES

Once the standard of treatment was determined, the sources of pollutants requiring control also had to be identified. There were three major categories which affected the quality and/or natural background level of a water course. These were: point sources, in-place sources, and areal sources.

Point sources pertained to wastewater volumes discharged at a specific location; be it a collector (pipeline) system or stream outfall. Included in this category were controlled waste loads from the various municipalities

and industrial plants. The critical factor was that the volumes and waste constituents could be directly related to a specific water user. Accordingly, the first phase of the study effort involved the preparation of an adequate data base. The approach, assumptions and findings of this study phase are summarized in Appendix A. The information collected included: (1) an inventory of existing treatment systems and their operating characteristics; (2) projections of future wasteloads by location and type; and (3) other pertinent resource data. As such, the information provided the basis for the planning and design efforts that followed. The geographical location of the population and industrial projections were kept consistent with the availability of land and local land-use plans. Moreover, the population projections were broken down to the township level in order to facilitate the determination of municipal wasteloads.

The second category, in-place sources, was more subtle in that it involved the physical attributes of the water courses themselves. Of particular concern in this category were the pollutants that had accumulated in the stream beds over time. It has been assumed that once a NDCP treatment system is in place and operation, the bottom deposits, especially the organic material, will stabilize due to anaerobic action. There may, however, be deposits or specific constituents such as heavy metals or toxicants which will require other remedial works such as dredging. The beneficial effects of the stream's increased assimilative capacity in eventually stabilizing these types of pollutants are not known; and related decisions must be deferred until extensive monitoring has been completed.

The control of areal sources of pollutants was the major differential between the NDCP and current water quality standards. Prime concern was the contaminant loading that storm water runoff would contribute to the area's watercourses if not captured and treated. This consideration would exclude the amount of storm water that naturally infiltrates into the collection and conveyance sewer systems. It was recognized that storm water runoff would become a carrier of the pollutants that are typical of the geographical area involved- be it urban (high density development), suburban, or rural in development. Specific pollutant sources would involve septic tanks, fall-out of air-induced pollutants, and the commercial fertilizers used in both agricultural production and the suburban open-spaces including homes. All of these had the potential of adding significant levels of critical constituents; enough to temporarily negate the water quality goal that otherwise would be achieved under the NDCP system design.

STORM WATER RUNOFF

In determining what, if any, portion of storm water runoff had to be captured, a search was made of published literature and available study-related data. Extensive work had been done by the Metropolitan

Sanitary District of Greater Chicago (MSDGC), the Illinois Institute for Environmental Quality, and the Department of Public Works for the City of Chicago in relation to the pollutant loadings of storm water runoff from combined sewer systems. The findings supported a need to collect the first 2 1/2 inches of runoff since the flush of contaminants were significantly high enough to become a definite point source (outfalls) of pollution, even under existing standards.

The management system in the suburban areas, however, involved separate collection and conveyance lines; thus, constituent loadings of separate storm water discharge were needed. Related studies pertinent to this subject were found but there were extensive variations in concentration levels. Most of the variations could be attributed to the time of sampling relative to rainfall occurrence and/or whether the samples were "grab" samples or taken on a flow-weighted basis. Consequently, the results of a study for Ann Arbor, Michigan as reported in the January 1968 issue of the Water Pollution Control Federation Journal was selected as the basis for this evaluation. The constituent loadings were reported in the form of flow weighted annual mean values, i.e., level of concentration correlated to a rainfall-flow relationship. Three constituents, Biochemical Oxygen Demand (BOD), phosphorus, and ammonia nitrogen were selected as the key discriminators because of their impact on the aquatic ecosystem through oxygen depletion and stream enrichment (a phenomenon similar to eutrophication).

An analysis was done to determine the effects on the receiving waterways if the storm water was not treated. In this analysis, two levels of treatment were considered for the 1990 municipal and industrial projections- local and NDCP standards. Furthermore, the local standards were subdivided: one reflecting current standards; the second the most stringent of known effluent requirements in the area- reflecting long range local planning goals. As such these treated discharges reflected the most optimized (quality) base flow condition that could be expected in the area's waterways. Then using the typical loadings for the suburban runoff, the applicable concentration (on a weighted flow value) of the three key parameters were determined. The resultant BOD and ammonia nitrogen loadings, determined using the stream's assimilative capacity for the 7-day, 10 year low flow, exceeded the acceptable concentrations levels for not only the NDCP but both local standards. The phosphorus concentrations were low enough to justify assuming that additional dilution would maintain the concentration level acceptable under current standards but unacceptable for NDCP standards. Based on this analysis it was concluded that the storm water runoff in the suburban area should be captured and treated particularly if the water quality was to provide for the enhancement of fishery and other stream-related recreational opportunities. Similarly, the same concept was applied to the rural storm water runoff where management concerns would be compounded by the suspended solids and other constituents more closely related to agricultural production. Without capture of this portion of the study area's runoff, the stability of the aquatic ecosystem could not, in all probability, be maintained.

REUSE AND CONSERVATION OBJECTIVES

The necessity to capture and treat storm water runoff in itself imposed two new conditions. First it provided a new source with which to meet the projected water requirements of the study area. Secondly, it effected a change in the existing stream flows characteristics and also provided the potential for land-use changes in the flood plain. Based on the foregoing factors, it became apparent that the wastewater management system could serve as a primary vehicle to meet the water and related land requirements. In essence, a more effective water balance for the study area could be obtained and multiple usage of both the water and land resources could be realized. In lieu of a detailed water use assessment, the inventory of needs from the comprehensive studies for the Upper Mississippi River and Great Lakes Regions were used. Among the water-based needs cited, flood control, general recreation, fish and wildlife conservation, commercial navigation, and water supply were pre-eminent. These needs served as the basic framework for evaluating the potential reuse and redistribution of the treated water.

The potential for meeting the projected water supply requirement was primarily a problem associated with the Illinois portion of the study area. The Indiana portion has no constraints imposed on its use of Lake Michigan waters. As a result, attention was focused on the costs and energy demands required to meet the Illinois usage. Also involved were the institutional constraints of the Supreme Court decision and the possible necessity to either change the present withdrawal allocations or reuse the treated water.

The opportunity also existed for the recycling and reuse of the residual by-products (called sludge) generated during the treatment process. The constituents removed by the treatment facilities are actually the consumptive wastes from the municipal and industrial usage of our natural resources and agricultural products. The method of recapture and potential for recycling the nutrients, however, varies with each of the three treatment technologies. Therefore, the costs, socio-environmental, institutional and resource implications were assessed for the recycling options available with each technology.

Another possibility for resources conservation was the multiple-use potential inherent in the physical layout or design of a system component. These synergisms or add-ons represent an opportunity to meet other area or regional needs with significant savings in costs and resources. In some cases the system provides the resource base with which the dual benefit can be readily attained. In other cases, the potential for achieving the dual benefit is enhanced, but additional resource commitments are required. In both cases additional investments although at a lower level are needed but the opportunity for realization is greatly improved. Most of the potential for the synergistic gain are dependent upon the technology involved but a few are affected by other system components.

SECTION III - ALTERNATIVE SELECTION

STRATEGY CONSIDERATIONS

In compliance with the study's technical goal and congressional directives, since reinforced by PL 92-500, major emphasis was placed on the design of alternative systems to meet NDCP standards. At the same time, it was considered necessary to formulate plans to meet current standards. The latter would then serve as a comparative base for evaluating the socio-environmental, institutional, and resource implications associated with the national goal of NDCP standards.

The plans to meet existing water quality standards and guidelines were predicated on (1) accepting those improvements which were at or near the drawing board stage as firm elements of the base plan; and (2) examining the State and/or local proposals for future implementation and modification of the existing system. These inputs provide the basis for establishing the area's present planning goals for wastewater management. This plan in turn was extended to meet 1990 and 2020 conditions. In this way the study could provide an immediate benefit by identifying opportunities for improving current plans without adversely impacting on the on-going programs.

To insure a compatability with present planning efforts, the current plans for areawide wastewater management were used as the basis for structuring the NDCP alternatives. The plan-formulation process used to select the NDCP alternatives retained for final study was divided into three stages. The first stage was used to help establish pertinent planning and design parameters in regard to an alternative's functional components. The functional components of each alternative were designed to treat the 2020 wasteloads. This provided an insight into the management and operational problems that the area would eventually face. As such, it also provided a planning framework within which to shape the 1990 systems. The second stage involved a redirection of the design effort and basis for assessment. As a first step, all of the alternatives retained for further study were redesigned to treat the 1990 wasteloads. Where economies of scale and construction dictated, however, the 2020 requirements were retained as part of the system design. In addition, attention was focused on the resource commitments associated with each alternative and the resultant socio-environmental, institutional and economic implications. This latter information then was furnished to the public with an intent to determine their viewpoints and preferences. The third stage involved a further refinement in design of the system's functional components and a more in-depth assessment of the alternatives retained for final study. A detailed discussion of the plan-formulation process is presented in Appendix C.

ARRANGEMENT OF FUNCTIONAL COMPONENTS

The components of the various alternative systems were one of the bases for evaluation by the other three study elements, namely the socio-environmental and institutional evaluators, and the general public including the citizens advisory committees and other study participants. The engineering, operational and managerial aspects also were assessed to determine the consumptive demands on the total resources of both the study area and the outlying area of influence. Discussed below are the major design and planning considerations that were utilized for the NDCP systems during the final stage of study. The presentation concentrates on those factors that ultimately became the focal points for evaluation. More detailed information on these aspects are presented in Appendix B.

COLLECTION AND CONVEYANCE SYSTEMS

For the purpose of design, management of the storm water runoff in the entire C-SELM area was divided into three categories: urban, suburban, and rural. The storm water was to be captured and treated in sufficient degree to preclude the discharge of critical pollutants to the area's watercourses. To achieve economies in system design, the storage capacity for the runoff was increased and regulated pump-out employed to reduce the capacities and costs associated with the treatment and conveyance facilities.

Designs of the collection and conveyance systems differed for the urban, suburban, and rural areas. In urban areas where the municipal, industrial, and storm wastewater were combined, the flows were conveyed to treatment plants by large underground tunnels. This was the least disruptive from a socio-environmental standpoint and in the long-run the most cost effective in providing water quality and flood control. Storage capacity was equivalent to 2.5 inches of storm water runoff. Figure G-III-1 shows the combined sewer area of the urban portion in the C-SELM region, and Figure G-III-2 the basic concept of urban wastewater control.

In suburban areas, storm water was collected separately and stored in surface ponds or deep pits, depending on land availability. The storage capacity provided was equivalent to 2.85 inches of runoff. Retention of the runoff would vary with the duration and intensity of the storm involved, however, the impoundments would be drained within a maximum of 60 days. Figure G-III-3 shows the basic concept of suburban storm water storage and the potential for incorporating restrictive recreational opportunities into site design. To achieve system economies, these storage sites were widely dispersed. This, in turn, should provide direct relief to local suburban collection systems and help reduce water damage problems caused by flooding and blocked drainage conditions. The captured storm water subsequently is conveyed from the storage areas by gravity or force mains to access points where it is combined with other wastewater. The access points either adjoin a treatment plant or are interconnected with a larger conveyance system leading to a regionalized treatment facility.

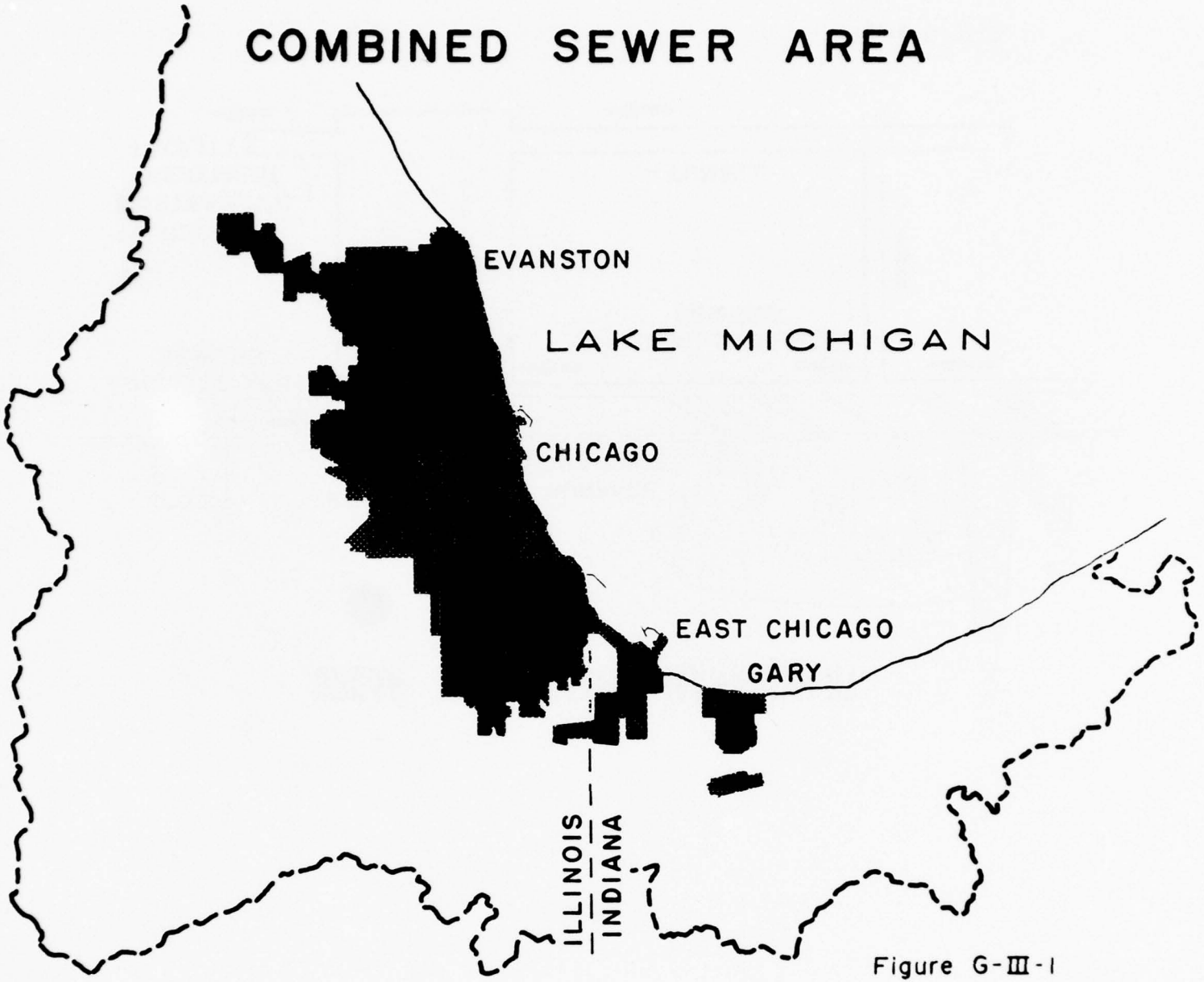


Figure G-III-1

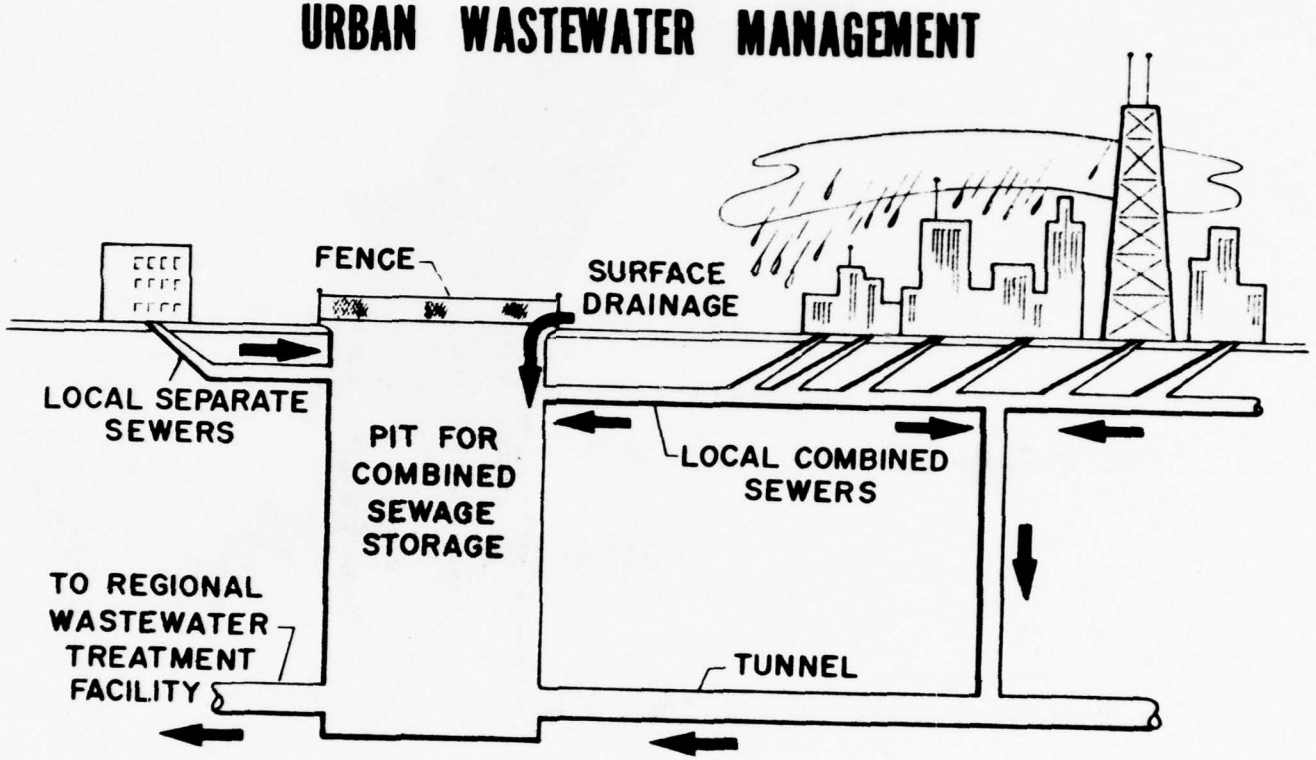


Figure G-III-2

SUBURBAN STORMWATER MANAGEMENT

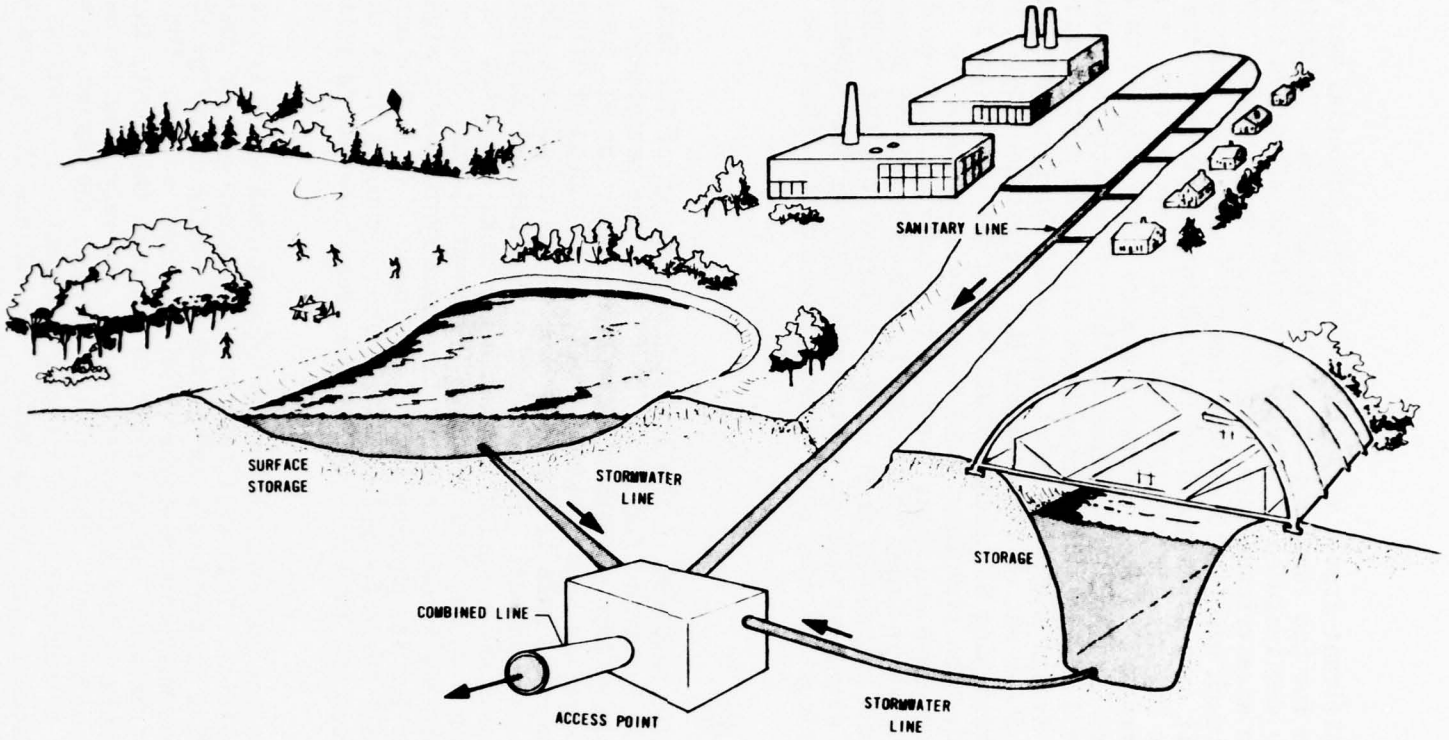


Figure G-III-3

The most significant from a multiple-purpose use potential was the storm water system for the rural portion of the study area. Suitable retention capacity was included to provide not only an effective flood reduction but also a restricted water-based recreational program. The basic modular approach was (1) to utilize natural topography, supplemented as necessary by pit excavation and dike impoundments adjacent to the stream, and (2) to capture and regulate the storm runoff so that it can be subsequently treated by the land treatment process and irrigated on adjacent agricultural lands. A schematic diagram of this storm water management concept is shown on Figure G-III-4. These management sites were distributed throughout the rural areas. Within a typical local watershed, the permanent pond would occupy only 5 percent of the area and the irrigation site(s) some 12 percent. The remaining 83 percent would be the tributary area providing runoff to the pond. The tributary acres will have essentially the same land use as they now have and their use will be consistent with good land conservation practices in order to prevent increased levels of suspended solids, nitrogen and phosphorus from being discharged into the C-SELM waterways. Grass waterways will be installed as part of the recommended conservation practices and used for conveying the surface runoff to the storage pond.

TREATMENT FACILITIES

Two factors are involved in the location and design of the facilities. While the physical layout and facilities do differ, the performance level for all three advanced technologies are comparable and, for all intents and purposes, achieve the same treatment goal. Utilization of different unit processes, however, make it virtually impossible to achieve identical levels of constituent removal. The advanced biological and physical chemical technologies use a series of buildings, tanks and other facilities similar in appearance to existing sewerage treatment plants. Unlike the two plant technologies, though, the land treatment system has a significantly larger requirement for its physical (acreage) layout. It is the acreage requirements for all three technologies that are of concern since they will directly affect the land uses within the area where the facilities are located.

The second factor concerns the volume of wasteload to be treated by the regional facilities. This will vary with the water quality goal under consideration. Most of the area's industries presently discharge their wastewater into the watercourses rather than municipal sewers. This requires on-site treatment. In an effort to minimize this cost, these industries, particularly the major water users, are recycling the water used in the manufacturing process. This, in turn reduces the amount of water used and the cost of treatment. This trend is expected to continue as the water quality treatment goals are upgraded. To achieve the equivalent of the higher NDCP goal, however, the cost of industrial pre-treatment will have

TYPICAL RURAL STORMWATER MANAGEMENT FACILITIES

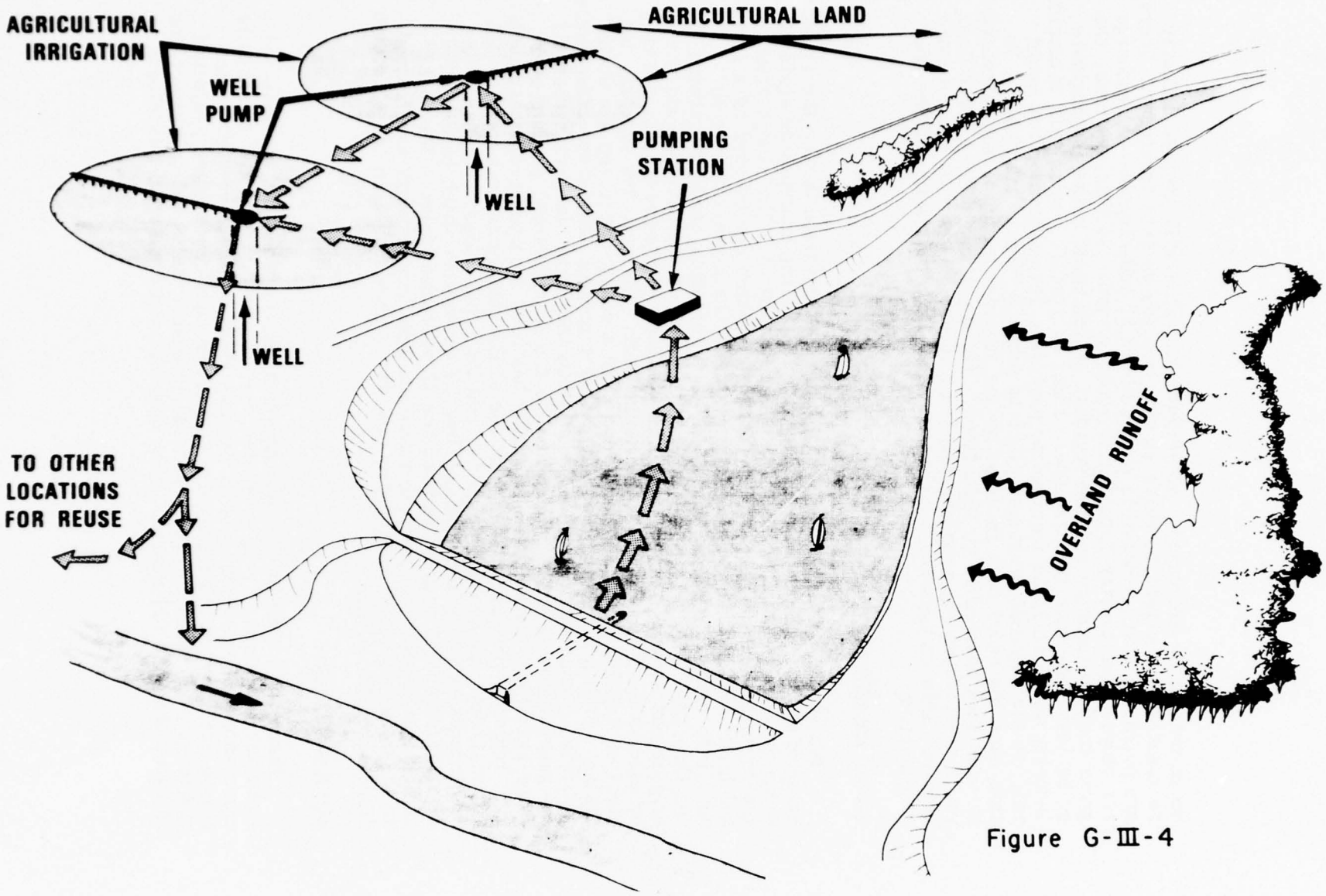


Figure G-III-4

to be materially increased some 40 percent. This will require industry to reassess the extent to which it must provide on-site treatment. There are potential savings possible particularly if industry was to discharge its recycled wastewater into the regional system. If this was done, the gross cost to industry and the regional system would either approximate or be less than what industry would incur by itself. Under this situation, industry would still be required to pre-treat its wastewater but would rely on the regional treatment plant to provide "final" treatment. In this case the added cost incurred by the regional system would be recovered by user fees chargeable to industries. The magnitude of this added cost would vary, dependent upon the treatment technology used by the regional entity. This concept has been incorporated into the design of the NDCP alternatives.

SLUDGE MANAGEMENT

Two sludge options were retained for consideration during the final stage of study. These involved the basic recycling concepts of agricultural usage (option 1) and land rehabilitation (option 2). The sludge from the Advanced Biological and Land Treatment systems can be used as a fertilizer and humus builder since they contain much of the organic matter and nutrients removed from the wastewater. On the other hand, the sludge from the Physical-Chemical process is rich in lime but the nitrogen and the organic matter have been lost by incineration. Consequently, it can only be used as a soil conditioner and pH control. However, two factors, the first a planning constraint and the second a design criterion are worth noting. From a planning standpoint, it was decided that where effectively possible, sludge should be utilized within the State boundaries where it was generated; primarily in response to the institutional concern over inter-state problems. This philosophy has been incorporated, consistent with regional considerations, into the sludge management schemes for all alternatives. The design criterion involved the sludge (residual by-products) yield per million gallons of wastewater which became a major differential between each of the three technologies. The most significant aspect involved the resultant land requirements as affected by the reuse potential and application rates permissable in the effective disposal of the sludge.

WATER MANAGEMENT

Based on the municipal and industrial projections and the selected storm water control, it is estimated that the area would have to ultimately treat some 4,080 million gallons per day (MGD) by the year 2020. This figure excluded system losses due to leakage, and represented projected treatment requirements. The wasteload, however, was based on projections of water usage by all sources. The domestic and commercial wasteloads

were projected to reach the equivalent of some 1300 MGD. At the same time the industrial flows would amount to only 1205 MGD. The industrial flows reflected the current trend of reducing water intake by internal recycling and discharging the "blow-down" into the municipal system. System design and costs are based on the assumption that sufficient pre-treatment of the industrial wasteloads is provided on-site to meet inflow controls for the collection and conveyance systems. Runoff from the urban-suburban areas which would be captured and conveyed to the treatment plants was estimated at 1,125 MGD. An additional 450 MGD of storm water runoff would be captured and treated in the rural area. Within this long-range framework, the 1990 treatment requirements total some 3,650 MGD.

The most significant constraint to designing a regulated water regimen was the result of the U.S. Environmental Protection Agency (USEPA) concern over the potential interjection of dissolved solids into Lake Michigan. The preliminary reaction of that agency was based on the non-degradation provisions of the water quality standards and the recent United States-Canadian agreement which expresses a need for dissolved solids control. Recognizing that the dissolved solid levels of both water quality standards are higher than the "natural background level" of the adjacent portion of Lake Michigan, adjustments were made to conform to the current "return" regimen now in effect. This meant constraints for the Illinois portion of the study area as opposed to the Indiana area.

Two water reuse options were considered in the design of the NDCP alternatives. The in-stream flows were common to both options and were adjusted to reflect a comparable relationship between technologies and alternatives; one which would tend to maintain a higher level of recreational potential. The reuse options also were used to analyze the implications of the U.S. Supreme Court decisions relative limiting the Illinois diversion of Lake Michigan waters for multiple usage. With attainment of the NDCP standard and the availability of treated storm water, the potential for reallocating the useage of the restricted 3200 cfs to meet projected water supply and in-stream uses was assessed. Consequently, the reuse options were structured to evaluate the implications of using Lake Michigan water to meet the area's needs. In one option the withdrawal was limited to 3200 cfs; the other had no such limitation. The purpose was to focus on the problems that could face the C-SELM area in the future. Under the option limited by the 3200 cfs constraint, the C-SELM area will face the necessity to re-use its treated water in order to meet the projected and desired requirements.

DESCRIPTION OF ALTERNATIVES

The following is a brief description of the five alternatives retained for final study. A more detailed presentation can be found in Appendix D. Selection of these five was based on providing as much information to those

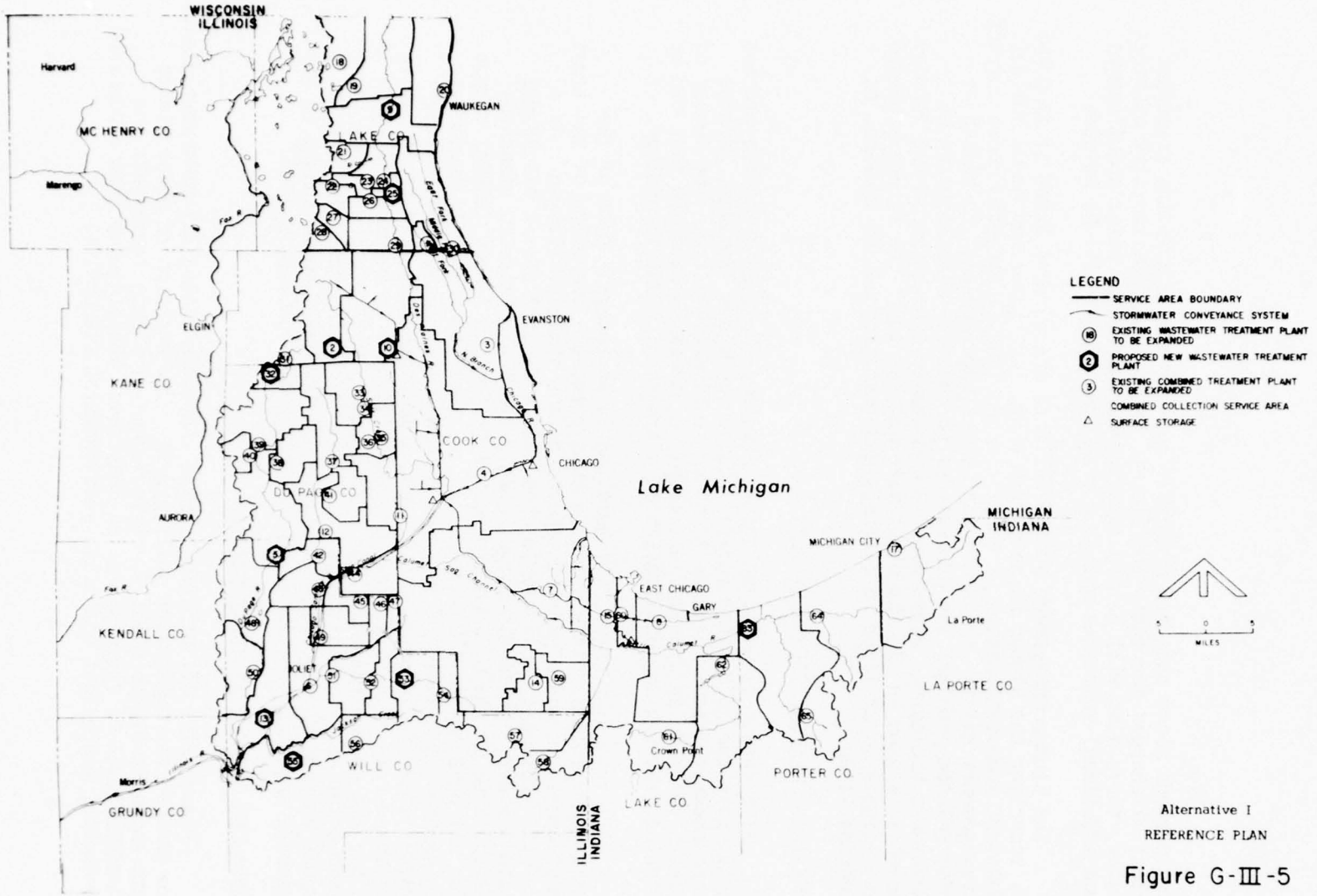
who ultimately have the responsibility to develop plans to meet the new national goals for wastewater management. Since Congress had underscored the necessity to evaluate all available technologies, it was decided that at least 3 alternatives, each involving a different NDCP technology should be evaluated. Furthermore, one alternative was designed to meet current treatment standards. The detailed assessment of this alternative would provide information relative to on-going and near future program commitments at the local level. At the same time, it would serve as a reference base and facilitate a comparison between water quality standards, thereby providing other interested Federal, State and local agencies information as to the implications of going to such high effluent standards as were adopted for this study. Consideration also was given to retention of at least one alternative involving a combination of advanced treatment technologies. This would tend to underscore the inherent advantages and/or disadvantages of different system balances, particularly if designed from a geographical and wasteload standpoint. At the same time efforts were made to maintain as much flexibility in system design as is possible, by using options as add-on considerations. This applied to the functional aspects of a system component (sludge management), such basic policy issues as withdrawals from Lake Michigan, and the potential for synergistic programs.

REFERENCE PLAN

Alternative I reflects the study area's present planning goals for a regionalized wastewater management system. There are some 64 treatment plants included in this plan. This represents an extensive reduction from the some 132 plants of 1 MGD capacity or greater, presently in operation. The 64 sites, as shown in Figure G-III-5 were based on the number and locations contained in existing regional plans, extended to meet 2020 conditions. As such the alternative represents a screening base with which to compare the four other alternatives which are designed to the higher NDCP water quality goal and reuse considerations.

The regional treatment plants will meet the current effluent (plant discharge) and water quality guidelines (for receiving streams) for Illinois and Indiana respectively. Moreover, the level of treatment will vary, depending upon the receiving stream. In general, those plants discharging into streams tributary to the Illinois River are designed to provide the equivalent of secondary treatment. On streams tributary to Lake Michigan, a higher level of treatment is achieved.

The existing or proposed collection systems in all areas would be utilized, with consolidation achieved by connecting conveyance systems. No treatment of storm water runoff is achieved other than in areas serviced by combined sewers, either presently and/or proposed. Nor is a redistribution of the treated water provided, as per existing plans. This would adversely affect the aquatic ecosystem of some streams in



Alternative I
REFERENCE PLAN

Figure G-III-5

dry periods since many are presently dependent upon existing treatment plant discharges for their low flows. Without the availability of storm water, there also will be problems in meeting future water requirements and additional resources and financial commitments will be needed.

The sludge management system reflects the current trend of disposal by recycling the sludge as an agricultural fertilizer and humus builder. However, some reclamation of surface mined land is included where current arrangements exist. To insure that the sludge presents no health or odor-related problem, the process design requires stabilization by anaerobic biological digesters. A comparable constraint in one form or another is used in all the other alternatives too. The sludge produced in Illinois is utilized in Illinois and that produced in Indiana, on Indiana sites.

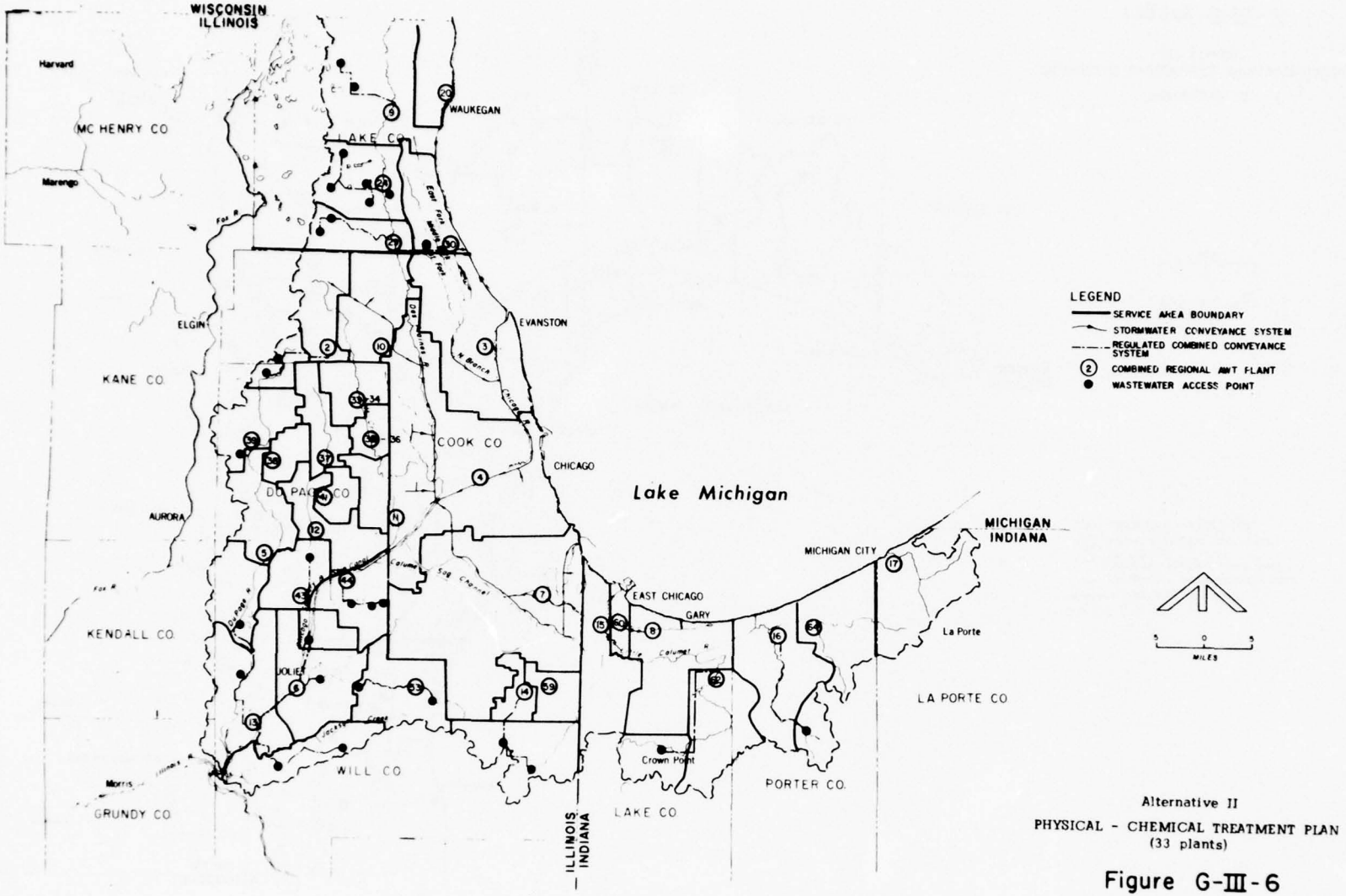
PHYSICAL-CHEMICAL TREATMENT PLAN

Alternative II utilizes a pure Physical-Chemical treatment process to achieve the NDCP water quality goal. There are 33 plants located throughout the study area as is shown in Figure G-III-6. The number of plants reflects an intermediate level in economies of scale that can be attained through regionalization of a treatment plant technology.

As previously noted, incineration is an integral part of the treatment process. This serves a dual purpose - recycling of the treatment chemicals and a partial removal of the ammonia nitrogen. As a result, there are considerable chemicals and particulates discharged into the air. These discharges meet current air emission standards established by the U.S. Environmental Protection Agency (USEPA) except for nitrogen oxides. Unfortunately, current technology is inadequate to maintain the level of nitrogen oxides within acceptable limits. Unless this problem can be overcome, some other unit process to remove nitrogen such as a biological process will have to be used. If this is done, the sequential order and complementary unit processes used to remove the other constituents would have to be changed. The result would be that the overall composition of treatment would change to one closely approximating an Advanced Biological treatment system.

ADVANCED BIOLOGICAL TREATMENT PLAN

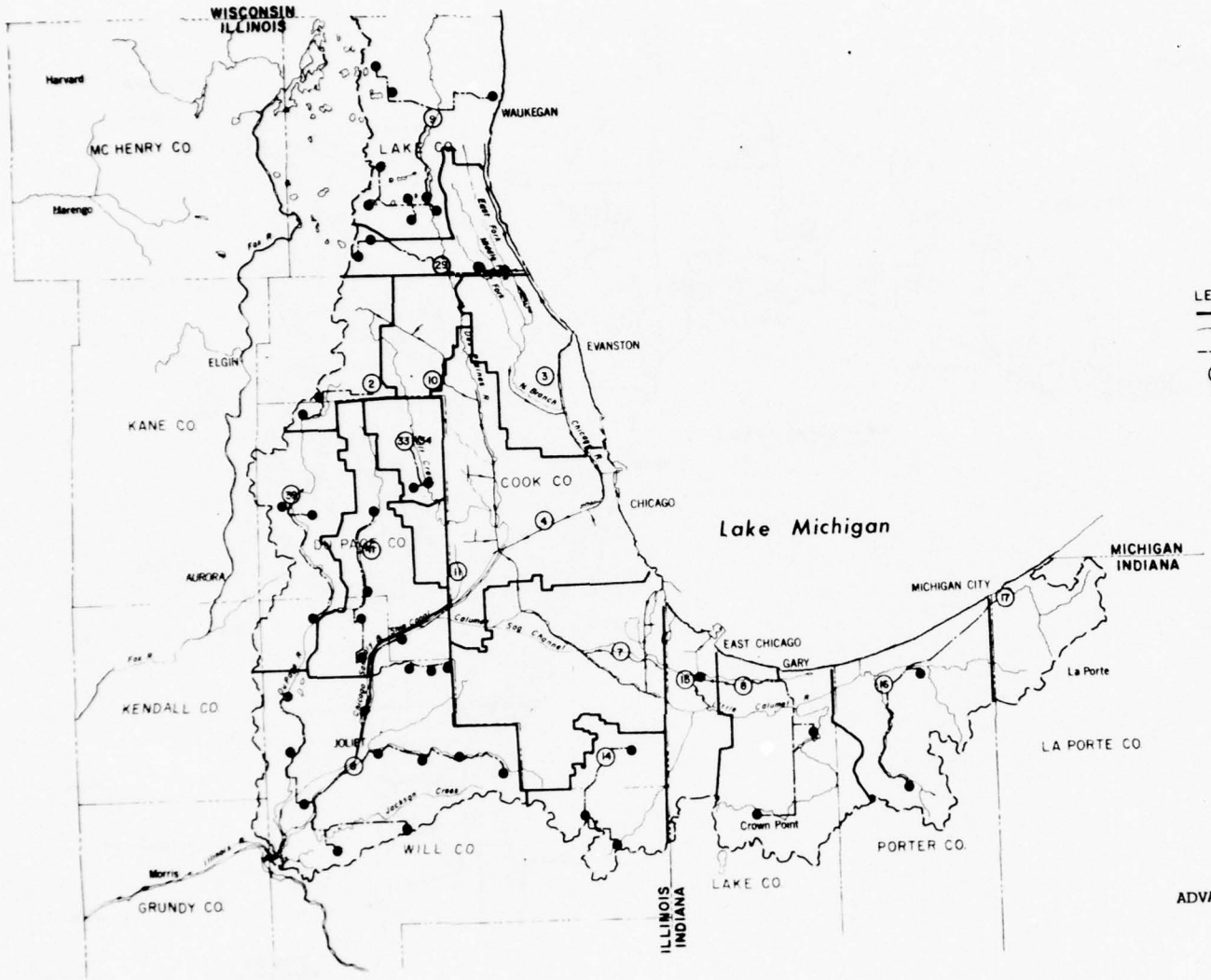
Alternative III utilizes some 17 advanced biological treatment plants to achieve the NDCP water quality goal. The location of these plants are shown in Figure G-III-7. This number of plants represents the maximum level of regionalization considered advantageous from a combined economic, management and socio-environmental standpoint.



Alternative II

PHYSICAL - CHEMICAL TREATMENT PLAN
(33 plants)

Figure G-III-6



Alternative III

ADVANCED BIOLOGICAL TREATMENT PLAN
(17 plants)

Figure G-III-7

Unlike the physical-chemical process, the advanced biological system can make full and effective use of those major plants which otherwise would be abandoned and foregone with regionalization. Conversely, a similarity does exist in that incineration is also part of the advanced biological process. However, while chemicals and particulates are discharged into the air, the air emissions do comply with current USEPA standards.

LAND TREATMENT PLAN

Alternative IV involves the use of some five, non-contiguous land areas outside the study area to achieve the NDCP water quality goal. The location of the five areas are shown in Figure G-III-8. The areas shown merely indicate the geographic limits within which the actual land treatment sites (irrigation fields and lagoons) would be located. This plan represents still another maximum level of regionalization which could be considered but, unlike the other alternatives, involves the inter-state transfer of wastewater for treatment.

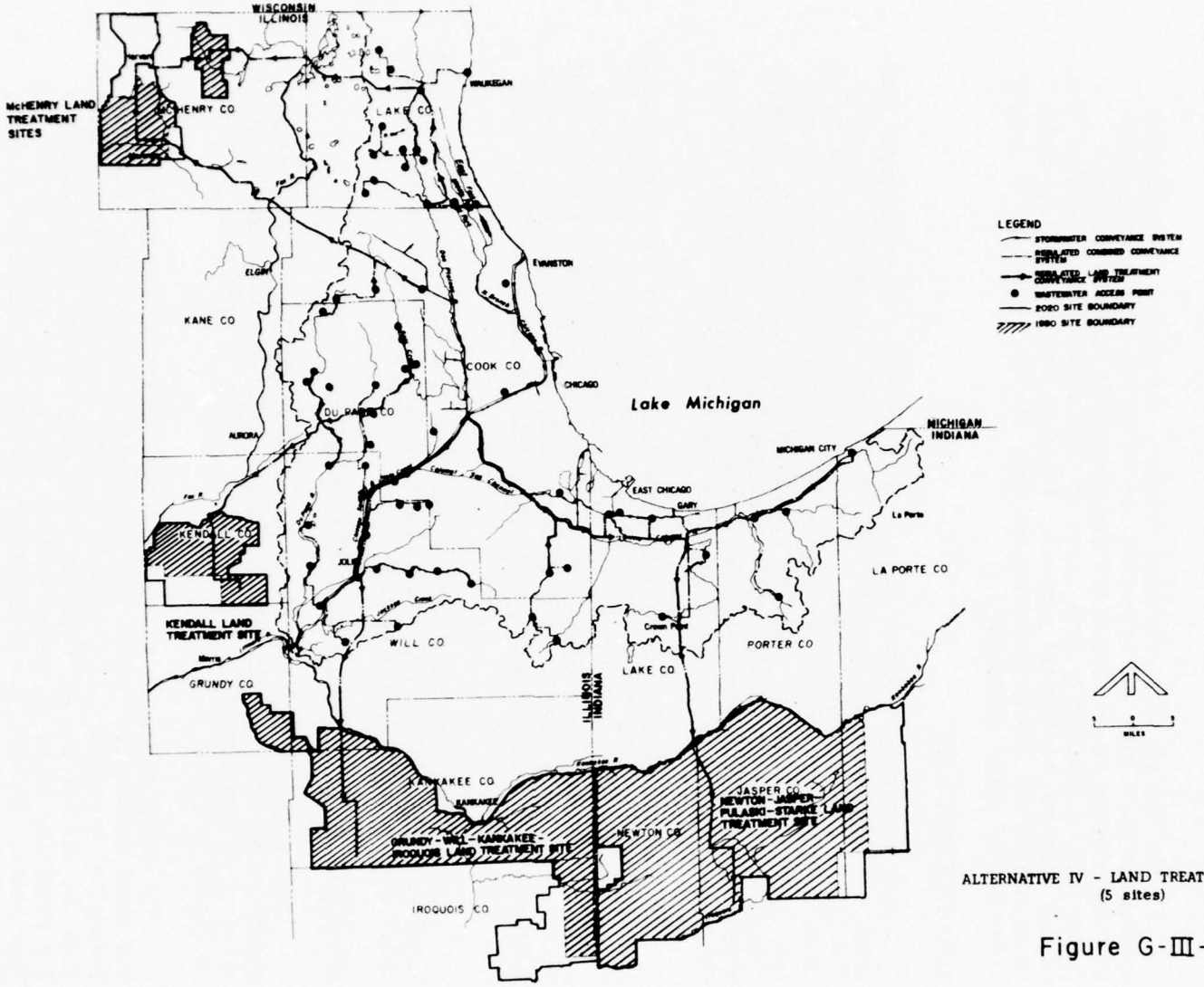
In the design of this system the wastewaters for the study area are conveyed to the land sites for treatment and subsequently returned for reuse. Under this plan all of the treatment plants in the study area would be abandoned, at which time most of the lands could be reclaimed to meet community needs. On the other hand, the outlying agricultural community would be asked to commit an extensive amount of their lands for the system needs.

Before this plan could be implemented, both States and the agricultural counties must be willing to participate and integrate the system requirements into their land use plans.

ADVANCED BIOLOGICAL-LAND TREATMENT COMBINATION PLAN

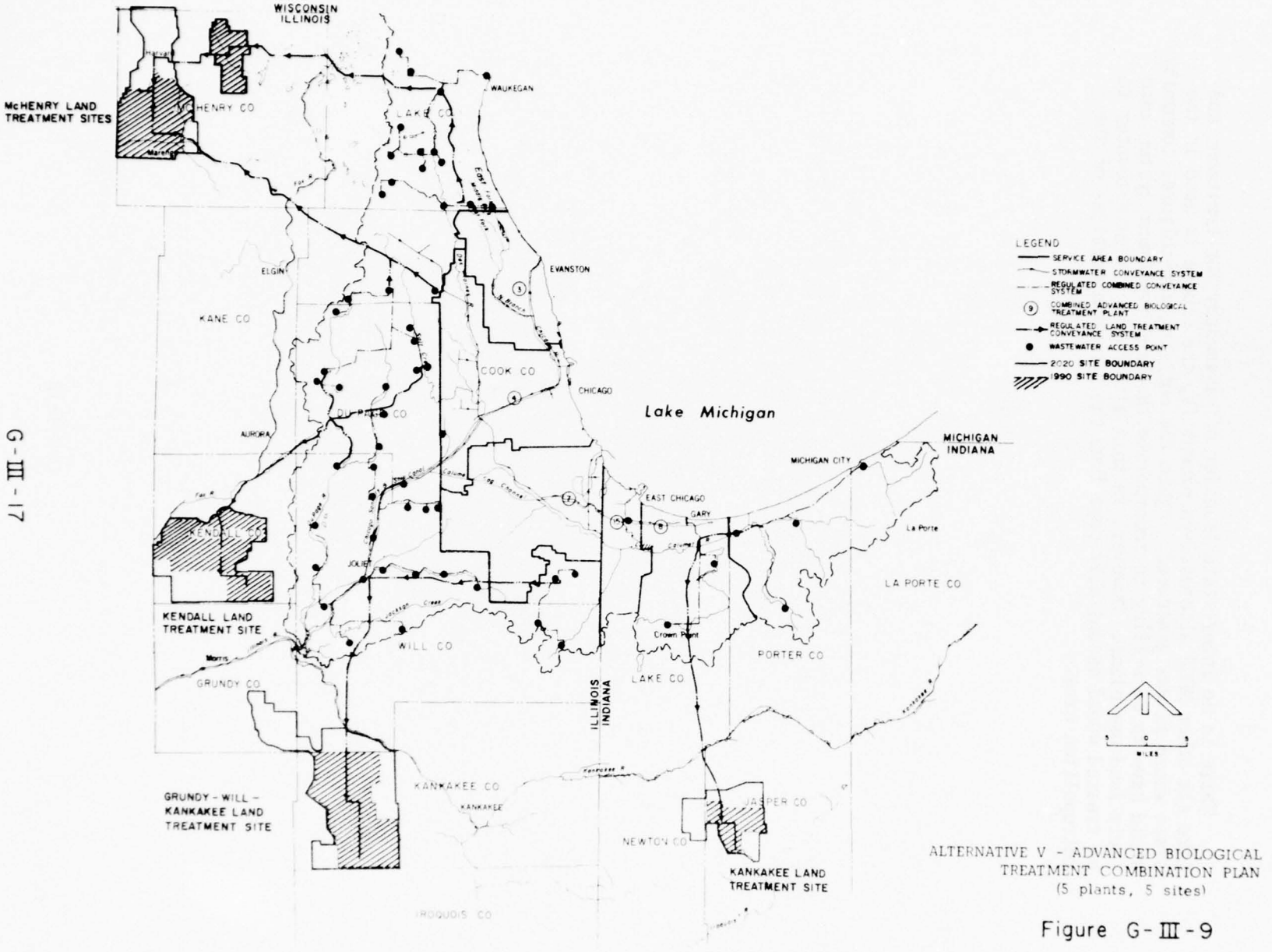
Alternative V combines the 5 major Advanced Biological treatment plants of Alternative III with a reduced scale of the 5 land treatment sites of Alternative IV. The graphical layout of this plan is shown on Figure G-III-9.

The advanced biological plants treat approximately two-thirds of the total wastewater volume. As previously indicated the Advanced Biological treatment plants would discharge chemical and particulates into the air but the air emission would meet current USEPA standards. The remaining third of the wastewater load is transported to the five land areas. Because the volume to be treated is significantly less, the land sites are greatly reduced in size.



ALTERNATIVE IV - LAND TREATMENT PLAN
(5 sites)

Figure G-III-8



ALTERNATIVE V - ADVANCED BIOLOGICAL - LAND TREATMENT COMBINATION PLAN
(5 plants, 5 sites)

Figure G-III-9

There is no inter-state transfer of wastewater for treatment and like all other NDCP alternatives except IV, the sludge is used in the state where it was generated. Again the outlying agricultural community would have to be willing to incorporate the land treatment system into their land use plans. However, in this alternative, the wastewater to be treated would essentially come from the suburban portions of the metropolitan area.

SECTION IV - RESOURCE IMPLICATIONS

FRAMEWORK FOR ASSESSMENT

The alternatives retained for final study have been purposely structured to focus on those planning and policy aspects which had to be resolved before the States and local interests can make a decision as to how the total needs of the area, including wastewater management, can best be met.

The degree of regionalization feasible for consideration regardless of the treatment technology used, has to be addressed. Concurrent with this decision are the related issues of: the water balance and use of Lake Michigan; the sludge management program; and the degree of synergistic potentials capable of being achieved or foregone, depending upon the component arrangement being considered.

The total resource commitments associated with the alternatives also have to be evaluated. These data are required to further differentiate between the alternatives. Resource consumption associated with each of the technological processes has implications beyond the local level. At the local level, the area resources of land (required), people (affected or displaced), social well-being (human dimension) and costs are basic considerations. At the regional level the competitive demands induced by the wastewater system on such growth factors as energy, chemicals, labor skills and land-use have to be identified and the causal effects scaled. Finally an assessment had to be made of the national implications of both the foregoing and the capability to meet those needs that contribute to the nation's economic development and the national environmental quality goals.

In addition, the institutional problems associated with the alternatives have to be identified to determine the practicality of the planning effort. Concurrent with this evaluation is the need to determine the public reaction and attitude to each alternative.

To accomplish the above, the resource commitments, engineering data, and costs associated with each alternative and the individual components were determined. This information then served as the basis for an independent evaluation of the socio-environmental, institutional and economic impacts involved.

RESOURCE CONSUMPTION

The resource consumptions associated with the design and operation of the five alternatives and options were divided into two broad categories: energy demands and chemical consumptions. Land requirements which had corollary socio-environmental implications were evaluated separately.

The energy demands included the electrical energy required for the collection and conveyance of the wastewater to the treatment facility (plant and/or land sites) and the redistribution of both the treated water and the sludge accrued during the treatment process. The second source of energy demand was the fuel required for incineration as part of the treatment process. Natural gas was the fuel used in this latter assessment because of its minimal impact on air pollution. The other category, chemical consumption, reflected the various key chemicals required for the daily operation of the three technologies. The chemical requirements of the three technologies were first determined on a unit volume (100 MG) of wastewater to be treated and that was used to evaluate the daily chemicals requirements for each of the alternatives.

ELECTRICAL ENERGY

The electrical energy requirements associated with each of the five alternatives' functional components and options are shown in Table G-IV-1. The consumptive demands are expressed in terms of average daily requirements to indicate the scope of impact involved. Of basic concern is the differential in power required between the land and the two C-SELM advanced treatment plant technologies; and the impact that this base (constant daily) load will have- locally, regionally and nationally.

Clean-up of the stream-related quality is but just one of the nation's pollution problems, but it alone will induce a significant power demand. The NDCP plant technologies will superimpose approximately 3.5 times the power demand that the current water quality standards will require. This differential amounts to an average of some 7,500 megawatt-hours per day for 1990 alone. For the same time period the land treatment system requires almost double the power level needed for the plant technologies and nearly 7 times the level required for the current quality standard. The two-fold increase is basically attributable to (1) the power load at the land treatment site, lifting (pumping) the wastewater from the conveyance tunnel into the treatment lagoons and thence for distribution to the field irrigation areas; and (2) the power demand for the return and redistribution of the treated water to the C-SELM need centers.

All of the cited power needs are primarily for the operations of the five alternatives. A secondary level however is also implicit to the analysis. This latter category would involve the energy demands for the supportative tasks such as the manufacturing of the chemicals used in the process design. Preliminary assessments of these secondary demands, some of which are presented in Appendix B, indicate that while the comparative impacts are not as significant as the primary levels, they do represent an additional demand on the nation's energy base. It should be noted that the secondary power demands are almost totally related to the plant and not the land technology.

The impact of the primary power needs are translatable into different categories, depending upon the socio-political level being considered. At the local level, the increased demand associated with the alternatives will

Table G-IV-1
ELECTRICAL POWER REQUIREMENTS - 1990
(Megawatt Hours/Day @ 3414 BTU/KWH)

System Components	Alternative I			Alternative II			Alternative III		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Wastewater Treatment Facilities	1,845	375	2,220	6,295	1,205	7,500	7,545	1,445	8,990
Wastewater Conveyance Systems	455	95	550	475	90	565	495	95	590
Storm Water Management System Suburban Storage	-	-	-	195	40	235	195	40	235
Conveyance	-	-	-	190	35	225	190	35	225
Rural Treatment	-	-	-	655	125	780	655	125	780
Sludge Management Option 1	165	35	200	345	65	410	125	25	150
Option 2	165	35	200	-	-	-	195	35	230
Reuse Option 1	-	-	-	510	100	610	490	95	585
Option 2	-	-	-	535	100	635	515	100	615
Total Sludge Option 1, Reuse Option 1	2,630	540	3,170	8,665	1,660	10,325	9,695	1,860	11,555
Total Sludge Option 2, Reuse Option 1	-	-	-	-	-	-	9,765	1,870	11,635
Total Sludge Option 1, Reuse Option 2	-	-	-	8,690	1,660	10,350	9,720	1,865	11,585
Total Sludge Option 2, Reuse Option 2	-	-	-	-	-	-	9,790	1,875	11,665

	Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total
Wastewater Treatment Facilities	6,550	6,285	12,835	8,895	1,700	10,595
Wastewater Conveyance Systems	485	465	950	600	115	715
Storm Water Management System Suburban Storage	120	115	235	195	40	235
Conveyance	115	110	225	190	35	225
Rural Treatment	400	380	780	655	125	780
Sludge Management Option 1	55	55	110	110	20	130
Option 2	105	105	210	160	30	190
Reuse Option 1	3,440	3,300	6,740	1,635	315	1,950
Option 2	3,450	3,310	6,760	1,660	320	1,980
Total Sludge Option 1, Reuse Option 1	11,165	10,710	21,875	12,280	2,350	14,630
Total Sludge Option 2, Reuse Option 1	11,215	10,760	21,975	12,330	2,360	14,690
Total Sludge Option 1, Reuse Option 2	11,175	10,720	21,895	12,305	2,355	14,660
Total Sludge Option 2, Reuse Option 2	11,225	10,770	21,995	12,350	2,365	14,720

Table G-IV-1 (cont'd)
ELECTRICAL POWER REQUIREMENTS - 2020
(Megawatt Hours/Day @ 3414 BTU/KWH)

System Components	Alternative I			Alternative II			Alternative III		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Wastewater Treatment Facilities	2,215	390	2,605	7,745	1,335	9,080	9,285	1,600	10,885
Wastewater Conveyance Systems	465	80	545	490	85	575	515	90	605
Storm Water Management System Suburban Storage	-	-	-	240	40	280	240	40	280
Conveyance	-	-	-	225	40	265	225	40	265
Rural Treatment	-	-	-	465	80	545	465	80	545
Sludge Management Option 1	190	35	225	420	70	490	145	25	170
Sludge Management Option 2	190	35	225	-	-	-	215	35	250
Reuse Option 1	-	-	-	905	155	1,060	880	150	1,030
Reuse Option 2	-	-	-	1,075	185	1,260	1,075	185	1,260
Total Sludge Option 1, Reuse Option 1	3,060	540	3,600	10,490	1,805	12,295	11,755	2,025	13,780
Total Sludge Option 2, Reuse Option 1	-	-	-	-	-	-	11,825	2,035	13,860
Total Sludge Option 1, Reuse Option 2	-	-	-	10,660	1,835	12,495	11,950	2,060	14,010
Total Sludge Option 2, Reuse Option 2	-	-	-	-	-	-	12,020	2,070	14,090

	Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total
Wastewater Treatment Facilities	8,055	7,155	15,210	11,475	1,975	13,450
Wastewater Conveyance Systems	505	455	950	645	110	755
Storm Water Management System Suburban Storage	160	140	300	255	45	300
Conveyance	140	125	265	225	40	265
Rural Treatment	290	260	550	465	80	545
Sludge Management Option 1	65	60	125	120	20	140
Sludge Management Option 2	120	110	230	180	30	210
Reuse Option 1	4,490	3,990	8,480	2,510	430	2,940
Reuse Option 2	4,565	4,055	8,620	2,865	495	3,360
Total Sludge Option 1, Reuse Option 1	13,705	12,175	25,880	15,695	2,700	18,395
Total Sludge Option 2, Reuse Option 1	13,760	12,225	25,985	15,755	2,710	18,465
Total Sludge Option 1, Reuse Option 2	13,780	12,240	26,020	16,050	2,765	18,815
Total Sludge Option 2, Reuse Option 2	13,835	12,290	26,125	16,110	2,775	18,885

superimpose an added priority demand that will conflict with the industrial needs of the area. This assumes that the residential demands would have top priority. As pointed out in a letter from the Chicago Regional Office, Federal Power Commission, (See Annex A) residential customers use less than one-third the total electricity generated; the remaining two-thirds being used for industrial and commercial application. Thus the required net demand could conflict with projected economic growth patterns and rates. This near-future and long-range constraint will impact generally on the job opportunities that normally would be expected to occur from current growth trends. The degree of impact, however, will depend upon regional and national considerations.

The regional impact will be reflected in the success that the power companies have in developing new power plants as an extension of their present system. There are three "Power Supply Areas (PSA)", so designated by the Federal Power Commission that would be involved in meeting these needs. One, PSA 12, encompasses all of Indiana and as such includes the three counties within the study area and the four outlying counties within the area of influence. The two others, PSA 14 and 40, are responsive to the four Illinois counties within the study area and the 8 outlying Illinois counties. The program to meet the power needs will induce several concurrent impacts:

(1) It will generate an extensive investment program that in turn could affect the money and construction markets and the consumer in terms of higher utility rates.

(2) It will require resolution as to types of fuel (nuclear and/or fossil) to be used and the sites whereon the power plant are to be built. Both of these factors involve allied environmental concerns such as air and water pollution as well as land commitments.

(3) It will increase the power level that would be required during the next 20 years. Since the quality of life and the use of energy are interrelated, the region's supply of power must be balanced to meet the total range of needs. This would require commitments beyond just the environmental concerns.

The national impact will primarily be two-fold. The first impact will be that the upgrading of the water quality standards will impose a new level of demand on the nation's power base; the magnitude varying significantly with the technology and management options considered. The second impact will be reflected in the need to review current policies and determine the extent to which the environmental and other competitive power demands will be met. Concurrently, technological research should be encouraged to help meet the potential energy drain. Improvements in generation efficiencies as a means to conserve our natural resources, and seeking new methods and fuel sources for generating electrical energy are examples of specific scientific research areas. In addition adjustments in national policy to facilitate the import and use of acceptable fuels, thereby supplementing the nation's existing resource base should be considered.

OTHER CONSUMPTIVE RESOURCE REQUIREMENTS

Natural gas as an effective fuel source together with the major chemicals required for the various alternative treatment processes were also quantified. As with the electrical energy, the resources implications are significantly greater for the NDCP alternatives as opposed to the one responsive to the existing quality standard. The one exception, however, is the land treatment technology which imposes a comparable if not lesser resource demand than does the present, conventional biological treatment process.

The local, regional and national implications of the natural gas requirements as shown in Table G-IV-2, are generally the same as those identified for the electrical power demands. One main differential exists and that pertains to natural gas as an available fuel. As is pointed out in a letter (see Annex A) from the Peoples Gas Light and Coke Company, a main area distributer, the Gas Industry does not have adequate supplies at the present time to meet the increasing consumer demands. Furthermore, the lack of new supply sources, the curtailment of existing supplies, and the increased demand for natural gas to meet the stringent air pollution controls have necessitated concerted State and Federal governmental actions to seek a "priorities of service" method for allocating the available gas supplies. The proposed rule making would designate Boiler Fuel use, the need pertinent to this study, as the lowest priority use of natural gas. This decision, if retained, would have serious impact on the plant technologies. Alternative fuel sources would have to be obtained and, because of the potential air pollution problem, the cost of these systems would increase if only to meet current and proposed air emission standards. Conversely, while the land technology does not utilize natural gas as part of the treatment process it does impose a secondary and comparatively minor demand for drying of the crop production. Even so, the added demand will compound the fuel problems already facing the farming community and further underscore the priority of use issue, though this time in relation to agricultural-related needs. The major factor again will be the availability of the fuel itself. While the problem has a long-range potential for technological assistance in creating synthetic fuels, the immediate near-future solution involves the national import of alternative fuels such as crude oil. This in turn, has an impact on the nation's trade balance, the world market value of the dollar, and, in the case of one alternative, the export of oil from the "Alaskan North Slope", an environmental issue. Moreover the cost to both the nation and the consumer will be reflected by the competitive usage of the gas or fuel oil and this will extend beyond the cost increase for the treatment technology.

The amount of chemicals required for treatment was not considered a significant discriminator as such. There should be adequate capability to meet the required demand shown in Table G-IV-3, and the regional

Table G-IV-2
Fuel Needs (Million Cubic Feet/Day)
(Natural or Synthetic Gas)

Time of Need	Alternative I			Alternative II		
	Ill.	Ind.	Total	Ill.	Ind.	Total
1990	-	-	-	131	23	156
2020	-	-	-	161	28	189

Time of Need	Alternative III			Alternative IV		
	Ill.	Ind.	Total	Ill.	Ind.	Total
1990	71	14	85	-	-	-
2020	87	15	102	-	-	-

Time of Need	Alternative V		
	Ill.	Ind.	Total
1990	50	11	61
2020	55	10	60

Table G-IV-3
Chemicals Required for Treatment (Tons/Day)

1990 Chemical Needs	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Activated Carbon	-	-	-	85.6	16.4	102.0	42.8	8.2	51.0	-	-	-	30.3	6.9	37.2
Aluminum Sulfate (Liquid)	-	-	-	147.3	28.2	175.5	147.3	28.2	175.5	-	-	-	104.3	23.8	128.1
Chlorine	36.5	7.4	43.9	41.6	8.0	49.6	41.6	8.0	49.6	25.3	24.3	49.6	41.6	8.0	49.6
Clinoptilolite	-	-	-	201.4	38.6	240.0	-	-	-	-	-	-	-	-	-
Lime	-	-	-	2,220.8	425.2	2,646.0	1,616.5	309.1	1,925.6	-	-	-	1,144.6	261.1	1,405.7
Methanol	-	-	-	-	-	-	420.5	80.5	501.0	-	-	-	297.7	67.9	365.6
Polymer	-	-	-	1.3	0.3	1.6	1.3	0.3	1.6	-	-	-	0.9	0.2	1.1
Sodium Chloride	-	-	-	793.1	151.9	945.0	-	-	-	-	-	-	-	-	-
Total Chemicals	36.5	7.4	43.9	3,491.1	668.6	4,159.7	2,270.0	434.3	2,704.3	25.3	24.3	49.6	1,619.4	367.9	1,987.3
2020 Chemical Needs															
Activated Carbon	-	-	-	105.3	18.1	123.4	52.6	9.1	61.7	-	-	-	33.6	6.2	39.8
Aluminum Sulfate (Liquid)	-	-	-	181.2	31.2	212.4	181.2	31.2	212.4	-	-	-	115.5	21.4	136.9
Chlorine	43.7	7.7	51.4	51.1	8.8	59.9	51.1	8.8	59.9	31.7	28.2	59.9	51.1	8.8	59.9
Clinoptilolite	-	-	-	247.7	42.7	290.4	-	-	-	-	-	-	-	-	-
Lime	-	-	-	2,731.1	470.6	3,201.7	1,988.0	342.5	2,330.5	-	-	-	1,267.6	234.6	1,502.2
Methanol	-	-	-	-	-	-	517.1	89.1	606.2	-	-	-	329.7	61.0	390.7
Polymer	-	-	-	1.6	0.3	1.9	1.6	0.3	1.9	-	-	-	1.0	0.2	1.2
Sodium Chloride	-	-	-	975.4	168.1	1,143.5	-	-	-	-	-	-	-	-	-
Total Chemicals	43.7	7.7	51.4	4,293.4	739.8	5,033.2	2,791.6	481.0	3,272.6	31.7	28.2	59.9	1,798.5	332.2	2,130.7

transportation network has the capacity to accommodate the increased commodity movements. The more important implications were associated with the secondary aspects of manufacturing (energy requirements) and the consumptive rate imposed on the nation's resource base. The first impact, previously discussed will tend to compound an already existing problem. The second has a long-range problem potential, particularly when considering what this and other concurrent demands could have on the depletion rate of the nation's natural resource inventory. A converse but again indirect impact concerns the agri-chemical industry. Both the agricultural utilization of sludge and the land system's recycling of nutrients through irrigation will have the potential for reducing the demand for commercial fertilizer. However, the inherent potential for stimulating agricultural production could result in a concurrent increased demand for those chemical insecticides and herbicides now being used.

AREAL RESOURCE IMPACT

The impact on the area's natural resources was also quantified. As before the quantification was done on a comparative basis in an effort to develop another level of differentiation between alternatives. Primarily though, this portion of the evaluation concerned the treatment technologies and their effects on the area's water, air and land resources.

AREAL WATERWAYS

The impact on the area's waterways are assessable from two different categories of concern. The first category involves water quality considerations and the fact that the alternatives designed to achieve the NDCP standard will markedly improve the aquatic ecosystem. The improvements will be reflective of the more stringent level of treatment required for a wider range of key constituents. Also inherent in this consideration is the fact that a significant portion of storm water runoff would be treated, thereby reducing the incidence of interim stream quality degradation.

The second category concerns the opportunity that the capture and treatment of storm water runoff provides for adopting a balanced flow regimen more responsive to meeting the area's water needs. Not only will there be an inherent reduction in the frequency and depth of flooding but a concurrent potential for increasing the low-flow stream regimen. This in turn will enhance the potential for multiple in-stream usage and also provide an improved (water) resource base for supplemental related land developments such as recreational and environmenal stream corridors or commercial facilities requiring water frontage. The extent to which this category of enhancement is achieved, however, is contingent upon local decisions regulating flow distribution and stream usage. Further implications of this particular aspect are discussed in more detail in subsequent portions of this appendix.

AIR QUALITY

The differences in effects in air quality induced by the treatment processes were of concern to the socio-environmental evaluators. The resultant air emissions from the incineration phase of the Advanced Biological and Physical-Chemical processes were considered a potential detriment to the area's total environment and life chain. The extent of this impact, however, depended upon the constituents and concentrations of the emissions, particularly the sulfur dioxides and nitrogen oxides. Both of these constituents can be "burning type" irritants once inhaled. Furthermore, any air inversions could trap and concentrate these smog-associated emissions- enough to be considered a problem in densely populated areas. Based on the foregoing, it was concluded that the discharged quantity of these chemicals as well as the particulates were the key factors for differentiation. The total discharge expected to be experienced for each of the five alternatives is presented in Table G-IV-4. While all technologies were designed to meet current USEPA air emission standards, present technology is inadequate to maintain the level of nitrogen oxides within acceptable limits for the Physical-Chemical process only. Moreover, it should also be noted that the implications of these discharges on the ambient levels within each particular geographical subarea were not determined. To do this would require a detailed assessment of concurrent discharges from other near-by sources. This, as well as an evaluation of the secondary effects from the energy production required for each alternative, were considered beyond the scope of this study.

Other concerns such as odor and aerosol concentrations were generally considered minimal. Both problems are associated with the plant processes of Conventional Biological and Advanced Biological as well as the land treatment systems. In all cases, the odor problems can be controlled with the use of mechanical aerators. On the other hand, the intensity of the aerosol problems are greater for the cited plant systems because of the comparative short retention time involved in the aeration process. The retention time (relative to surface acres) for the plant processes range from 3 to 6 hours as opposed to the 3 to 5 days required for the aeration lagoon of the land system. The time variant for the land treatment system reflects the volume fluctuation caused by the storm water runoff, some 1.5 times greater than the dry weather flow. Thus, to accomplish the same degree of biological treatment, the plant processes must employ a more intensified aeration system and utilize greater microorganism concentrations. This results in a far greater aerosol concentration for the biological plant process. Even so the aerosol concentrations are within normal operational guidelines associated with plant treatment processes and therefore, were not considered a pertinent discriminating factor. Additional aerosols will be generated by the field irrigation system of the land treatment process. But again, the resultant will be of minor concern because of built-in design control of droplet size.

Table G-IV-4
AIR EMISSIONS (TONS/DAY)

Air Emissions, 1990	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Particulates	-	-	-	8.7	1.7	10.4	6.4	1.1	7.5	-	-	-	4.2	1.0	5.2
Sulfur Dioxide	-	-	-	1.1	0.2	1.3	0.1	-*	0.1	-	-	-	0.1	-*	0.1
Nitrogen Oxides	-	-	-	453.2	86.8	540.0	1.8	0.3	2.1	-	-	-	1.2	0.3	1.5
Total	-	-	-	463.0	88.7	551.7	8.3	1.4	9.7	-	-	-	5.5	1.3	6.8
Aerosols		Present		-	-	-		Present			Present			Present	
Air Emissions, 2020															
Particulates	-	-	-	10.7	1.8	12.5	7.2	1.3	8.5	-	-	-	4.6	0.9	5.5
Sulfur Dioxide	-	-	-	1.3	0.2	1.5	0.1	-*	0.1	-	-	-	0.1	-*	0.1
Nitrogen Oxides	-	-	-	557.4	96.0	653.4	2.0	0.3	2.3	-	-	-	1.3	0.2	1.5
Total	-	-	-	569.4	98.0	667.4	9.3	1.6	10.9	-	-	-	6.0	1.1	7.1
Aerosols		Present		-	-	-		Present			Present			Present	

*Present but in comparable minor quantities, amounting to some 0.01 tons per day.

LAND REQUIREMENTS

The land requirements were considered one of the most important of the differentiating criteria. Any commitment as to use will directly affect the social, environmental and economic phases which together comprise the life-style of not only the study area but also the surrounding counties. Without exception, all of the alternatives concerned with the treatment of C-SELM wastewater will have an impact on the adjacent outlying area. However, the extent (magnitude) and nature (acquisition or contractual arrangements) of the impacts varied considerably between alternatives, primarily due to the treatment technology involved. Based on the foregoing, the land impact analysis was divided into several parts: the nature and extent of land commitments associated with the functional component of each alternative system; and the location of impact, i.e., inside and outside the study area.

Four basic planning and design considerations were adopted that warrant specific mention.

1. The collection, conveyance, and redistribution systems in both the urban and suburban portions of the study area were specifically located within the public rights-of-way to avoid unnecessary land commitments. At the same time, the use of tunnels was employed, where flow volumes warranted, to minimize the social disruption that generally occurs during the construction phase.

2. The management program for the storm water runoff was constrained to fit into the current and projected land-use patterns. The urban storage requirements are designed to utilize either existing quarries or pit excavations. Therefore, the impact of this component on land-use patterns will be minimal. The suburban storm water storage, however, will require the purchase of land for the types of storage facilities feasible for consideration. Two types of storage are contemplated: shallow pit storage in areas where open space is still available; and mined storage where land is totally used for suburban development. As will be discussed later, both types have multiple-use potential. The rural storm water management system represents an integrated but miniature-sized land treatment system. As such, and also because of its multiple potential, the lands required for the storm water detention reservoirs are purchased while the lands irrigated as part of the rural treatment process are retained in private ownership through the use of contractual arrangements. The collection system for the storm water runoff would essentially consist of on-farms ditching and grassed drainage ways- both of which are an integral part of the land conservation program required in support of the water regimen control.

3. The land required for the actual physical layout of the plant processes is purchased in fee. For the three plant technologies, i.e. Conventional Biological, Advanced Biological and Physical-Chemical systems, this includes the supportive acreage for all of the unit processes and the on-site storage of the sludge volumes generated during the winter months. Lands for the aeration and storage lagoons are the only acreage in the land treatment process which are purchased in fee simple. Contractural arrangements would be employed between the operating entity and the participating farmers for the use of the lands to be irrigated. This would minimize lands taken from private ownership and removal from the local tax base.

4. No acquisition but only the use of contractural arrangements are anticipated to be required for the sludge management programs.

Of all the functional components of system design, only three had any specific land impacts. These three included the storm water management components, the treatment facilities and the sludge management program. The land requirements for the five alternatives are shown in Tables G-IV-5 (1990) and G-IV-6 (2020).

The needs for the storm water management function were common to all of the NDCP alternatives and as such were a discriminator only between water quality standards. Moreover the impact was confined to the land-use within the study area and did not affect the area of influence.

The land requirements for the treatment processes differed in many ways. Those alternatives (I through III inclusive) involving only the pure plant technologies required the minimum amount of land and significantly, lands only within the study area boundaries. The Physical-Chemical alternative involved the least amount of land, some 1,800 acres, with the Conventional and Advanced Biological plans requiring approximately 2,600 and 4,700 acres respectively. Included in these requirements are some 1,200 acres already being utilized and which would be incorporated into the areawide system.

Alternative IV, the plan involving the pure land treatment technology requires the greatest amount of land and because those sites are located outside the study area boundary, has different institutional problems implicit within its design. The acreage acquired in fee initially would amount to some 63,400 acres or some 21 times the weighted average required for the three plant alternatives. By the year 2020 this ratio would increase to some 76,700 acres or approximately 25 times more land. In addition, the acreage utilized for irrigation, the final stage of treatment, would involve 5 times the land acquired in fee. Though the irrigated lands would be retained in private ownership and integrated into the system through contractural arrangements, its impact would be extreme. Ultimately some 363,000 acres are required for irrigation. However to successfully integrate the system into the life-style of the agricultural community will involve consideration of a much larger area. Prototype model studies

Table G-IV-5
LAND REQUIREMENTS - 1990
(Acres)

System Component	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
A. Inside Study Area															
1. Treatment Facilities															
(a) Purchased a/	1,170	270	1,440	500	150	650	2,940	570	3,510	-	-	-	1,540	350	1,890
2. Storm Water Management															
(a) Suburban-Purchase	-	-	-	17,600	2,700	20,300	17,600	2,700	20,300	17,600	2,700	20,300	17,600	2,700	20,300
(b) Rural															
(1) Purchase	-	-	-	28,800	14,100	42,900	28,800	14,100	42,900	28,800	14,100	42,900	28,800	14,100	42,900
(2) Leased	-	-	-	78,500	37,800	116,300	78,500	37,800	116,300	78,500	37,800	116,300	78,500	37,800	116,300
(3) Total	-	-	-	107,300	51,900	159,200	107,300	51,900	159,200	107,300	51,900	159,200	107,300	51,900	159,200
B. Outside Study Area															
1. Treatment Facilities															
(a) Purchased	-	-	-	-	-	-	-	-	-	32,400	31,000	63,400	15,600	1,600	17,200
(b) Leased	-	-	-	-	-	-	-	-	-	153,100	146,900	300,000	73,600	7,500	81,100
(c) Total	-	-	-	-	-	-	-	-	-	185,500	177,900	363,400	89,200	9,100	98,300
2. Sludge Management System															
(a) Agricultural Utilization	47,300	9,700	57,000	551,700	97,300	649,000	47,300	9,700	57,000	28,000	29,000	57,000	47,300	9,700	57,000
(b) Surface Mine Reclamation	-	-	-	-	-	-	42,500	8,700	51,200	-	-	-	33,100	7,500	40,600
C. System Total (Purchase & Leased) b/ (rounded)	48,500	10,000	58,500	677,100	152,100	829,200	170,300	63,900	234,200	310,400	232,500	542,900	248,700	71,600	320,300

a/ Excludes 1,190 of which 1,060 acres are in Illinois, that are already owned in the study area and which would be incorporated into the system (plant or access points).

b/ Based agricultural utilization of sludge for Alternatives I and II; surface mine reclamation for Alternatives III, IV and V.

Table G-IV-6
LAND REQUIREMENTS - 2020
(Acres)

System Component	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
A. Inside Study Area															
1. Treatment Facilities															
(a) Purchased a/	1,170	270	1,440	500	150	650	2,940	570	3,510	-	-	-	1,540	350	1,890
2. Storm Water Management															
(a) Suburban-Purchase	-	-	-	17,600	2,700	20,300	17,600	2,700	20,300	17,600	2,700	20,300	17,600	2,700	20,300
(b) Rural															
(1) Purchase	-	-	-	28,800	14,100	42,900	28,800	14,100	42,900	28,800	14,100	42,900	28,800	14,100	42,900
(2) Leased	-	-	-	55,800	31,300	87,100	55,800	31,300	87,100	55,800	31,300	87,100	55,800	31,300	87,100
(3) Total	-	-	-	84,600	45,400	130,000	84,600	45,400	130,000	84,600	45,400	130,000	84,600	45,400	130,000
B. Outside Study Area															
1. Treatment Facilities															
(a) Purchased	-	-	-	-	-	-	-	-	-	40,700	36,000	76,700	23,700	3,600	27,300
(b) Leased	-	-	-	-	-	-	-	-	-	192,300	170,700	363,000	112,300	16,800	129,100
(c) Total	-	-	-	-	-	-	-	-	-	233,000	206,700	439,700	136,000	20,400	156,400
2. Sludge Management System															
(a) Agricultural Utilization	57,000	10,100	67,100	652,600	115,200	767,800	57,000	10,100	67,100	33,600	33,500	67,100	57,000	10,100	67,100
(b) Surface Mine Reclamation	-	-	-	-	-	-	260,500	47,900	308,400	128,600	128,600	257,200	251,100	46,700	297,800
C. System Total (Purchase & Leased) b/ (rounded)	58,200	10,400	68,600	755,300	163,500	918,800	365,600	96,600	462,200	463,800	383,400	847,200	490,800	115,600	606,400

a/ Excludes 1,190 of which 1,060 acres are in Illinois, that are already owned in the study area and which would be incorporated into the system as plant or access points.

b/ Based on agricultural utilization of sludge for Alternatives I and II; surface mine reclamation for Alternatives III, IV and V.

of various geographical locations indicate that of the land areas under consideration, there will be an acreage use-effectiveness ratio of some 40 percent. This means that only some 40 percent of the land can be successfully incorporated within the treatment system. The rest would not be used in order to: avoid disruption to eco-unique areas, communities, and other developments; maintain the integrity of the local transportation network; minimize the impact to the participating farmer's home and facilities; and circumvent those types of soils which could not be effectively used in the system's operations. As a result, the land treatment system will indirectly impact on an area some 1 1/2 times its size. This geographical area of influence will amount to some 500,000 acres (2020)and as such require that many outlying counties retain their present land-use patterns for the next 50 years. This constraint in turn superimposes a series of interrelated impacts on the area of influence, which because of their nature are discussed under socio-environmental implications. A breakdown of the various effected acreage within each of the five land site areas is presented in Table G-IV-7.

The land requirements of Alternative V, an integrated system of both the Advanced Biological and land technologies represents a balance between the needs of the plant technologies and the pure land system. Because the five plants treat some two-thirds of the total wastewater volume, the total acreage requirements are approximately one-third the scale of the pure land system. Of equal importance is the fact that the alternative involves location of treatment sites both within the study area and the area of influence. The division of the various effected acreage within each of the five scaled-down land site areas is also presented in Table G-IV-7.

The proposed sludge disposal programs involve the use of lands located totally outside the study area. Moreover the impact on the outlying area of influence varies with the sludge management option being considered. If the sludge is used for agricultural production, Option 1, contractual arrangements similar to those required for the irrigated acreage in the land treatment processes will be required. The sludge disposal for the Physical-Chemical alternative, though, will be a particular problem. Its use as a soil conditioner and pH control has limited market value and restrictions as to repetitive applications. Therefore excessive amounts of acreage are required- some 11 to 12 times the needs of the other technologies. On the other hand if Option 2, rehabilitation and integration with surface mining operations were to be selected, the acreage requirements ultimately (2020) would be some 4 to 4.5 times that required for Option 1. The increased acreage reflects a one-time application rather than a yearly rate in order to facilitate the reuse of the reclaimed land. As is recognized in a letter from the Mid-West Coal Producers Institute Inc. (See Annex A), Option 2 reflects the opportunity to recycle the

Table G-IV-7
Acreage Implications - Outlying Area
Land Treatment Sites

ALTERNATIVE IV

Treatment Site	1990 Purchased	1990 Leased Lands for Irrigation	1990 Other a/ Affected Acreage	1990 Total b/	2020 Purchased	2020 Leased Lands for Irrigation	2020 Other a/ Affected Acreage	2020 Total b/
McHenry: West	4,300	20,300	18,575	43,175	7,000	33,000	33,000	73,000
Central	1,700	7,900	7,900	17,500	1,700	7,900	7,900	17,500
Kendall	4,600	21,700	15,435	41,735	6,800	32,600	24,450	63,850
Grundy-Will-Kankakee & Iroquois	21,800	103,200	154,000	279,000	25,200	118,800	178,100	322,100
Subtotal, Illinois	32,400	153,100	195,910	381,410	40,700	192,300	243,450	476,450
Newton-Jasper-Pulaski & Starke	31,000	146,900	221,100	399,000	36,000	170,700	256,300	463,000
Total	63,400	300,000	417,010	780,410	76,700	363,000	499,750	939,450

ALTERNATIVE V

Treatment Site	1990 Purchased	1990 Leased Lands for Irrigation	1990 Other a/ Affected Acreage	1990 Total b/	2020 Purchased	2020 Leased Lands for Irrigation	2020 Other a/ Affected Acreage	2020 Total b/
McHenry: West	4,300	20,300	18,575	43,175	7,000	33,000	33,000	73,000
Central	1,700	7,900	7,900	17,500	1,700	7,900	7,900	17,500
Kendall	4,600	21,700	15,435	41,735	6,800	32,600	24,450	63,850
Grundy-Will-Kankakee & Iroquois	5,000	23,700	35,600	64,300	8,200	38,800	58,200	105,200
Subtotal, Illinois	15,600	73,600	77,510	166,710	23,700	112,300	123,550	259,550
Newton-Jasper-Pulaski & Starke	1,600	7,500	6,400	15,500	3,600	16,800	16,200	36,600
Total	17,200	81,100	83,910	182,210	27,300	129,100	139,750	296,150

a/ Acreage the usage of which may be constrained by the system from other alternative uses. The degree of effect, if any, would be determined during detailed study efforts.

b/ Total acreage within which the land treatment agricultural sites would be located.

residual waste by-products and at the same time enhance the fertility of mined lands in the outlying area. With proper coordination between the mining industry and governmental entities, there could be multiple benefits to all concerned with the land use developed in consonance with the individual county(s) land-use objectives. Furthermore, there would not be any social disruption to the area nor any additional constraints imposed on the current land use trends.

Based on the foregoing it was concluded that the main differential between the alternatives is the acreage requirements for the various treatment processes. This excludes the socio-environmental considerations implicit in the land use. There were two other factors which further helped to differentiate between the alternatives. The first pertains to the sludge management program and the fact that the Physical-Chemical technology is the only one which precludes this program, regardless of option, being a common factor of design. Moreover, the acreage requirements for this function also were comparable except for the Physical-Chemical process which was significantly larger. The second factor was that the acreage required for the storm water management function was a pertinent discriminator only between water quality standards.

SECTION V - SOCIO ENVIRONMENTAL CONSIDERATIONS

There were three major categories of plan-associated effects that were considered within the context of the social and environmental assessment. These three included the labor required for system operations and its potential impact on the employment market; the number of people displaced or directly affected; and the impact induced on those environmental aspects and human activities that together comprise the life style of an area.

LABOR REQUIREMENTS

The manpower needs are directly related to the water quality standards. The alternatives designed to achieve the NDCP goal generally require substantial increases in both the amount of manpower and the level of skills. A breakdown of the general labor requirements per functional component and the type of labor (unskilled, skilled and supervisory) are presented for each of the five alternatives in Tables G-V-1 through G-V-5. The majority of the labor needs are associated with the operation of the treatment facilities; the requirements for the other components being comparatively minor. The labor requirements for the operation of the plant facilities ranged from about 70 to 85 percent of the total system needs. On the other hand, only 55 percent of the total labor needs is required for the operation of the land treatment facilities. Furthermore, the total labor needs for the land system averages less than 50 percent of that required for the rest of the NDCP alternatives and only 1.7 times greater than that which would be required to meet the current standards. The manpower needs will be satisfied in part by new labor hires while a substantial number will require retraining particularly for the treatment plant alternatives. Depending upon the degree of regionalization ultimately adopted, Federal and State assistance may be needed in conjunction with job relocation and labor training programs.

While a new source of employment will be available, its impact will not be significant especially when compared to the existing job market. Of more concern is that the jobs associated with this type of service industry have not been able to attract and retain enough qualified personnel. The problem has mainly been the lack of pay and job image and until these aspects have been overcome, the personnel problem will continue. The number of jobs that would provide a source of local employment to the residents in the outlying area will not be significant either. First, many of the areas are changing rapidly, converting from a rural to a semi-rural economy. Thus, the number of hires will be comparatively small in relation to other gain sources. Aside from the potential offered by the land treatment system, only the sludge management programs will be involved. Regardless of the option used, the labor requirements for this functional component will range from 3 to 10 percent of the total systems labor needs. This applies to all the alternatives except the Physical-Chemical process which imposes a 15 percent use factor.

Table G-V-1
LABOR REQUIREMENTS - ALTERNATIVE I

FUNCTIONAL COMPONENTS - 1990	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	836	1,047	107	1,990	171	214	22	407	1,007	1,261	129	2,397
Conveyance System	34	98	49	181	7	20	10	37	41	118	59	218
Storm Water Management System	-	-	-	-	-	-	-	-	-	-	-	-
Sludge Management Program a/	133	118	12	263	28	24	3	55	161	142	15	318
Reuse System	-	-	-	-	-	-	-		-	-	-	-
Total	1,003	1,263	168	2,434	206	258	35	499	1,209	1,521	203	2,933
Say	1,000	1,260	170	2,430	210	260	30	500	1,210	1,520	200	2,930

FUNCTIONAL COMPONENTS - 2020	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	1,006	1,255	130	2,391	179	223	23	425	1,185	1,478	153	2,816
Conveyance System	34	98	49	181	7	20	10	37	41	118	59	218
Storm Water Management System	-	-	-	-	-	-	-	-	-	-	-	-
Sludge Management Program a/	143	129	14	286	29	24	3	56	172	153	17	342
Reuse System	-	-	-									
Total	1,183	1,482	193	2,858	215	267	36	518	1,398	1,749	229	3,376
Say	1,190	1,480	190	2,860	210	270	40	520	1,400	1,750	230	3,380

a/ Agricultural Utilization

Table G-V-2
LABOR REQUIREMENTS - ALTERNATIVE II

FUNCTIONAL COMPONENTS - 1990	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	1,990	3,525	706	6,221	381	675	135	1,191	2,371	4,200	841	7,412
Conveyance System	41	119	58	218	8	23	12	43	49	142	70	261
Storm Water Management System	386	796	398	1,580	74	153	77	304	460	949	475	1,884
Sludge Management Program a/	650	600	58	1,308	125	115	12	252	775	715	70	1,560
Re-Use System	26	11	5	42	5	2	1	8	31	13	6	50
Total	3,093	5,051	1,225	9,369	593	968	237	1,798	3,686	6,019	1,462	11,167
Say	3,090	5,050	1,230	9,370	590	970	240	1,800	3,690	6,020	1,460	11,170

FUNCTIONAL COMPONENTS - 2020	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	2,450	4,336	867	7,653	422	747	150	1,319	2,872	5,083	1,017	8,972
Conveyance System	41	121	59	221	8	23	12	43	49	144	71	264
Storm Water Management System	286	592	298	1,176	50	102	52	204	336	694	350	1,380
Sludge Management Program	780	718	72	1,570	135	124	13	272	915	842	85	1,842
Re-Use System	26	11	5	42	5	2	1	8	31	13	6	50
Total	3,583	5,778	1,301	10,662	620	998	228	1,846	4,203	6,776	1,529	12,508
Say	3,580	5,780	1,300	10,660	620	1,000	230	1,850	4,200	6,780	1,530	12,510

Table G-V-3
LABOR REQUIREMENTS - ALTERNATIVE III

FUNCTIONAL COMPONENTS - 1990	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	2,720	4,029	756	7,505	521	772	145	1,438	3,241	4,801	901	8,943
Conveyance System	38	114	58	210	8	22	12	42	46	136	70	252
Storm Water Management System	386	796	398	1,580	74	153	77	304	460	949	475	1,884
Sludge Management Program a/	189	169	16	374	37	33	3	73	226	202	19	447
Re-Use System	26	11	5	42	5	2	1	8	31	13	6	50
Total	3,359	5,119	1,233	9,711	645	982	238	1,865	4,004	6,101	1,471	11,576
Say	3,360	5,120	1,230	9,710	650	980	240	1,870	4,010	6,100	1,470	11,580

FUNCTIONAL COMPONENTS - 2020	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	3,345	4,956	928	9,229	577	854	161	1,592	3,922	5,810	1,089	10,821
Conveyance System	38	114	58	210	8	22	12	42	46	136	70	252
Storm Water Management System	286	592	298	1,176	50	102	52	204	336	694	350	1,380
Sludge Management Program	208	187	17	412	39	35	3	77	247	222	20	489
Re-Use System	26	11	5	42	5	2	1	8	31	13	6	50
Total	3,903	5,860	1,306	11,069	679	1,015	229	1,923	4,582	6,875	1,535	12,992
Say	3,900	5,860	1,310	11,070	680	1,020	230	1,930	4,580	6,880	1,540	13,000

a/ Sludge Option 2, Reclamation of Surface Mines

Table G-V-4
LABOR REQUIREMENTS - ALTERNATIVE IV

FUNCTIONAL COMPONENTS - 1990	ILLINOIS Unskilled	ILLINOIS Skilled	ILLINOIS Supervisors	ILLINOIS Total	INDIANA Unskilled	INDIANA Skilled	INDIANA Supervisors	INDIANA Total	TOTAL Unskilled	TOTAL Skilled	TOTAL Supervisors	TOTAL Total
Treatment Facilities	752	423	95	1,270	722	406	92	1,220	1,474	829	187	2,490
Conveyance System	37	109	56	202	36	105	53	194	73	214	109	396
Storm Water Management System	386	796	398	1,580	74	153	77	304	460	949	475	1,884
Sludge Management Program a/	94	85	8	187	90	81	8	179	184	166	16	366
Re-Use System	103	42	20	165	99	40	20	159	202	82	40	324
Total	1,372	1,455	577	3,404	1,021	785	250	2,056	2,393	2,240	827	5,460
Say	1,370	1,450	580	3,400	1,020	790	250	2,060	2,390	2,240	830	5,460

FUNCTIONAL COMPONENTS - 2020	ILLINOIS Unskilled	ILLINOIS Skilled	ILLINOIS Supervisors	ILLINOIS Total	INDIANA Unskilled	INDIANA Skilled	INDIANA Supervisors	INDIANA Total	TOTAL Unskilled	TOTAL Skilled	TOTAL Supervisors	TOTAL Total
Treatment Facilities	944	531	118	1,593	839	472	105	1,416	1,783	1,003	223	3,009
Conveyance System	37	112	56	205	36	105	53	194	73	217	109	399
Storm Water Management System	286	592	298	1,176	50	102	52	204	336	694	350	1,380
Sludge Management Program	110	101	10	221	98	89	9	196	208	190	19	417
Re-Use System	108	43	22	173	96	40	19	155	204	83	41	328
Total	1,485	1,379	504	3,368	1,119	808	238	2,165	2,604	2,187	742	5,533
Say	1,490	1,380	500	3,370	1,120	810	240	2,170	2,610	2,190	740	5,540

a/ Sludge Option 2, Reclamation of Surface Mines

Table G-V-5
LABOR REQUIREMENTS - ALTERNATIVE V

FUNCTIONAL COMPONENTS - 1990	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	2,288	3,054	581	5,923	477	672	127	1,276	2,765	3,726	708	7,199
Conveyance System	45	134	67	246	8	24	13	45	53	158	80	291
Storm Water Management System	386	796	398	1,580	74	153	77	304	460	949	475	1,884
Sludge Management Program a/	178	160	15	353	36	32	4	72	214	192	19	425
Re-Use System	79	31	17	127	13	5	3	21	92	36	20	148
Total	2,976	4,175	1,078	8,229	608	886	224	1,718	3,584	5,061	1,302	9,947
Say	2,980	4,170	1,080	8,230	610	890	220	1,720	3,590	5,060	1,300	9,950

FUNCTIONAL COMPONENTS - 2020	ILLINOIS				INDIANA				TOTAL			
	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total	Unskilled	Skilled	Supervisors	Total
Treatment Facilities	2,684	3,469	661	6,814	478	631	121	1,230	3,162	4,100	782	8,044
Conveyance System	47	140	72	259	8	24	13	45	55	164	85	304
Storm Water Management System	286	592	298	1,176	50	102	52	204	336	694	350	1,380
Sludge Management Program a/	195	176	16	387	38	34	4	76	233	210	20	463
Re-Use System	79	31	17	127	13	5	3	21	92	36	20	148
Total	3,291	4,408	1,064	8,763	587	796	193	1,576	3,878	5,204	1,257	10,339
Say	3,290	4,410	1,060	8,760	590	800	190	1,580	3,880	5,210	1,250	10,340

a/ Sludge Option 2, Reclamation of Surface Mines

SOCIAL DISRUPTION

While every attempt has been made to minimize disruption to residents in any of the areas, there will be displacements involved with the siting of the treatment facilities. People displacements for the various areas under consideration were obtained by multiplying the gross township population densities for each location by the new area needed. A summary is presented in Table G-V-6. As is shown, the major displacement factor is the storm water management system. Since it is a common feature of the NDCP alternatives, the attributable disruption is a discriminator between water quality goals, not alternatives. Consequently, the disruption caused by the treatment facilities physical layout was the basis for differentiation. The smallest impact will be attributable to the Physical-Chemical alternative and the largest caused by the Advanced Biological alternative. There are two reasons for this. First the Advanced Biological requires a much larger site to accomodate the unit processes required to meet the higher quality standard. The second factor is that the Advanced Biological alternative represents the optimum in terms of regionalization i.e. the minimum number of plants. Consequentially the plants tend to impact more extensively on the urbanized or more densely populated areas and the higher number of displaced people is the net causal effect. The actual displacement caused by construction of the aeration and storage lagoons for the land treatment systems were minimal, in fact less than that required for the plant alternative to meet current standards. However the reasons for this should be clearly understood. Although large tracts of land are purchased, the impact is offset by the comparably low population density of the semi-rural area. In addition system design was specifically modified to take into consideration the present and projected distribution of population and growth centers. This was one of the major factors that (1) contributed to the adoption of the 40 percent use-effectiveness land ratio previously mentioned and (2) is why the cost of the land system is so high in comparison to one designed only to achieve treatment and not modified for social considerations.

SOCIO-ENVIRONMENTAL IMPACTS

BASIS OF EVALUATION

The impact of the five alternatives on the area's environment and human activities was evaluated in terms of over-all implications rather than on a disaggregate basis. It was recognized that one of the major factors in the final decision-making process will be the extent to which the area's treatment system will be consolidated. Aside from the interaction that resource commitments imposes on a community's lifestyle, regionalization was considered the one variant with the most potential for impacting on the natural and social environment. Accordingly attention was focused on the system components and the causal effects associated with the function and the alternative's degree of regionalization. Impacts specific to a site and surrounding locality should, of necessity, be evaluated once a wastewater management program is adopted for the study area. At that time an effect assessment and environmental impact statement must be prepared before any phase of the plan of improvement is implemented.

Table G-V-6
Displacement of People

System Components	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
1. Treatment Facilities															
1990: Plant	2,577	815	3,392	879	423	1,302	9,780	2,409	12,189	-	-	-	6,111	2,048	8,159
Land	-	-	-	-	-	-	-	-	-	1,665	1,085	2,750	860	60	920
Total	2,577	815	3,392	879	423	1,302	9,780	2,409	12,189	1,665	1,085	2,750	6,971	2,108	9,079
2020: Plant	2,577	815	3,392	879	423	1,302	9,780	2,409	12,189	-	-	-	6,111	2,048	8,159
Land	-	-	-	-	-	-	-	-	-	2,120	1,260	3,380	1,310	130	1,440
Total	2,577	815	3,392	879	423	1,302	9.780	2,409	12,189	2,120	1,260	3,380	7,421	2,178	9,599
2. Storm Water Management															
Suburban Storage	-	-	-	4,000	600	4,600	4,000	600	4,600	4,000	600	4,600	4,000	600	4,600
Rural Storage	-	-	-	8,630	4,230	12,860	8,630	4,230	12,860	8,630	4,230	12,860	8,630	4,230	12,860
Total	-	-	-	12,630	4,830	17,460	12,630	4,830	17,460	12,630	4,830	17,460	12,630	4,830	17,460
3. Total (rounded)															
1990	2,600	800	3,400	13,500	5,300	18,800	22,400	7,200	29,600	14,300	5,900	20,200	19,600	6,900	26,500
2020	2,600	800	3,400	13,500	5,300	18,800	22,400	7,200	29,600	14,800	6,100	20,900	20,100	7,000	27,100

In order to insure its relevancy, the evaluation was done by a group of academicians from a number of universities located in the study area. The members of the evaluation team included such special fields of competence as Environmental Health Engineering, Biology, Aquatic Biology and Chemistry, Urban Sociology and Urban Systems Planning, Water Resources Planning, Geology and Economics. The results of their assessment, the methodology of analysis and conclusions are presented in Appendix E. The following is a summary of the key observations evaluated within the context of ecological, social, aesthetic and hygenic considerations.

STORM WATER MANAGEMENT PROGRAM

The storm water management program associated with the NDCP alternatives is localized with respect to design and hence essentially independent of system regionalization. Capture and treatment of surface runoff will not only improve the stream water quality but also effectively regulate its quantity. At the same time, construction of the impoundments especially in the rural area will result in an increase of standing water biotic (aquatic organisms) communities and a reduction in flowing water and terrestrial (flora and fauna) communities. This trade-off was not viewed as a negative effect on the distribution or diversity of the biotic communities since most areas have already been highly modified by man. However, care should be exercised in the final siting studies to avoid disruption of any eco-unique area that may still exist. There also will be some concurrent losses in agricultural lands within the study area, but this should be offset by the gain in flood plain relief achieved by the retention reservoirs. These storm water management systems also will provide an opportunity to increase the study area's recreational opportunities and open-space due to the storage site's potential for multiple objective design. As with all items of urban construction, there will be some degree of disruption to the public transportation and communication services but this will be temporary in its negative impact and, over time, should prove minimal.

COLLECTION AND CONVEYANCE SYSTEM

The collection and conveyance systems are a function of the degree of regionalization being considered. Most of the impacts associated with this functional component are directly related to the construction phase and the surface disruption to the total environment. Some of the biotic communities will be irreparably altered during the installation of the pipeline systems for either the collection or redistribution system elements. Conversely tunnel construction for the regional conveyance system elements will not involve surface distribution and so was not considered detrimental. In fact the spoil material can be put to good use as is discussed in a later section. From a social standpoint there will

be temporary inconveniences to public access and traffic flows and interim aesthetic blights caused by the noise, dust and visual contrasts with normal conditions. Another main factor is that the location of the conveyance system will influence area development, particularly since growth patterns will follow these lines if free access is permitted. Thus, every effort should be made to incorporate the study area's open-space objectives in with the wastewater management system's physical layout.

TREATMENT FACILITIES

Plant Technology

The treatment facilities and particularly the technological processes involved were calculated only in relation to their direct impact on the total environment. Specifically excluded was any consideration of the end product, a highly desirable gain in the water quality. In this way attention was focused on the relative negative aspects of each technology since either could be independently used and substituted, regardless of the degree of regionalization ultimately adopted. The plant technologies were evaluated together since the facilities impacted only on the study area itself. The Physical-Chemical was consistently downgraded in relation to the Advanced Biological process primarily due to the adverse impact on air quality previously discussed. It was generally felt that the long-term effects when added to those emissions already present in the urbanized area will adversely impact on the residential patterns, biotic communities, aesthetic (visual and odors), and hygienic (irritants and particulates) facets of the environment. In addition the Physical-Chemical process did not foster as wise a use of resources as the Advanced Biological technology. It is the most consumptive of the natural resources and converts them into noxious air pollutants as well as less usable sludge.

Land Technology

The impact attributable to the land treatment system was assessed separately, though the cause and effect relationship of using rural resources to treat urban problems also was discussed. The land system will involve some disruption of the natural biotic communities due to construction of the aeration and storage lagoons; but the planning constraints relative to protection of the eco-unique areas should minimize the impact. Furthermore the drawdown of the water table under the irrigated sites must be controlled to prevent an adverse (shock) effect on the vegetative ground cover. At the same time the extensive number and location of storage lagoons in Alternative IV will undoubtedly attract waterfowl into the area particularly since an abundance of vegetative cover and food crops will be nearby. The significance of this aspect and its effects on the migration pattern for the Mississippi River fly way is not known at this time.

While the land system does conserve nutrient resources through recycling of the wastewater nutrients, there was concern over the possible long-range change in the soil's use potential. It was recognized that the research program concerning sludge application currently being conducted by the University of Illinois indicates both the feasibility and effectiveness of maintaining the soil quality. The sludge used in the research program comes from two Chicagoland plants that treat wasteloads from highly industrialized areas and, as such, represents a constituent concentration far in excess of that obtained with the use of the treated effluent. Nevertheless it does underscore the importance of an extensive monitoring program, a critical part of the operational system for all technologies. In addition the subsurface water quality over a long period of time will approximate the same constituent levels obtained from the higher water quality standard. This will include a level of total dissolved solids that could be higher than exists there now but still within potable supply standards.

The impact on the sociological and community political structure was the major concern of the evaluators as well as the residents of the agricultural areas. It was noted that some of the employment skills associated with the land treatment process could effectively use the manpower available in the area. Employment of those small farmers that need an outside source of income, would help them remain in the area, rather than work in or migrate to the city. As previously noted, however, this was of comparable minor importance. The concept of controlling the use of such large parcels of land within the outlying agricultural area was the basic concern.

Alternative IV the pure land system may well have negative impacts on other than agricultural land uses in the rural areas such as the Newton-Jasper County area in Indiana where the development of I-65 has opened a new path to urbanization. Prediction of a growth vector to the south in the Calumet Region was made as early as 1966. Thus, the extensive nature of land treatment suggested in Alternative IV reverses an established trend away from agricultural land use if it is to be applied to so large an area. Obviously, the I-65 right-of-way is desirable for conveyance systems, however, treatment and/or storage along this artery, especially near exits, could result in major dislocations unless properly planned.

Key to assessing the final impact prior to selection will be the rural communities willingness to work with the urban communities and forego certain values, social and economic, implicit within their long-range plans. The use of long term contractural arrangements (50 years) and the magnitude of land commitments will constrain any real flexibility in land-use planning and growth patterns. Some planners see advantages in the land system to

maintain open space and control urban-related developments. However, the scale of commitment, particularly in the Kankakee River Basin (Indiana and Illinois) has generated a strong political and social opposition. The social, political and institutional aspects are discussed in more detail in subsequent portions of this appendix.

SLUDGE MANAGEMENT

Very little differences were noted between the potential use value of the sludges produced by any except the Physical-Chemical technological process. The differential in impact due the constituent composition and use potential previously was discussed from a land use aspect.

Land reclamation and agricultural disposal of biological sludges from wastewater treatment has already been adopted by the Metropolitan Sanitary District of Greater Chicago and the North Shore Sanitary District in Lake County, Illinois. The Gary Sanitary District already has two borrow pits (from construction of the Indiana Toll Road) for sludge disposal and these pits will be useful until 1990. Since approximately one half of the sludge from wastewater treatment in the C-SELM area is already being utilized or disposed on land sites, total agricultural utilization of sludges was considered only a slight improvement over current practices. Furthermore, restricting land for agricultural uses faces the same social and political problems confronting the implementation of the land treatment system, Alternative IV. The option of land rehabilitation was judged to have the most beneficial potential, especially from a local and regional standpoint.

Strip mined areas when reclaimed can become useful sites for recreational purposes. For example, Shakamac State Park and Green-Sullivan State Forest in southwest Indiana were once strip mined areas. Today, they provide for a wide range of recreational opportunities, including: hiking, horse-back riding, picnicing, boating, swimming, camping and fishing. Given the increasing population projected for the C-SELM region in 1990 and the expected increase in leisure time, there is also anticipated a need for increased recreational opportunities near the metropolitan areas. Strip mined areas that are currently unproductive and those that will be surface mined in the future could well utilize the soil building qualities of the biologically produced sludges for reclamation purposes. With land reclamation, the land becomes available for a variety of potential uses once the character of the soil has been again made productive and vegetative cover, shrubbery and trees are introduced. Other use could include such diverse purposes as residential development, open-space, agricultural and beef production or regional industrial and light commercial park sites. Regardless of the selected use, such areas should be incorporated into local land-use plans to enhance such opportunities. This, in turn, should lead to an orderly development in consonance with local thinking and growth patterns.

SECTION VI - INSTITUTIONAL ASSESSMENT

An evaluation and analysis of the institutional impacts was prepared by a private concern and is presented in Appendix F. The assessment identifies: (1) institutional, including financial impacts of the five alternatives upon a cross-section of existing institutions; (2) the types of changes which would be necessary for implementation by existing institutions; and (3) alternative institutional arrangements which also could be considered if so desired.

BACKGROUND FACTORS

Current policies require that all Federal programs are consistent with regional service needs and that they encourage regional solutions and the most efficient use of Federal and local resources. This runs counter to the State emphasis on the need to maintain the integrity of home rule for local counties and communities. Nowhere is this concept of home rule more in evidence than in the States of Illinois and Indiana.

Provision of wastewater management services in the C-SELM area will be affected by several factors at the state and Federal levels. At the Federal level, a change in philosophy has occured with enactment of PL 92-500. Now, instead of assisting local efforts to set water quality standards, a national framework for effluent standards and implementation of areawide plans is being established. Strict new limits on effluent discharges by class and category (in some cases amounting to a total prohibition of toxic pollutant discharges) will be set by the U. S. Environmental Protection Agency and areawide solutions to pollution control will be emphasized.

Along with Federal policies and actions shaping wastewater management policies and programs, several significant local factors are of equal significance. The C-SELM area is a bi-state area and includes, in addition to most of the Chicago Metropolitan Area, a significant portion of the highly urbanized and industrialized northwestern corner of Indiana. As a result, the study area is affected and complicated by two distinct sets of institutions. At present, Indiana does not have the authority to assume general obligation bond indebtedness. Illinois does. The recently revised Illinois Constitution supports the concept of local community rule, a factor which could have a direct bearing on attempts to regionalize wastewater services. In Indiana, on the other hand, there is now authority to establish regional water and sewage districts, however, no public demand for such a district has been heard. Three types of institutions currently provide wastewater management and/or treatment services within the C-SELM area: municipalities, counties, and special districts. Illinois counties may provide these services only if they are not already provided by an entity organized for similar services.

While there are attempts in Indiana to widen the institutional authority to provide wastewater management services, there are other attempts to limit this authority. Thus, for example, legislation has been passed by Indiana which would prohibit the interstate transfer of sewage and which would prohibit the implementation of any land disposal system without State and county approval. Similar legislation is now under consideration by the State of Illinois which will inhibit intercounty transfers. These would certainly have a negative effect on any regional proposals which include outlying portions of Indiana and Illinois. Moreover, no regional institution exists in either state with the authority or jurisdiction to implement and/or operate wastewater management programs and proposals. At the interstate level, the Interstate Planning Committee makes recommendations but it has no authority to implement, regulate or enforce its recommendations. At the regional level, the Northeastern Illinois Planning Commission in Illinois and the Lake-Porter County Regional Planning and Transportation Commission in Indiana both have comprehensive planning authority but no power to implement plans. At the state level, both states have their own regulatory and enforcement agencies.

The concern for protecting local community's antonomy and integrity is a factor recognized by policy and decision makers at all levels of government in the two affected states. It is also becoming more apparent that increased regional coordination of technical systems, financing and institutional capabilities is the optimal solution to the need for efficient and economical wastewater management and treatment services. This establishes the potential for a basic conflict between home rule and regionalization. In short, the technological trend is toward greater consolidation of wastewater management services because of greater economies of scale. This trend is responsive to the concern over the mounting costs associated with these services. The "taxpayer revolt", as it has come to be known, is a clear sign that costs cannot continue to rise without some dramatic protest from the taxpayers of the affected areas. Although these realities are, on the surface, in conflict, this does not necessarily mean a solution is not possible. On the contrary, it means these issues demand close attention and a realistic evaluation of the interests involved if a crisis is to be averted.

ASSESSMENT OF FUNCTIONAL COMPONENTS

REGIONALIZATION OF TREATMENT

There are more similarities than differences in institutional impacts between the five alternatives. All alternatives would regionalize or consolidate services beyond the existing treatment system. Alternative I for example is a compilation and projection of planning efforts presently advocated by existing local and regional planning agencies. The other plant alternatives would carry these effects even further and would,

to increasing degree, require the coordination of planning operations and management activities. Accordingly the number of plants utilized determines the number of institutions affected by the abandonment of existing plants. This, in turn, creates a secondary level of institutional concerns: the assumption of the outstanding debts and compensation due the abandoned plant owners; and the interrelationships among the existing institutions. The latter creates the need for consolidation and/or contractual arrangements between those institutions without treatment plants and those with plants.

The utilization of the spray irrigation sites required by Alternatives IV and V will have significant institutional impacts outside, as well as inside, the study area. Within the study area, the alternatives would have a similar impact because of the common need for a cooperative arrangement among wastewater management institutions to regulate the use of shared facilities such as the conveyance and storm water management systems. Outside of the study area, the institutional impacts of the alternatives would be similar in that both use land treatment sites in the same general areas. However, Alternative IV would have a greater impact because it utilizes components which cross state lines and thus would require some type of interstate compact and Congressional approval. Alternative IV also requires the use of more acreage. Institutions outside the study area which would be affected include agencies responsible for the relocation of people, agencies responsible for land use planning and control, and agencies with the potential for being assigned responsibility for the acquisition and operation of the spray irrigation sites.

The major impact of the irrigation sites, however, would stem from the need to incorporate citizens living outside of the C-SELM area in the wastewater management decision-making process. In order for these citizens to be assured that their own self-interests and values are protected it is imperative for them to have administrative responsibility over their lands. A good technique for incorporating such citizens in the decision-making process would be to establish locally controlled agencies which would be responsible for acquisition and operation of the spray irrigation sites. The local agency would contract with existing wastewater agencies within the C-SELM area for the treatment of wastewater. A second alternative would be to coordinate operation of the locally operated irrigation sites and the existing collection systems through a regional body composed of representatives from within and outside of the C-SELM area. If this regional approach was adopted, steps would have to be taken to avoid potential conflict with the one man, one vote principle while providing the citizens in the outlying area an influential voice.

STORM WATER MANAGEMENT SYSTEMS

Two basic types of storm water collection and treatment systems are utilized by the technical alternatives. All alternatives would treat the storm water of the Metropolitan Chicago and Gary areas which would be collected through combined sewers. The impact of this storm water system would be minimal as similar systems exist at the present. The NDCP alternatives would utilize a more complex and regionalized storm water treatment system. The rest of the storm water in the urban, suburban and rural areas would be collected separately and stored before being released at a controlled rate for treatment. This system will have several institutional impacts. First, it will be necessary to acquire the storage sites. Second, institutional adjustments will be necessary if storage sites are utilized for recreation. Third, a cooperative mechanism will be required to control the release of water from storage sites to treatment plants or spray irrigation sites.

SLUDGE MANAGEMENT

Two sludge disposal options have been proposed as part of the regional wastewater systems. These options raise several institutional problems. The problems associated with Option 1, agricultural utilization, are similar to the problems connected with the acquisition of spray irrigation sites in that contractual agreements to use farm land for sludge disposal will have to be employed. Option 2, land rehabilitation, will require contractual arrangements with the coal companies or other owners of the land to be reclaimed. Furthermore, land reclamation projects will have to be coordinated with applicable county and local land-use plans. This would be accomplished by involving representatives of local governments located in the disposal areas in the decision making process. Both Options 1 and 2 will also require regional cooperative arrangements to regulate the use of shared facilities such as conveyance systems and disposal sites.

WATER REUSE OPTION

All alternatives but Alternative I, consider comparable reuse capability of the treated water. The four NDCP alternatives accomplish this integration by planning the reuse of wastewater with related proposals which, in turn, create institutional impacts. Although there are distinctions among the alternatives, they are not critical from a broad institutional perspective. The four alternatives consider to some degree, reuse alternatives such as crop production, recreation, land reclamation, power production, stream flow augmentation and water supply. To cope with these resource management considerations, existing institutions must either be granted new authorities. or cooperative arrangements developed with those agencies that have the authority. At the same time all treatment and reuse options must be integrated with land use planning. This will be required regardless of which technical alternative is adopted.

FINANCIAL CONSIDERATIONS

Under present arrangements, wastewater financing is obtained from three sources: federal cost sharing, state bonding (Illinois only) and local contributions. All of the alternatives would strain these resources beyond their present and real authorized capabilities; in many cases these proposals would require expenditure levels of as much as ten times the current annual level. This suggests that existing institutions may not be able to accommodate such a financial burden without radically affecting the tax structure and without reallocating resources from other public services. Regardless of which alternative is considered, the increased spending levels required will have major institutional repercussions. As a result, different financial requirements of one or two percent, even though they may indicate additional millions of dollars, become relatively insignificant when compared in the relative increase over present level of wastewater expenditures. The significant institutional question raised is how to meet these financial requirements through modifications to existing institutions, the creation of new authorities or increases in State and Federal cost sharing.

In order to implement any of the selected wastewater management alternatives, a number of changes in existing institutions would be required. These anticipated changes would apply to local institutions and to state institutions which could either be modified or supplemented with new institutional arrangements. The most basic changes would be legislative. If the states are to take a more viable role, Indiana would have to pass a Constitutional amendment that would enable it to assume general obligation bonds indebtedness. Illinois is presently enabled to issue general obligation bonds.

Changes other than those by the legislature would relate to the relative contributions of local, state and federal governments. Local institutions will be unable to finance any of the alternatives that have been presented even if they have sufficient legal bonding capacity remaining (they generally do not) or have their bonding authority increased. Poor bond ratings and the unwillingness of the public to support this debt are the main reasons. Therefore, the State and Federal government will likely be required to ease the local financing burden. In Illinois, the state has demonstrated the ability to finance local wastewater projects. Indiana, on the other hand, being prohibited from issuing a general obligation bond has neither the experience nor capacity to finance wastewater debt costs through this type of bond. However, such potential could be used and expanded in both Illinois and Indiana. A necessary measure for meeting the costs of the five technical alternatives will be an increased Federal role in financing. Some commitment to this increased role is evident

from new Congressional wastewater financing provisions contained in the PL 92-500. In particular the Environmental Financing Authority contained in this Act creates a $100 million fund to assist local government to borrow funds on reasonable terms to construct waste treatment works. It is important to note that certain provisions of the recently-enacted law authorizes the federal government to provide 75 percent of the capital costs for wastewater projects and requires that a system of user fees be established to meet operation, maintenance and replacement costs attributable to all users of the facility. However, subject to the State's commitment, the local share of capital costs may be financed through revenue bonds which are serviced with user fees or general obligation bonds which are paid off from general taxation. Of equal importance is the fact that the annual operation, maintenance and replacement cost must be borne totally by local interests.

INSTITUTIONAL ARRANGEMENTS FOR IMPLEMENTATION

On the basis of the foregoing, consideration was then directed to the political, economic and administrative feasibility of implementing each of the alternatives. A discussion of specific institutional relationships and possible modifications, including financial considerations also are presented in Appendix F. Implicit in this discussion is the assumption that, to the greatest extent possible, the existing institutions and structure should be maintained and utilized. New structures, institutions or concepts should be introduced only when existing institutions or modifications thereto would be unable to implement the technical alternative. The general discussion of institutional approaches includes three basic institutional arrangements for consideration in the C-SELM study area. The first, referred to as the local approach, emphasizes the maximum use of existing institutions. It would be implemented primarily through the use of bilateral and multilateral contractual agreements. The second approach goes beyond the local level and as an intermediate regional approach would involve a greater restructuring of service districts. This approach could require special state enabling legislation to create the required service districts and would conflict with home rule advocates. The third approach goes further still and would create one or a few multi-county service areas. This approach would very likely require new state enabling legislation. This latter approach referred to as the areawide approach, would be the most far reaching in terms of institutional, political, economic and administrative repercussions. Information on these ranges of institutional arrangements should facilitate the state and local entities in their selection of the plan(s) most acceptable to the residents and most feasible from an operation and administrative standpoint.

SECTION VII - ECONOMIC ASSESSMENT

The economic impact associated with any alternative reflects the direct and indirect effects on those values that make up the economic structure of both the study and outlying areas. Primarily these effects are the result of potential changes in net income, water and land uses, industrial and agricultural productivity and costs, and property values. Another consideration, level of employment, has already been discussed. What follows is an overview of the economic assessment similar to those for the socio-environmental and institutional considerations. Supplemental material is presented in Section VIII, which relates system-induced changes (impacts) to causal effects.

NET INCOME

The first and most personal effect relates to an individual's net income. In the study area, the property owners and industries who discharge their wasteloads in the collection system will face higher user charges. This increase will reflect the need to pay the annual equivalent of a pro-rated (shared) capital investment and the system's total yearly operating costs. To achieve the higher water quality goals will require an expenditure of approximately 3 to 3-1/2 times the level of system-related costs associated with attaining current standards. Hence, the taxpayer must anticipate increased sewer charges. This will reduce the net or disposable income that the taxpayer has left to spend and, in turn, will affect the sales of consumer items.

The effect on the individual's net income for those residing in the outlying area was of similar concern. The potential for impact primarily exists in relation to both the sludge management program and the land treatment system. To safeguard against any adverse impact, provisions were made both in the design and costing of the two functional components (detailed in Section VIII). Two sludge management options were assessed. The option involving the reclamation of surface mines would not impact on the citizens and could prove beneficial to the area as is discussed later. The agricultural sludge management option does have the potential for affecting the participating farmer's income. Accordingly, payments are made to compensate any system-related losses. This applies to the farmer's annual income and the long-term capital gain from the increased market value when the land is sold. Similar provisions were made in connection with the land treatment system. In addition it was considered necessary that the operating entities for the two systems indemnify (insure) the participants against any crop losses directly associated with the functional component's operation. As with any large entity, they would probably be self-insuring.

It should be noted that the foregoing involves the concern of net income protection. It does not include the potential in economic gain from the nutrient recycle achieved in the sludge program and land treatment component. In both cases, the costs of commercial fertilizer would be practically eliminated and the farmer would achieve a significant reduction in his total production cost budget. See Appendix B Annex, land system design. Another consideration is the gain attributable to the irrigation and drainage systems of the land treatment process. The unpaid-for capital improvements represent a level of improvement beyond that normally installed from an agricultural risk-decision standpoint. Consequentially both installations will help increase the farmer's average net income by practically eliminating the reduced yields heretofore incurred during excessively wet or dry years.

PROPERTY VALUES

Achievement of the NDCP goals will impose an intermix of impacts on the property values in the study and outlying areas. Within the study area, the assessed roles of property values will be affected by the purchase of lands necessary for the storm water storage sites and the treatment sites, if either of the two plant technologies are used. Since these lands will be publically owned, there will be a reduction in the area's property values. However, it is anticipated that this reduction will be slight in comparison to the total value. Moreover, the reduction should be more than offset by (1) the enhanced value of properties located along the improved watercourses, (2) the increased value of the lands made available for community usage with the abandonment of existing treatment plants, and (3) the potential changes in land and water use to meet other area requirements such as water supply and local recreational demands. Of the foregoing, the latter two are significaant in that the local communities will have the opportunity to adjust their land uses to meet a variety of demands. The accelerated population growth during the latter 20 years prevented effective land-use planning in many areas. The add-on potential for other water and related land programs as discussed in Section VIII can be used to better balance the area's development.

The property values in the outlying areas will be affected to varying degrees by all of the wastewater management systems. Both the agricultural sludge management options for all the technologies and the land treatment sites will require retaining the area's agriculturally-related economic base and life style. In any one locality, the acreage retained in agricultural usage would in all probability be greater than might ordinarily be experienced over time. Thus, the 50-year duration of the contractural arrangements, as used in this report, will run counter to both the desires of some of the residents and the present pattern of regional growth. However, while the retention of a farming life style is a personal consideration, the inability for land usage to change in market value represents a potential economic impact. In addition the land system will require purchase of land for the aeration and storage lagoons. This potential

loss in property value and accruing tax revenues were offset by providing yearly compensatory payments to municipalities. Moreover, there is a comparative ability to control regional growth patterns inherent in these two system components. The effects of being able to control land usage on such an areawide scale can be considered beneficial or adverse. Involved is balancing the socio-economic wishes of the effected residents with the States' and regional efforts to maintain a viable agricultural base. The change from rural to urban land usage in those outlying counties immediately adjacent to the Metropolitan Chicago area is already reflecting this transition. The potential for the same type of change exists in the areas under consideration but in a later time frame.

The sludge management operation involving reclamation of surface mines does provide the potential for gain. While the costs are comparatively higher, the opportunity is provided to enhance the productivity and hence land values of the surface mines. The main objective should be to meet the local and regional land needs. Some cost sharing might be necessary particularly if the selected restoration program would require an incremental investment greater than normally required to achieve a reasonable land-use objective. Nevertheless, the economic base as reflected in assessed property values would be enhanced and this would assist local governments in providing additional services.

AGRICULTURAL PRODUCTIVITY

The main impact from an agricultural productivity standpoint is again the scale of lands which conceivably could be retained in agricultural usage. Additional impacts would accrue with the anticipated production gain associated with the irrigation sites of the land treatment system. In both cases the effects cannot be readily assessed, since it could prove beneficial or adverse depending upon the forecast of the commodity market. Crop selectivity possible under either the sludge management program or the land treatment system can also be beneficial or adverse. Double cropping system of corn and rye, the illustrative example used in the design and evaluation of the land system, is a case in point. Concern over the selective crops feasible for system use is valid, but can be overcome with development of special hybrids as has been done in the past. Even so, the corn and rye represent a base with which to expand the potential of the present agri-economic structure- particularly commercial feeder or finishing beef operations. Thus, the implications extend to the national level and the present crop support program's interrelationship with both the domestic and international market demands. Since both systems also contribute to the reduction of the farmer's production cost budget, it can provide added financial incentive to continue farming. This latter factor could help reverse the present trend of farm displacement and emigration from the rural area.

INDUSTRIAL IMPLICATIONS

The impact to industry will be felt in at least three different ways. Industries, especially major water users, presently are readjusting their manufacturing processes to minimize the pre-treatment costs required to meet current water quality standards. This includes recycling the process required water which also reduces the amount of water being consumed. This trend is expected to continue as the water quality treatment goals are upgraded. At the same time, most of the industries discharge their wastewater into the watercourses rather than municipal sewers. To achieve the equivalent of the higher NDCP goal, however, the cost of industrial pre-treatment will have to be materially increased by some 40 percent. This will require industry to reassess the extent to which it must provide on-site treatment. There are potential savings possible particularly if industry was to discharge its recycled wastewater into the regional system. If this was done, the gross cost to industry and the regional system would either approximate or be less than what industry would incur by itself. Under this situation, industry would still be required to pre-treat its wastewater but would rely on the regional treatment plant to provide "final" treatment. In this case the added cost incurred by the regional system would be recovered by user fees chargeable to industries. The magnitude of this added cost would vary, dependent upon the treatment technology used by the regional entity. See Appendix D. This concept has been incorporated into the design of the NDCP alternatives.

Another factor to be considered is that the renovated water from the NDCP alternatives could be usable for most industrial processes. This represents a new source of water and has the potential for reducing the competitive demands on existing supplies. However, this potential would apply to only those processes where the total dissolved solid (TDS) level can exceed 500-600 milligrams per liter.

In addition, there will be the potential for added gains from the recycling efforts. Industrial recycling has already provided other fringe benefits. Some industries have reduced costs by recovering some of the constituents contained in its residual wastes and reusing them in the manufacturing process. Similarly attention is being focused on the potential to combine the organic-based sludges with solid wastes to generate synthetic fuels and other recoverable by-products. If this proves successful, another option can be added to the sludge management for the Advanced Biological and Land Treatment Technologies.

SECTION VIII - SYSTEM-RELATED CHANGES

BASIS FOR RESOURCE CHANGES

As previously discussed, the study's planning effort and output was one essentially responsive to the national objective of enhancing the environment. However, to achieve this goal required changes to both the water and related land resources in the study area - and to varying degrees in the outlying area of influence. Consequently, the potential existed to utilize system design as a primary vehicle for meeting other needs within the affected areas. By so doing, system related benefits can be obtained which contribute to the other national objectives- those of enhancing the area's social well-being and improving the regional and national development. These represent a potential for substantial savings to both the local taxpayer as well as those throughout the States and nation whose tax dollars are used to support the allied Federal and State programs.

Water-related needs such as water supply deficiencies, reduction in water damage problems and in-stream use for recreational pursuits and commercial navigation were met by adoption of a regulated water regimen and effective use of the captured and treated storm water runoff. Achievement of additional gains and at least the partial satisfaction of still other needs were based on the reuse and/or recycling potential provided by the system or a specific component. Some of the foregoing benefits will accrue directly from the system design while others will involve concurrent use of a resource and require additional investments before the inherent value can be obtained. In all cases there are changes in the water and land uses of the affected areas; the nature and implications of which are discussed in the following paragraphs.

SYSTEM-RELATED POTENTIAL, STUDY AREA

WATER BALANCE

The basic considerations in establishing the area's water balance were the water needs and transfer (transport) economics. Once the use requirements were determined, the total water volume available for use (input) in the study area and regulated (output) flow regimen were analyzed. This involved evaluating what impact the water reuse, including in-stream needs as well as water supply, had on an alternative's design, costs and other resource implications. The evaluation involved a two-step process: first, the identification and location of the amount of wastewater to be treated; and secondly, the effective use and redistribution of not only the treated water, but also water from other available sources to meet area uses. Both of these evaluations were further analyzed along State lines to

facilitate identification of any inherent institutional problems. For all intents and purposes the only common interstate transfer involved the treated water discharged by the Hammond, Indiana Sanitary District into the Grand Calumet and thence to the Illinois Rivers. This transfer resulted when, in the past, canals were built to divert polluted stream flows from Lake Michigan. Consequently the same flow regimen was retained as a base condition for all but Alternative IV, the all land system. A breakdown of the municipal and industrial flows including infiltrated storm water requiring treatment and the variations between alternatives are shown in Table G-VIII-1.

The water balance for the study area also was analyzed along State lines and adjusted to conform with the current regimen. This facilitated evaluating the implications of the restraint in the withdrawal from and return of flows to Lake Michigan currently applied to the Illinois portion but not the Indiana area. Two options to the water balance were analyzed for all four the NDCP alternatives which involved the capture and treatment of storm water runoff. Implicit was the consideration of system design with (Option 1) and without (Option 2) the 3200 cfs (2068 MGD) constraint imposed on the State of Illinois. Included were the rural, suburban, and urban storm water which are captured and treated. The maximum groundwater supplies available for use without actual mining or aquifer drawdown occuring, and withdrawals from Lake Michigan. In this way the value of storm water capture and treatment as a reliable source of water supply were assessed along with the internal problems facing the State of Illinois and Chicago area in allocating the water withdrawn from Lake Michigan.

The water demand areas were divided into two sectors, Lake Michigan potable supply areas and the groundwater potable supply area. Then, based on the projections for municipal and industrial supplies, and in-stream recreational and navigational requirements, the demands were computed for each area and the most optimal source of supply used. The application of each reuse option differed between the land treatment system and the treatment plant system, only in the method of supply; the flow quantities (use satisfaction) remained the same.

Option 1 - with constraint

The water balance for the C-SELM area constructed within the 2068 MGD (3200 cfs) Lake Michigan withdrawal constraint is shown in Table G-VIII-2. A water balance was prepared for two time frames, the years 1990 and 2020. This was necessary to evaluate the effects on the storm water control and Lake Michigan withdrawals due to the changes in the land use categories of urban, suburban and rural.

Table G-VIII-1
Average Annual Flows Requiring Treatment (MGD) a/

Alternative	1990 Illinois	1990 Indiana	1990 Total	2020 Illinois	2020 Indiana	2020 Total
Alt. No. I b/	2,211.4	451.2	2,662.6	2,646.6	468.8	3,115.4
Alt. No. II c/	2,517.9	482.1	3,000.0	3,096.5	533.5	3,630.0
Alt. No. III c/	2,517.9	482.1	3,000.0	3,096.5	533.5	3,630.0
Alt. No. IV d/	1,530.8	1,469.2	3,000.0	1,922.5	1,707.5	3,630.0
Alt. No. V c/						
a. Plant	1,782.8	406.7	2,189.5	1,974.4	365.4	2,339.8
b. Land	735.1	75.4	810.5	1,122.1	168.1	1,290.2
Total	2,517.9	482.1	3,000.0	3,096.5	533.5	3,630.0

a/ Exclusive of rural storm water amounting to 651 MGD (1990) and 458 MGD (2020).

b/ Excludes storm water runoff except that amount captured and treated by existing and proposed combined sewer systems.

c/ No interstate transfer of wastewater involved.

d/ Involves interstate transfer of wastewater from Illinois to Indiana for treatment only. Renovated water would be returned.

Table G-VIII-2
Water Balance (MGD)
(Option 1 - 2068 MGD Constraint)

Area Input	ILLINOIS 1990	ILLINOIS 2020	INDIANA 1990	INDIANA 2020	TOTAL 1990	TOTAL 2020
1. Rural Storm Water	423	268	228	190	651	458
2. Suburban Storm Water	407	532	48	83	455	615
3. Urban Storm Water	411	472	25	38	436	510
Subtotal Storm Water	1,241	1,272	301	311	1,542	1,583
4. Ground Water Supply	209	228	55	114	264	342
5. Lake Michigan Withdrawal	2,068	2,068	378	336	2,446	2,404
6. Total Water Input	3,518	3,568	734	761	4,252	4,329
Area Distribution (Demand)						
1. Lake Michigan Service Area	1,592	1,732	366	324	1,958	2,056
2. Ground Water Service Area	480	778	67	126	547	904
3. Total Water Demand	2,072	2,510	433	450	2,505	2,960
Supply Source						
1. Lake Michigan	1,591	1,580	378	336	1,969	1,916
2. Ground Water	209	228	55	114	264	342
3. Rural Storm Water	139	268	-		139	268
4. M & I Reuse	133	434	-		133	434
5. Total Water Supply	2,072	2,510	433	450	2,505	2,960
Lake Michigan Balance						
1. Withdrawals for use	1,591	1,580	378	336	1,969	1,916
2. Indirect Withdrawal*	477	488	-	-	477	488
Total Withdrawal	2,068	2,068	378	336	2,446	2,404

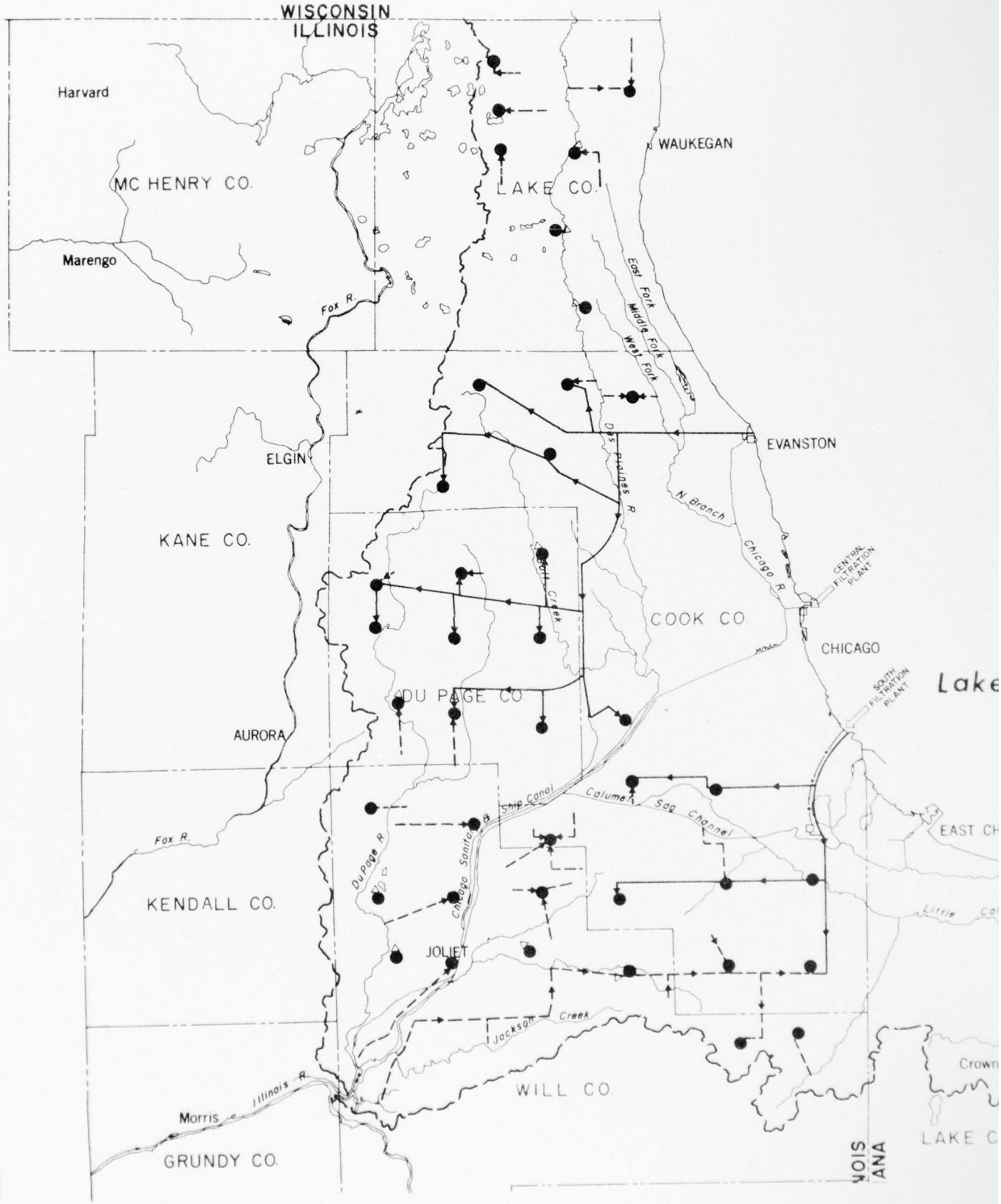
*Diversion of storm water from areas that normally flows into Lake Michigan. Because of the area's development, the storm water must be captured, treated and diverted away. Thus, this amount must be credited against the 2068 MGD (3200 cfs) constraint.

Both demand sectors in the Illinois portion of the study area ultimately face a deficiency in relation to their needs. Concurrent with this problem is a reduction in net withdrawal available for need satisfaction from Lake Michigan. As more of the land-use in the area tributary to the Lake changes, there is an accompanying requirement to capture, treat and divert the runoff volume. This diversion is required to avoid a degradation of the Lake's natural background constituent levels. Since the runoff will increase in volume with the time-phased transition from rural to urban, the net available for effective usage will decrease in a corresponding manner. With the demand in both sectors exceeding supplies or current Lake allocations, extensive use was made of available rural storm water flows. Not all of the rural storm water can be effectively used because of transportation economics and, again, the eventual land-use conversion which reduces its availability over time. Ultimately, the need in the water supply deficient areas must be met by withdrawals from Lake Michigan and combined with the reuse of the renovated (recycled) municipal and industrial flows. For purposes of this study, the flow mix was regulated to maintain a somewhat equal concentration of total dissolved solids in both demand sectors. This meant extending pipeline transfer of Lake Michigan waters to the communities in the western portions of the C-SELM area. This is an extension of one alternative now under consideration by the State of Illinois. However, there are significant political, social and institutional implications associated with this proposal. First this proposal will impose a need on the State to reevaluate the present allocation of Lake Michigan withdrawals and assess the cost-sharing arrangements implicit in the redistribution system. Secondly, it raises the question as to the extent to which the State of Illinois has to undertake the recycling of its waters before being granted additional withdrawal rights from Lake Michigan. Figure G-VIII-1 shows the Option 1 supply system.

In Indiana, the problems are comparable, but not of any serious consequence. Most noteworthy is the anticipated reduction in the usage of Lake Michigan withdrawals due to the industrial trends in water recycling. This recycling helps achieve an economy in the amount of wastewater that has to be treated before being discharged into the area's water courses or municipal collector system. At the same time, the use of ground water will increase because of the availability and comparative cost advantage over pipeline transfer.

Option 2 - without constraint

Under this reuse option, all potable needs in both demand sectors that are ground water deficient are supplied from Lake Michigan. See Table G-VIII-3. The storm water runoff in the rural areas and the reuse flows from the treatment plants or land treatment systems are used exclusively to supply the in-stream needs. Consequently, the cost and resource consumption differentials between the two options reflect the implications involved in satisfying only the water supply needs. Under the second option, Illinois withdrawals from Lake Michigan will increase by 113 and 134 percent by the year 1990 and 2020 respectively. Figure G-VIII-2 shows the Option 2 supply system.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ILLINOIS
Harvard
MC HENRY CO.
Marengo
LAKE CO.
WAUKEGAN
Fox R.
East Fork
Middle Fork
West Fork
EVANSTON
ELGIN
Des Plaines R.
N. Branch
Chicago R.
KANE CO.
Salt Creek
CENTRAL FILTRATION PLANT
COOK CO
CHICAGO
SOUTH FILTRATION PLANT
DU PAGE CO.
AURORA
Ship Canal
Calumet Sag Channel
Fox R.
DuPage R.
Chicago Sanitary
KENDALL CO.
JOLIET
Jackson Creek
WILL CO.
Illinois R.
Morris
GRUNDY CO.

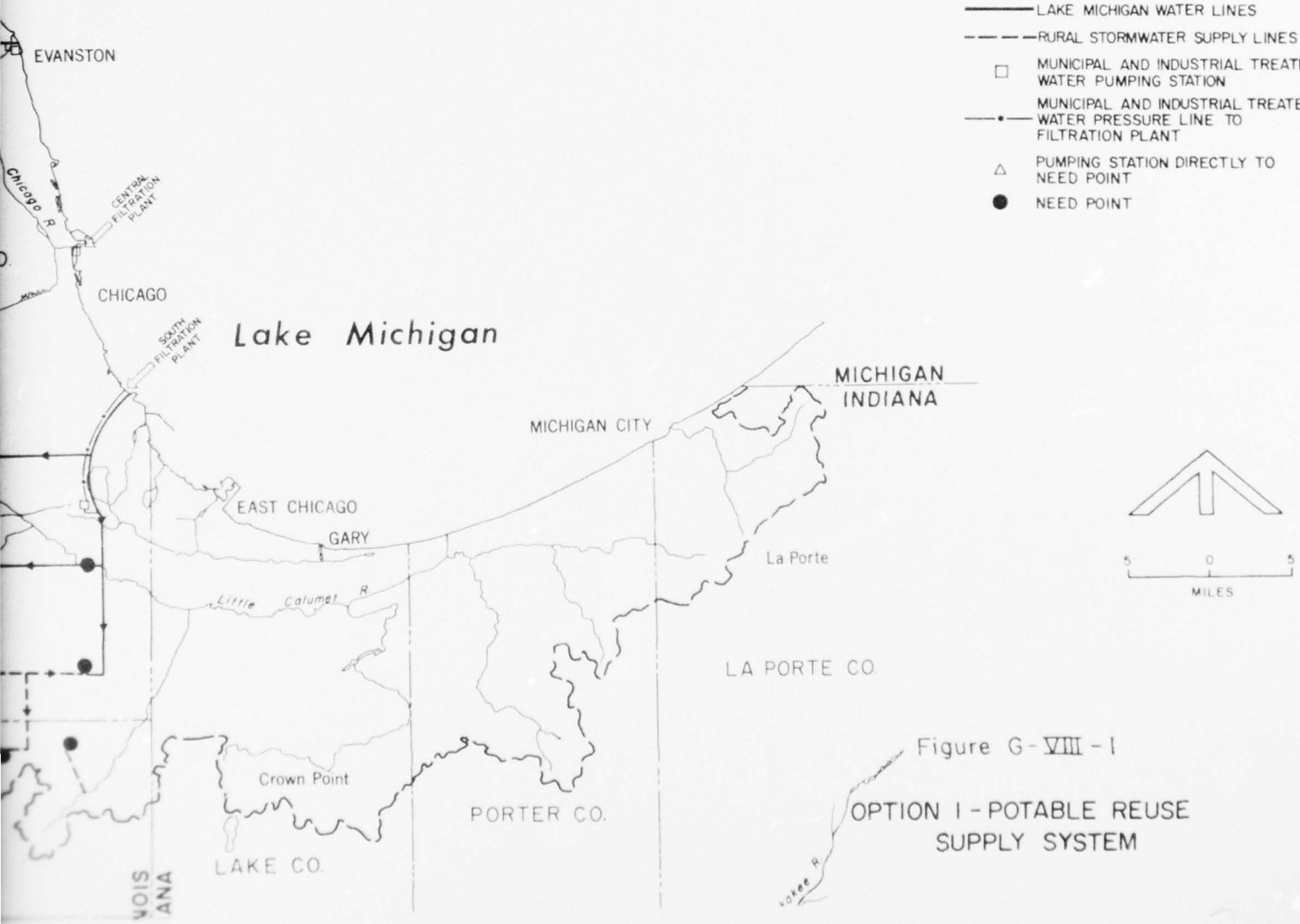


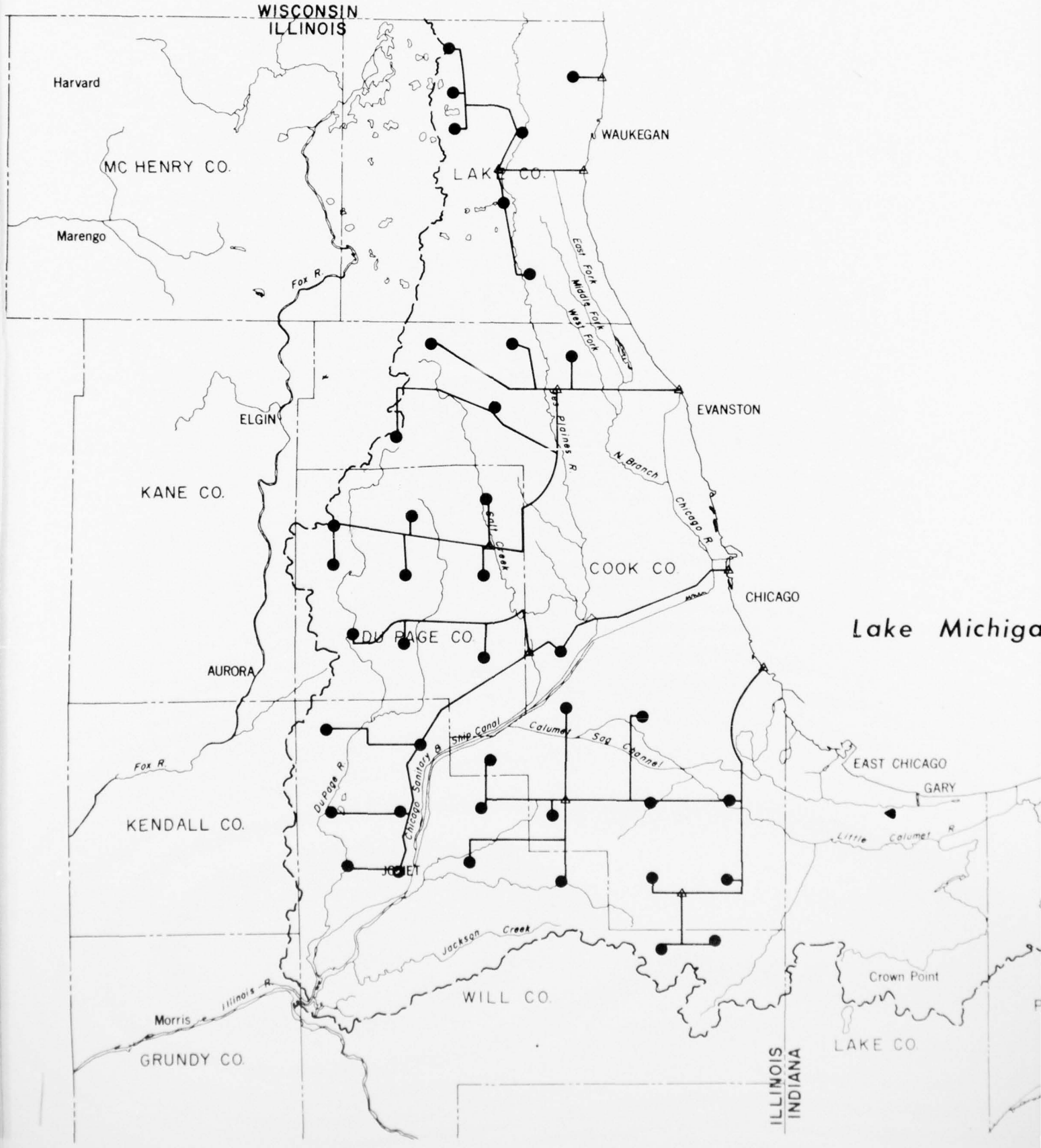
Figure G-VIII-1

OPTION I - POTABLE REUSE SUPPLY SYSTEM

Table G-VIII-3
Water Balance (MGD)
(Option 2 - No Constraints)

Area Input	ILLINOIS 1990	ILLINOIS 2020	INDIANA 1990	INDIANA 2020	TOTAL 1990	TOTAL 2020
1. Rural Storm Water	423	268	228	190	651	458
2. Suburban Storm Water	407	532	48	83	455	615
3. Urban Storm Water	411	472	25	38	436	510
Subtotal Storm Water	1,241	1,272	301	311	1,542	1,583
4. Ground Water Supply	209	228	55	114	264	342
5. Lake Michigan Withdrawal	2,340	2,770	378	336	2,718	3,106
6. Total Water Input	3,790	4,270	734	761	4,524	5,031
Area Distribution (Demand)						
1. Lake Michigan Service Area	1,592	1,732	366	324	1,958	2,056
2. Ground Water Service Area	480	778	67	126	547	904
3. Total Water Demand	2,072	2,510	433	450	2,505	2,960
Supply Source						
1. Lake Michigan	1,863	2,282	378	336	2,241	2,618
2. Ground Water Supplies	209	228	55	114	264	342
3. Total Water Supply	2,072	2,510	433	450	2,505	2,960
Lake Michigan Balance						
1. Withdrawals for use	1,863	2,282	378	336	2,241	2,618
2. Indirect Withdrawal*	477	488	-	-	477	488
Total Withdrawal	2,340	2,770	378	336	2,718	3,106

*Diversion of storm water from area that normally flows into Lake Michigan. Because of the area's development, the storm water must be captured, treated and diverted away and thus credited against Lake Michigan withdrawal.


WISCONSIN
ILLINOIS
Harvard
MC HENRY CO.
Marengo
WAUKEGAN
LAKE CO.
Fox R.
East Fork
Middle Fork
West Fork
ELGIN
EVANSTON
Des Plaines R.
N. Branch
Chicago R.
KANE CO.
Salt Creek
COOK CO.
CHICAGO
Lake Michiga
DU PAGE CO.
AURORA
Fox R.
Ship Canal
Calumet
Sag Channel
EAST CHICAGO
GARY
DuPage R.
Chicago Sanitary &
KENDALL CO.
Little Calumet R.
JOLIET
Jackson Creek
Crown Point
Illinois R.
WILL CO.
Morris
GRUNDY CO.
LAKE CO.
ILLINOIS
INDIANA

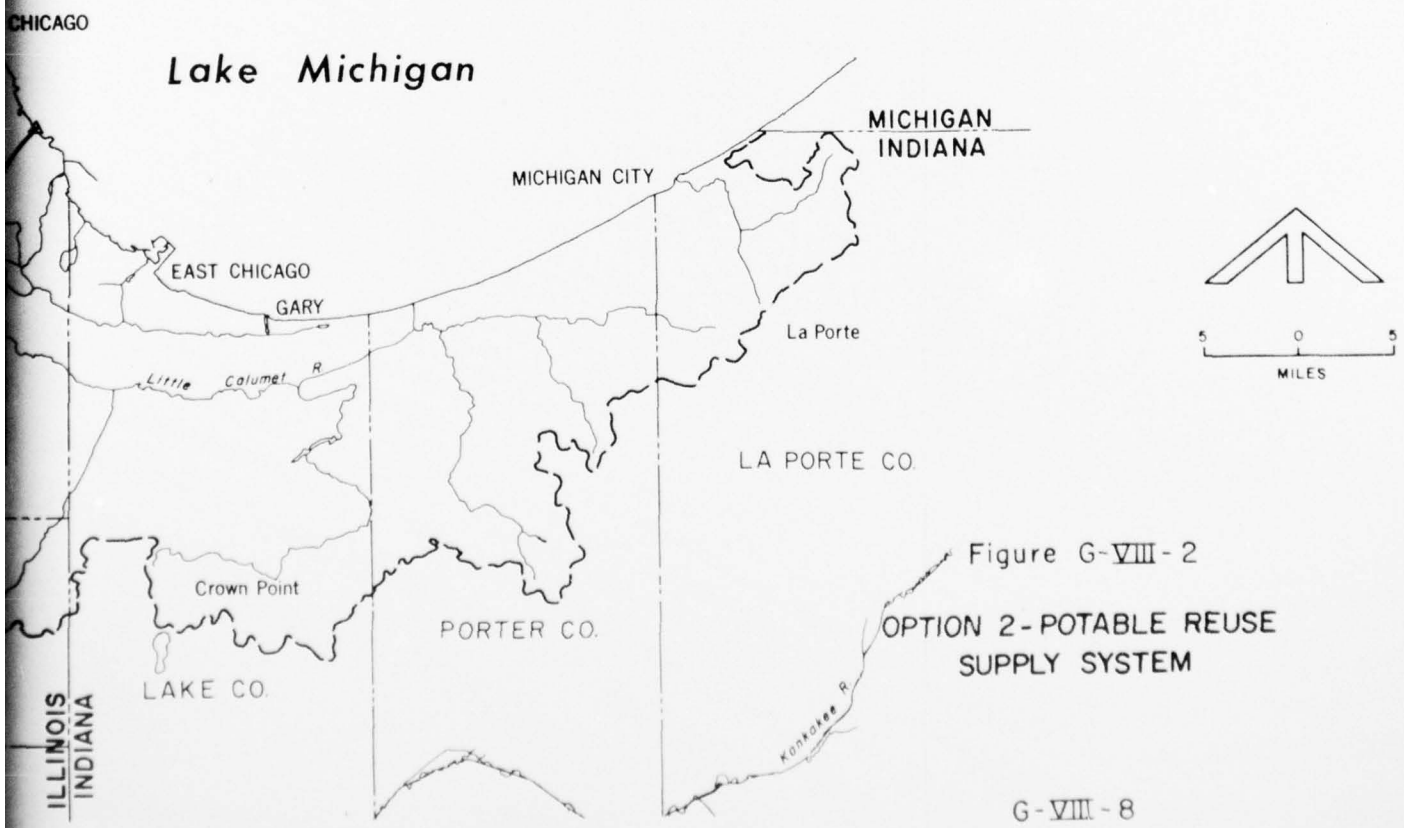


Figure G-VIII-2

OPTION 2-POTABLE REUSE SUPPLY SYSTEM

FLOOD CONTROL

The capture of approximately 2.5 to 3.0 inches of storm water runoff will reduce the frequency and severity of inundation within the flood-plains of the study area. While the degree of relief has not been determined, an estimate of the areal extent has. The extent of flooding was measured by using flood hazard maps prepared by the Northeastern Illinois Planning Commission (NIPC). The flood incidence shown on these maps involved all major storms that occured in the Illinois portion of the C-SELM area within recent years. No comparable maps were available for the Indiana portion. However, for the purposes of this estimation, it was assumed that the ratios of streams and amount of flood plain acreage to total acreage in northern Indiana were similar in nature to the adjoining Illinois portion. Of the 2,050 square miles of acreage in the Illinois portion, approximately 54,700 acres were located in the flood plain. Therefore, of the 570 square miles within the Indiana portion, some 15,200 acres would be classified as flood plain acreage on a proportional basis. This would mean that approximately 69,900 acres would be afforded some degree of relief.

It should be noted that previous to this study the MSDGC and the State of Illinois had completed a detailed evaluation of a combined flood and pollution control project. That study concerned the construction of an underflow (tunnel) plan to capture and treat 2.5 to 3.0 inches of runoff in addition to municipal and industrial sewage flows. The storage together with the collary pump-out rates to the treatment plants reduced the quantity of spillage experienced during a 21 year period of record, by some 96 percent. The runoff that would spill into the streams would occur only during the very large and infrequent storm periods when the runoff volume exceeded the system's storage capacity. The storm water design purportedly reduced the frequency of flooding on some 10,000 acres of flood plain from some four to five occurrences per year to a frequency of from three to four events in 21 years. Since the degree of runoff retention is similar, it is reasonable to expect comparable reduction on the remaining 59,900 acres of flood plain located within the C-SELM area. Furthermore the disbursement and placement of the rural and suburban storm water storage is designed to achieve additional reductions in local water problems such as damages from basement floodings and blockage in traffic movement caused by surface ponding.

STREAM USAGE

Most of the streams within the C-SELM area presently have little potential for extended in-stream recreational usage. Aside from the spring and early summer storm water runoff, the stream flow is comprised of the outflows from the existing treatment plants. As a result both the quantity and quality has precluded extensive development of stream-related recreational opportunities. Moreover, any degree of regionalization

will directly affect the present stream flow regimen. Without some degree of redistribution, as would be the case for Alternative I, the aquatic ecosystem and use potential of the small streams would be adversely affected during dry periods. This problem would be further aggrevated by the degree of regionalization made economically feasible by the increased volume of flow to be treated under the NDCP alternatives. At the same time the NDCP alternatives offer a real potential for improving the stream flow regimen through the effective reuse of the treated storm water runoff. Accordingly, a distribution system was adopted for use in all NDCP alternative designs to determine the implications primarily due to regionalization and capability to meet a range of enhanced stream milage. The distribution system was designed to improve the flow regimen in all or portions of some 30 or more streams. Aside from the major watercourses, 26 of these streams were selected because of their proximity to main population centers and/or the surrounding natural environment which still exists. The streams and counties which would benefit from the increased flows and resulting enhanced potential for water based recreational opportunities are listed in Table G-VIII-4. Other streams were excluded from consideration because the cross-sectional capacity was unable to sustain the necessary seasonal variations in flow. Final decisions regulating the flow distribution and in-stream uses must ultimately be decided by local interests.

One of the concerns involved in the foregoing analysis was that potential redistribution of the treated water and Lake Michigan withdrawals could affect the flows in Upper Illinois Waterway System. Accordingly first priority was assigned the satisfaction of the estimated water supply deficiency. This deficiency, ranging from some 270 to 550 MGD (see Appendix B) by 1990 and 2020, respectively, was met primarily by Lake Michigan withdrawals and/or strategic reuse of treated water. Then the recreational redistribution, municipal and industrial flows and all reclaimed storm water flows were balanced through a reiterative process to insure that the flow selection would provide adequate depth for current and projected waterborne movements. Pumps were provided at the locks to Lake Michigan to insure adequate capacity for Lake movements.

LAND USE CHANGES

There is the potential for at least four types of changes in land use that could occur within the study area concurrently with the proposed changes in the water regimen. The first will be affected by the purchase of lands required for the permanent system facilities. The amount will vary between alternatives, reflecting the degree of regionalization and the type of treatment process involved. Another variant will involve the land required for storage of the storm water runoff but this acreage differs only between quality standards and is common for all NDCP alternatives.

Table G-VIII-4
STREAMS SELECTED FOR AUGMENTATION

Main Stream and Tributaries	Location						
	Illinois Counties				Indiana Counties		
	Lake	Cook	Will	Du Page	Lake	Porter	La Porte
North Branch Chicago River	X	X					
East Fork	X	X					
West Fork	X	X					
Des Plaines River	X	X	X	X			
Mill Creek	X						
Indian Creek	X						
Avon-Fremont Drainage Ditch	X						
Weller Creek		X					
Willow Creek		X					
Silver Creek		X					
Buffalo Creek		X					
Hickory Creek		X	X				
Spring Creek		X	X				
Jackson Creek			X				
Tinley Creek		X					
Salt Creek		X		X			
Addison Creek		X		X			
Du Page River		X	X	X			
East Branch		X		X			
West Branch		X		X			
Lilly Cache Creek		X	X	X			
Little Calumet River		X			X	X	X
Calumet Slough		X					
Butterfield Creek		X					
Thorn Creek		X	X				
Deer Creek		X	X				
Plum Creek-Hart Ditch		X	X		X		
Deep River					X	X	
Turkey Creek					X		
Salt Creek						X	
Grand Calumet River					X		

The potential for a second type of land use change will occur concurrently with the first. For, as the degree of regionalization is extended, a greater number of the 132 existing treatment plants will be abandoned, and only a portion retained for use as an access point to the plan's collection and conveyance systems. Consequently, much of the lands now part of the treatment sites will be surplus to the system's requirements and could be effectively used to meet other community needs.

A third change will be reflected in the increased property value and use potential of those lands adjacent to those streams where quality and/or flow regimen are enhanced. The flood relief afforded by retention of storm water runoff will also provide added inducement for change and the opportunity to meet other land related needs. A comparable ability to meet other land needs can be achieved by the effective sizing and location of the suburban and rural storm water systems. Both provide the potential for controlling growth patterns and maintaining a balance between intensive urban development and open-space usage.

The fourth change reflects an intensification of present land use. Irrigating existing crop lands with rural storm water will allow the participating farmer to increase his average annual production through increased yields and reduced losses during wet years. The potential for this change would result from the capital improvements (drainage and irrigation systems) installed by the system's operating entity. Moreover, the long-range contractual arrangement for retaining these lands in agricultural usage will provide a significant contribution to local efforts to maintain open-space lands. As is pointed out by the University of Illinois Cooperative Extension Service, most of the open-space requirements must come from the rural area. See Annex A. Using agricultural lands in the C-SELM area as a method of treatment could be a means for preserving open space.

ROCK AND SOIL MANAGEMENT

Construction of a wastewater management system for the C-SELM region will require the movement of enormous quantities of materials. The greatest quantity will be of dolomite rock from the construction of deep surface storage reservoirs and deep conveyance tunnels. In addition large quantities of soil and other overburden materials from reservoir, force main and sewer construction must also be moved. Much of this material will originate in the most densely populated areas. Therefore, proper management is essential not only to minimize costs, but to minimize the adverse effects caused by movement of the materials.

The disposal of the materials present a wide range of opportunities for constructive use within the region. These opportunities may be broadly classified as reclamation, recreational, or commercial. Selection of the final management procedures must be made on the basis of cost, compatibility with regional goals, disruptive effects on the communities, environmental effects, and other factors. Some examples of possible management options are included here to illustrate the potentials for constructive use of the materials. Many other possibilities undoubtedly exist, and it is not intended to recommend any one option for implementation.

Reclamation Opportunities

Fill for local borrow pits. Many of the borrow pits, especially in the Gary-Hammond area, are presently being considered as potential sites for sanitary landfills. These borrow pits are located in sand deposits of glacial Lake Chicago origin, and could make poor sanitary landfill locations due to the high leachate transmission potential of such permeable materials. On the other hand filling the pits with clay, sand, or glacial till derived from the construction program would minimize the disposal costs, eliminate the hazards of the open pits and enhance the positive geohydrologic effects of such filling on the environment. See letter from Indiana Department of Natural Resources, Geological Survey contained in Annex A.

Lake Michigan related works. Some of the material, particularly the rock can be utilized to protect or stabilize extensive lengths of beach shoreline from erosion. In addition, the material could be used for construction of coast line harbor facilities and other public or private protective works that are in the general public interest.

Recreational Opportunities

Recreational Islands in Lake Michigan. By utilizing the materials excavated in the urban area for fill, and with extreme care for environmental and ecological effects, it would be possible to construct islands along the Illinois and/or Indiana shoreline for recreational use. With proper design, the islands may have the added benefits of protection of the shore from erosion and providing a quiet area for recreational boating. Sufficient material will be available from the urban areas to construct approximately 3,000 to 4,000 acres of islands, assuming an average water depth of 30 feet.

Other Open Space Landscaping. The extensive nature of the tunnel systems allows opportunities for relatively modest quantities of materials to be utilized by many communities to construct recreational landscapes in diverse open space areas. This could take the form of modest walking or tobogganing hills in city parks, larger hills in forest preserves or suburban areas, or landscaping of abandoned quarries to make them suitable for recreational use. These options have the advantage of making use of the materials nearer their point of origin, thus decreasing cost and disruption due to transport.

Mountain Landscape. The concept to construct a "Mount Trashmore" has also been advocated in an effort to provide an extended range of recreational opportunities. The rock and soil from the urbanized area would be sufficient to construct a mountain approximately 400 to 500 feet in height and 700 to 1,000 acres in area at its base. This mountain would be suitable for skiing, hiking, tobogganing, picnicing, and other related recreational uses.

Commercial Opportunities

The sale of aggregate or stone was an option that could help conserve and supplement the local aggregate market when viewed as a use source for a portion of the material management. While the moled rock, is in a shape which is more expensive to crush and grade for aggregate than is quarried rock, the quantities could be integrated into the existing commercial crushed stone and aggregate market. To do this, however, an agreement would have to be reached with the aggregate industry to stock pile and integrate this material into the rock market.

SYNERGISMS

The potential for achieving still other benefits will increase with the foregoing improvements to the area's water and land resources. The new programs for meeting the other needs are synergistic in nature. This means that they are dependent upon the resource base of the wastewater system or the design of a specific functional component. In either case the expenditure of a supplemental investment will be required. Thus, while these add-on programs are conceptual in design, they represent a secondary level of return and additional options to be considered.

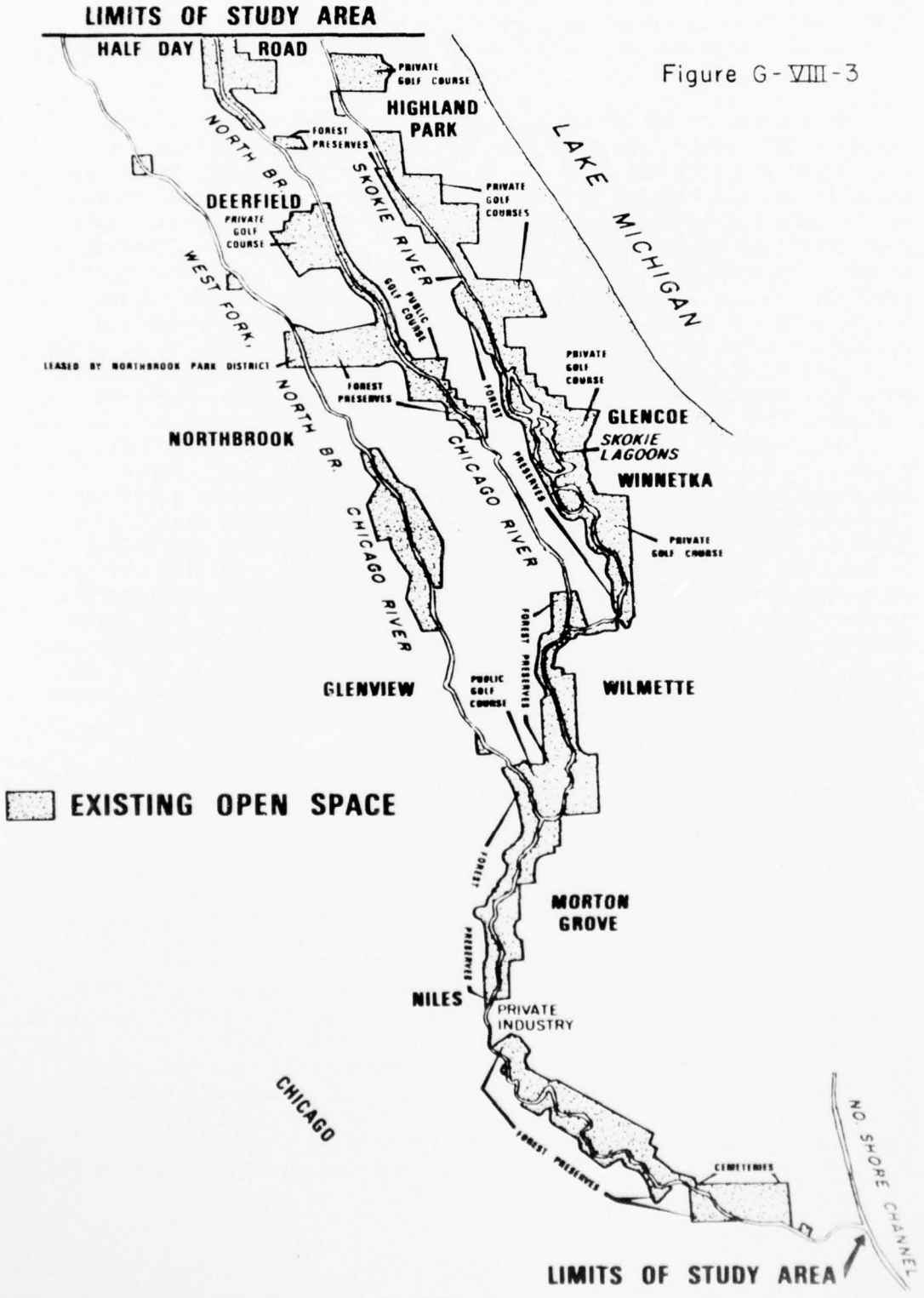
Recreational/Environmental Land Corridors

Concurrent with the installation of the storm water runoff management phase of the overall program, will be the major question as to the usage of the flood plain levels. The potential reduction in flood hazards will immediately generate competative demands for the use of those acreages. Whatever the decision, the resultant impact will have significant social and environmental implications.

To date the regional planning agencies in both Illinois and Indiana have stressed the need to retain the flood plain lands in open space usage and to encourage recreational and conservational practices. With this in mind, attention was directed to the study of a plan of improvement that would be responsive to these goals. The 26 streams previously selected for recreational and environmental considerations were used as the basis for the evaluation. A prototype model first was developed for the North Branch of the Chicago River. See Figure G-VIII-3. This stream was selected because the range of urban, suburban and rural development

NORTH BRANCH, CHICAGO RIVER PROTOTYPE STUDY AREA

Figure G-VIII-3



was considered typical of the density and socio-economic conditions that would be predominant throughout the study area over time. A detailed discussion of the prototype study and the resultant findings is presented in Annex B to the appendix.

In summary it was found that approximately 80 percent of the stream length would lend itself to an integrated water and related land based recreational program. In the upper 20 percent, the stream capacity was too limited to justify a water oriented program. Moreover, of the area considered for development, only 80 percent of that area lent itself to those types of pursuits that could sustain extensive usage. The remaining 20 percent had sufficient physical constraints to preclude all but low-density, open space, or private usage. Shown in Tables G-VIII-5 and G-VIII-6 are the length of stream, acreage and estimates of annual recreational usage that should be considered to meet this need of the C-SELM area. Most of the developments would involve park-type improvements with the diversity of recreational opportunities dependent upon the acreage. These parks would be augmented by a series of linear connecting corridors which would either be used for nature trails or as a preserve for maintaining the stream's environment. Additional data as to costs, types of developments and the potential of land-use easements to supplement the acquisition program also can be found in Annex B. Acquisition is considered a necessary guarantee to keep the usage of these lands open to the public. It also shifts the cost responsibility for maintenance and operation to the governmental sector if the public would choose to exercise this type of use option. Passage of zoning ordinances and use of open-space restrictive easements would not make the land available to the public. Without a shift in ownership and responsibility, the private sector could not be expected to assume the degree of financial burden implicit in this type of improvement.

Urban Fishing Program

An urban fishing program involving construction of impoundments between 50 and 300 surface acres in size with a minimum depth of from 10-15 feet in 25 to 50 percent of the water area has been suggested. Recommended to provide quality game fishing, the impoundments would be drainable to about 50 percent of their normal storage capacity to facilitate management. The objective is to avoid contamination from rough fish, which precludes the use of even high quality in-stream flows. Since a continuous through-flow should be provided ranging from 0.25 to 0.5 cfs, it was concluded that the impoundments must be located near or adjacent to the larger treatment plants. Transportation economies of such small volumes by pipeline could not be justified if delivered from the land treatment sites. An artist concept of the program and its incorporation with the treatment plant design is shown in Figure G-VIII-4 .

Table G-VIII-5
Suggested Fee Acreage
C-SELM Land Corridors

Stream	Linear Miles of Corridor	Acreage Suggested* for Purchase
North Branch Chicago River	48	1,300
Des Plaines River	93	3,490
Mill Creek	6	220
Indian Creek	11	440
Avon-Fremont Drainage Ditch	3	70
Weller Creek	10	360
Willow Creek	7	290
Silver Creek	6	220
Buffalo Creek	9	360
Hickory Creek	23	870
Spring Creek	11	800
Jackson Creek	14	510
Tinley Creek	6	220
Salt Creek (Illinois)	42	1,600
Addison Creek	10	360
Du Page River	77	2,910
Lily Cache Creek	19	730
Little Calumet River**		
Calumet Slough	6	220
Butterfield Creek	14	510
Thorn Creek	10	360
Deer Creek	6	220
Hart Ditch	10	370
Deep River	17	660
Turkey Creek	14	510
Salt Creek (Indiana)	10	360
Grand Calumet River	19	730
Total	501	18,690

* Acreage figures are based on acquisition relationships established in prototype.

** Little Calumet River figures are left blank intentionally. The Chicago District's recent study will have influence here.

Table G-VIII-6
Projected Annual Recreational Usage
C-SELM Land Corridors

Stream	Acreage		Estimated Annual Usage
North Branch Chicago River	1,300		8,800,000
Des Plaines River	3,491		18,249,200
Mill Creek	218		1,874,800
Indian Creek	436		2,746,800
Avon-Fremont Drainage Ditch	72		864,000
Weller Creek	364		2,511,600
Willow Creek	291		2,182,500
Silver Creek	218		1,874,800
Buffalo Creek	364		2,511,600
Hickory Creek	873		4,316,000
Spring Creek	800		3,440,000
Jackson Creek	509		3,003,100
Tinley Creek	218		1,874,800
Salt Creek (Illinois)	1,600		9,490,000
Addison Creek	364		2,511,600
Du Page River	2,910		16,686,000
Lily Cache Creek	727		3,416,900
Little Calumet River**			
Calumet Slough	218		1,874,800
Butterfield Creek	509		3,003,100
Thorn Creek	364		2,511,600
Deer Creek	218		1,874,800
Hart Ditch	364		2,511,600
Deep River	655		3,209,500
Turkey Creek	509		3,003,100
Salt Creek (Indiana)	364		2,511,600
Grand Calumet River	727		3,416,900
Total	18,683	Say	110,000,000

*User Day Estimates were based on similar size land parcels as identified on North Branch.

**Little Calumet River figures are left blank intentionally. The Chicago District's recent study will have influence here.

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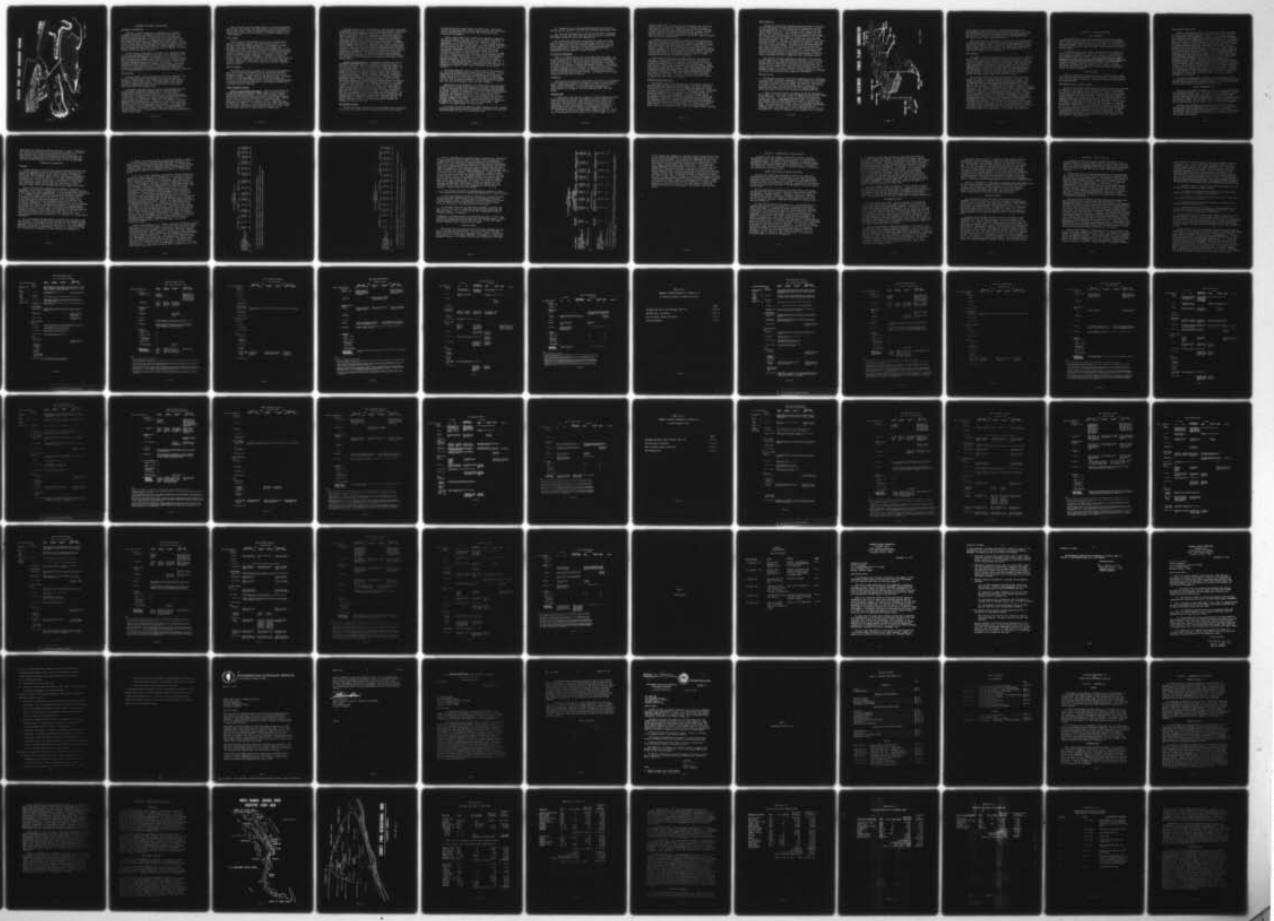

SELECTIVE SPORT FISHERY MANAGEMENT PROGRAM

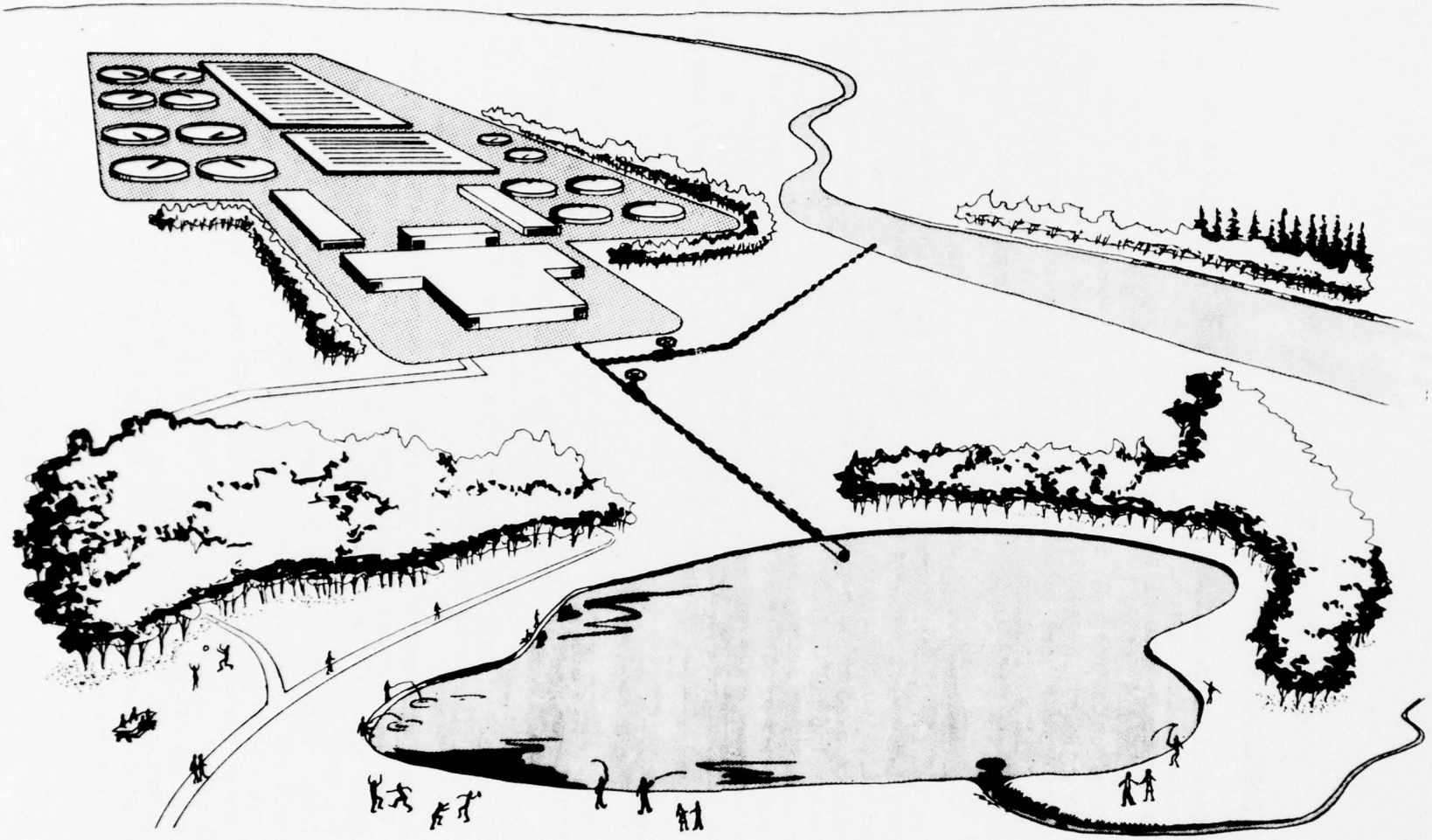

Figure G-VIII-4

POTENTIAL FOR CHANGE, OUTLYING AREA

BACKGROUND CONSIDERATIONS

Regardless of which alternative or combination of components is ultimately selected for implementation within the study area, the residents and resource base of the outlying area will be affected. However the degree and nature of impact will vary significantly with the alternative considered. An interdependence between the two areas now exists, one that is primarily economic and service related. Current trends in urban growth have intensified the impact on outlying areas and the cohesion of the agricultural community is being changed. This in turn has changed the life style of the agricultural community and imposed changes on the rural land use patterns.

Now for the first time there is a potential for significant change in the interrelationship between the two areas. Past consumption rates have necessitated the adoption of a national policy to conserve our natural resource base through a more effective recycle and reuse program. This may impose the possibility that solutions to local problems such as wastewater management become more regional in character. If so, these solutions must be acceptable to residents in the outlying area and not disruptive to their goals and values. Consequently the implications of the five alternatives on the outlying area have been qualified in the following paragraphs to insure that all tradeoffs are properly considered.

WATER BALANCE

The water balance of the outlying area will not be affected by any of the alternatives except those employing the land use method of treatment. Alternatives IV and V impose the potential for a change in the outlying area's water balance. The change would result from the increase in evapotranspiration rates and the control of the ground water table under the irrigated fields.

Preliminary assessments indicate that the evapotranspiration rates resulting from the enhanced cropping practice will approximate the average annual rainfall in the outlying area. If true, the net contribution from the affected lands to the area's stream flow regimen would be lost. Instead both the surface runoff and natural infiltration to the stream via a changed water table will be entrapped by the proposed field drainage system. Furthermore, the necessity to maintain a depressed water table under the irrigated field could have a minor but additional effect in the underground water movements. Accordingly there may be a need to offset the potential change in the average annual and low-flow patterns in the area's streams using renovated C-SELM water. Since the water quality is responsive to the higher standard, no degradation should be experienced.

Due to the fact that the acreage involved is extensive and highly concentrated, the potential for change applies mainly to Alternative IV, the all land system. Since the acreage required for Alternative V is comparatively minor and widely dispersed, a comparable induced effect is not expected.

FLOOD CONTROL

Flood control in the outlying area will not be provided, other than as an incidental aspect to the land treatment process. The drainage system with regulated pumping rates is designed to protect the crop's root zone through the control of both surface and subsurface water flows. As such the participating farmer will be able to minimize his crop losses during wet years. In addition the drainage system is designed to control the infiltration from a rainfall whose intensity and duration had a frequency of occurrence of once in 100 years or more. Consequently Alternative IV because its extensive acreage is highly concentrated, should be able to provide some reductions in small floods on the local stream. Due to its size and dispersed location, Alternative V would not be expected to provide a comparable degree of benefit.

LAND-USE CHANGES

The potential for land use changes in the outlying area generally comes from two different components of the alternative wastewater management systems. The first involves the effective reuse of the residual by-products (sludge) from the treatment processes. The second involves the land requirements necessary to sustain the physical facilities of the land treatment system. Both reflect different methods of recycling the nutrients contained in the wastewater and both have significant factors to consider.

Sludge Management Program

Option 1, Agricultural Utilization. Under this program both the biological and physical-chemical sludges would be used to support present agricultural production. The biological sludges from the Conventional and Advanced Biological processes and the Land Treatment systems would be used for their fertilizer and humus values. This in turn will not only increase the farmer's income by reducing his production cost budget but by eliminating its use, reduce the demand for commercial fertilizer. The physical-chemical sludge would be used for its acidity control and soil conditioning values. As such it has limited market value and its impact would be insignificant.

The land involved is not purchased but is utilized under contractural arrangements with the owner. Due to the investment required, the duration of the contractural arrangements would have to extend over a 50-year period. Consequently there is a potential for imposing an impact on two different groups. The first would naturally be the participating farmer who would be paid an initial sum to compensate for potential crop losses during system installation and for the necessary changes in farming practices occasioned by the system constraints. In addition annual payments would be made to compensate the present or future owner for his inability to realize any long-term capital gain from alternative land uses. The second group which might be affected would be the other residents in the area. An impact would be imposed only if the long-term contractural arrangements would constrain the land use patterns and economic base in the area. As long as the counties can incorporate these agricultural commitments into their land-use planning objectives, the residents will not be required to forego any social values or other related gains.

Option 2, Land Reclamation. Reclamation of surface mine areas is confined to three NDCP alternatives producing biological sludge. As with the first option, there is a potential for imposing an impact on two different groups. The first involves the surface mine owners. It is anticipated that the use of the land would be secured without payment to the owners in exchange for the increased land value which would result from the reclamation program. However this assumption is based on the concept that the land could and would be developed for optimum income producing potential, but also in accordance with the applicable county's land-use planning objectives. This, plus other operational, managerial and administrative considerations, are outlined in a letter from the Mid-West Coal Producers Institute, Inc. included in Annex A to this appendix. The latter reflects the coal industry's interest in this particular phase of the study. The second group of people affected would be the residents and taxpayers of the outlying area, the States and the rest of the region. The land reclamation represents the potential to effect a change in existing land use. Not only will the aesthetic of the surface mine areas be enhanced but the program offers the opportunity to meet local, state and regional land related needs at a reduced investment level. Depending upon the selected land-use(s) there is the added potential to increase the economic base of the local area.

Land Treatment System

The land use changes affected by the land treatment will be reflected in two ways. The first involves the purchase in fee of land required

for the aeration and storage lagoons and buffer zones. The second involves an intensification of present agricultural production achieved on the irrigation lands made available under long-term, 50-year contractural arrangements.

Both of these changes have a potential for imposing an impact on two different groups. The impact will be particularly significant for Alternative IV but comparatively minor for Alternative V which is approximately 1/3 in size and implications. The first group of people affected will be the owners of the lands. For those persons whose lands will be purchased in fee, reimbursements include not only the cost of the land and improvements, but also the cost for relocation and resettlement. Payments to the participating farmers who own the irrigation lands will be divided into parts. The first will be a lump sum cost to help defray the cost of new agricultural equipment and for any loss in income resulting from the installation of the irrigation and drainage system. The second will be in the form of an annual payment to compensate the present or future owner for his inability to realize any long-term capital gain from alternative land uses. In addition it is anticipated that the administrative entity would provide indemnification against income losses attributable to the system's operation.

The second group which could be affected would be the residents of the area and the taxpayers both locally and in the two States. It was recognized that the fee purchase for the permanent facilities would remove lands from the tax base and consequently impose an additional economic burden to the local taxpayers. Accordingly, an annual payment will have to be provided to reimburse the local government and service units that rely on the property taxes for their revenue.

Concurrent with the foregoing is the causal impact that Alternative IV imposes on the residents and taxpayers of the area. Prototype model studies involving growth and projected land use patterns have indicated an average 40 percent use capability in siting the land treatment physical facilities, including the irrigation fields. As a result it must be recognized that implementation of the land treatment system in all probability will impose a constraint in land use beyond just the actual treatment component requirements. While the constraint will vary in character and degree, it is safe to assume that some type of impact will be imposed on a geographical area some 1 1/2 times greater. Some examples of the causal impacts are listed below:

(1) Not all of the participating farmer's land may be used. Possible exclusions would involve flood plain woodlands, unsuitable soil types and isolated acreage too small to be economically used.

(2) Communities whose long range growth would be limited by the location and use constraints placed on the surrounding agricultural lands.

(3) The short-term inability to attract outside capital investment and people into the area until sufficient time has passed to demonstrate the system's workability and social compatability.

All of the above illustrates the uniqueness of impact associated with the land system when located outside a major urban area. In net effect it imposes the need for a decision whether or not to retain the present agricultural economy and life-style and forego other types of socio-economic gains. The impact is further underscored by the geographical area and number of counties involved.

Rock and Soil Management

There is an added potential for still another land use change. As previously discussed the construction of the wastewater management system in the C-SELM area will require the movement and disposal of enormous quantities of materials. Extensive areas of surface mines are located in Grundy, Will, LaSalle, Livingston and Kankakee Counties. The dolomite rock and overburden could be transported to these areas and used for fill, to improve drainage and for pH control. In addition there are large open-mined limestone quarries, particularly in Indiana about which the State is concerned and desireous of filling. This material could be used to help satisfy this type of need too.

SYNERGISMS

The potential for achieving other benefits will occur if the residents in the outlying area indicate a willingness to accept the land treatment system. While these benefits will accrue to the local area, most are really regional in nature. As such these add-on programs have significance to the residents of the two States and other concerned groups.

Regional Parks

As indicated in the Inventory of Needs for both the Upper Mississippi River and Great Lakes Regions, the demand for in-close land and water based recreational activities cannot be met effectively within the study area. The opportunity to meet portions of this need may best be provided by the five land treatment sites which have an effective time-distance traveled relationship to the metropolitan area and the various population centers. Regional parks ranging in size from 2 - 3,000 acres and providing a total usable acreage of some 12 - 15,000 can be incorporated into the perimeter of the land treatment sites and

serve as buffer zones. Scattered surface impoundments and artificial waterways can be provided to supplement local streams and support a wide range of land and water-related recreational activities including fishing. Quality water would be obtained from the treatment site in volumes sufficient to sustain storage and flow-through rates. At least two types of regional parks could be considered: resource-oriented parks and activity-oriented parks.

Resource-oriented parks would be located, sized and developed to emphasize and preserve a particular area's natural environment. On the other hand, reforestation and other restoration or enhancement measures could be adopted in the land treatment system to attain the same objective. Either way, such parks would be spacious and possess varying terrain, vegetative cover types and natural features generally attractive to the recreationalist. The hallmark of this type of park is that the overall area of land (up to 60 percent) would be left in a lightly developed and/or totally undeveloped condition.

The activity-oriented parks are both intensively and extensively developed. The main objective is to provide as wide a diversity in recreational opportunities as is feasible. In such parks, at least 65 percent of the lands would be devoted to facility developments. These parks would be located close to main arterial highways to insure maximum accessibility from population centers. Very little emphasis would be accorded the natural environment, since major reliance would be placed on man-made developments. These parks would be designed to provide a full range of recreational activities, reflective of the needs and desires of the urban family. As such it would be tailored to sustain a comparatively high yearly use per acre.

Wildlife and Waterfowl Areas

The multiple return of the land system is particularly effective in meeting wildlife and migratory waterfowl needs. The buffer zones which will be part of the land system can be expanded and planted to provide excellent cover or habitat for a variety of wildlife and birds. Furthermore, the type of cropping practices utilized in the treatment process can be varied and managed to serve as food plots for selected game species. Provisions of various sized impoundments to serve as resting grounds or for flooding of food plots also can be incorporated in the system design and thereby be effective in meeting the needs for both ducks and geese. The treatment process will generally be shut down by the time the hunting season for most species starts and so much of the lands can be opened to public hunting. This will provide new lands to the urban hunter and relieve much of the pressures on those areas and refuges presently available.

POWER GENERATION

Integration of large base load power generation plants is practical with the land treatment system which provides a large source of water for cooling purposes. It is estimated that an additional 20,000 and 55,000 megawatts of power will be required in this region by the year 1990 and 2020 respectively. These estimates do not include the total additive that would be required by the new environmental clean-up needs. The storage capacity of the lagoons in Alternative IV, the all land system would be sufficient to meet the cooling pond requirements for both time increments. Similarly, the lagoons in Alternative V will have comparable ability but only some one-third of the capacity to meet the base land cooling requirements. The proposal has the added advantages of not only removing a potential source of heat pollution from the major lakes or waterways in the region. It also can provide the lands that otherwise would have had to be acquired for cooling ponds if the projected power deficiencies of the region are to be met. Moreover, there is the added potential of pumped-back power generation using the surface improvement and mined storage tied to the conveyance system.

The potential for power generation is there due to the necessity for providing surface storage and should be evaluated in light of the national effort to help meet the projected power deficiences. The new revenue base this would bring to the area also will help offset the loss in tax base caused by the land acquisition program for any of the treatment systems. An artist's concept is shown in Figure G-VIII-5. Comments concerning the validity of this co-siting proposal are contained in a letter from the Federal Power Commission (See Annex A).

SATELLITE CITIES

The continued expansion of the major metropolitan areas is leading to the establishment of regional megalopolis. Many planners feel that unless controlled, this growth will just compound the many social and political ills found in the urban centers of today. One solution is the creation of satellite cities - self contained communities of residential, commercial and industrial mixes which still are dependent upon the major urban center for many of its services and cultural amenities.

In many of the rural counties surrounding the Chicago metropolitan area, changes are occuring that reflect the population and land-uses trends of the urban area. This trend is bound to continue and become even stronger over time. A long-range opportunity exists to integrate the land treatment system into the regional and counties' land-use plan and establish urban-type development zones on the surrounding perimeter lands. The wastewater loads of these satellite developments (residential, commercial and/or industrial) can be easily integrated into the treatment process and a high quality water source provided for local use at minimal cost. Moreover, shaping the land treatment sites to conform

LAND TREATMENT - POWER PLANT COMBINATION

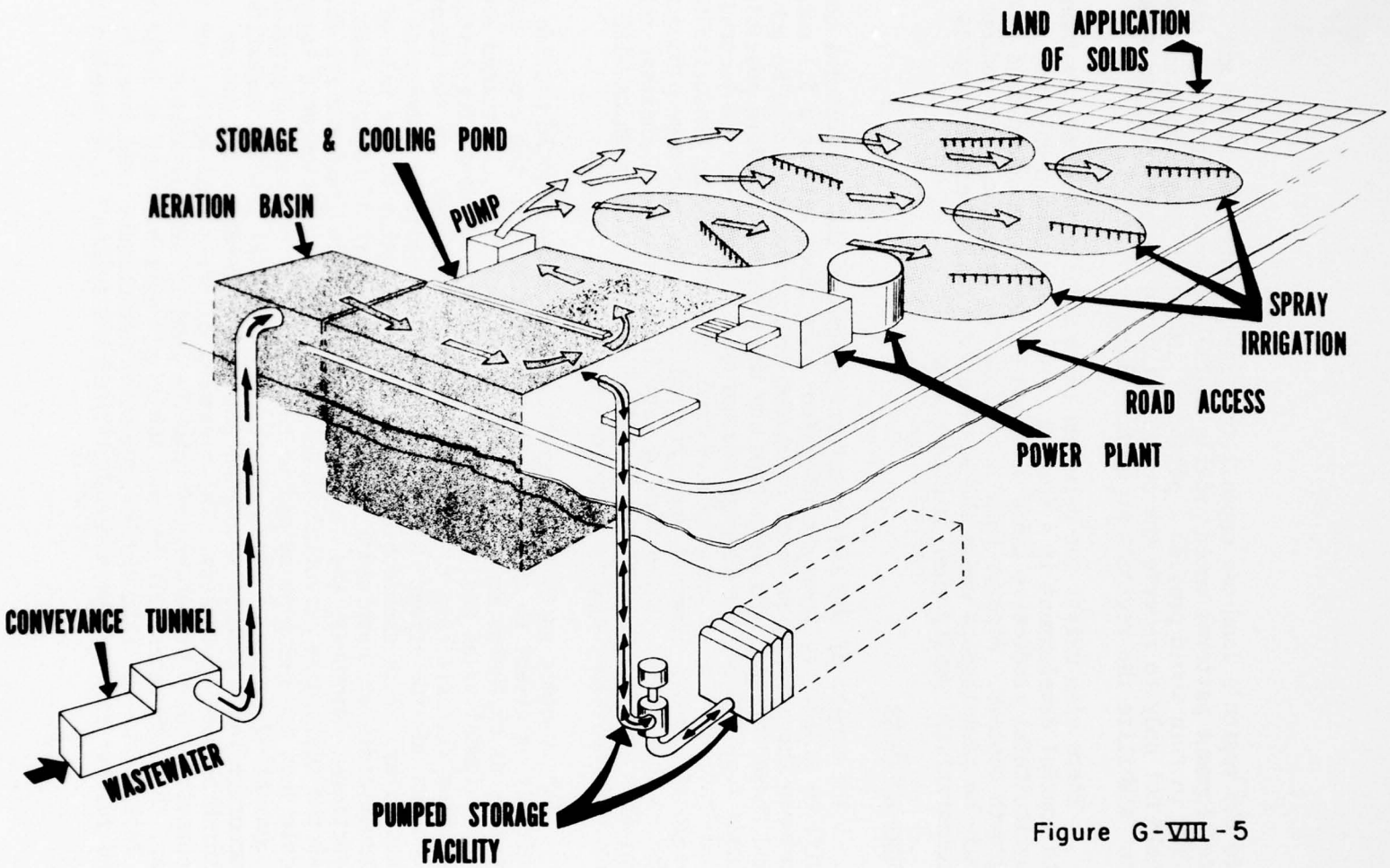

Figure G-VIII-5

to the region's land-use capability, transportation networks and development patterns would provide controlled growth centers in the area. This in turn would provide a potential source of local employment and help not only to reverse the out-migration to the metropolitan area but stabilize the region's population density.

There also exists the opportunity to utilize the land treatment site to control development in a specific area, using the open-space of the agricultural productive lands as green belts between and around selected growth centers. However this as well as the satellite city concept may only be advantageous where the scale of the land treatment site is comparatively small, such as Alternative V.

AGRI-BUSINESS

The impact of the land treatment system on the agricultural community will be mixed. In terms of benefited lands there will be a 5:1 ratio between the acreage on which increased crop production would be achieved and those acreages withdrawn from any use potential. Where possible, the lands required for the storage and aeration lagoons will be located on comparatively low or unproductive lands and not acreage conducive to regional growth. However, on irrigated lands the increased production and savings mostly in the form of fertilizer costs will increase the farmer's income. So will the installed drainage system which will protect the farmer against crop losses due to wet years.

The economic gains to the participating farmer should provide a multiplying effect to the total economic structure of the area. Such factors as expansion in storage and drying facilities, increased seed and equipment sales and the accompanying increased demand for custom services will all help to stimulate the local economy. On the other hand, an adverse effect will be noticed in the sales of commercial chemical fertilizer. This should be somewhat offset by gains in the sale of chemical insecticides and herbicides which are used as part of today's farming practices. Moreover, the cropping pattern of corn grain and rye forage has the additional potential of fostering beef production on a larger scale than now being practiced in the area. The prospect of providing a guaranteed source of feed can attract commercial feedlot operations or encourage local farmers to expand into either feeder stock and/or finishing beef operations. The treatment of the animal waste from these operations could be integrated into the land system operations. Either way, this can materially improve the area's agri-business as indicated in a letter from the Illinois Department of Agriculture (see Annex A) and further enhance the marketability of the system's crop production.

SECTION IX - COST CONSIDERATIONS

COST EVALUATION

The evaluation up to this point has underscored the interdependency between the social and resource base of the study area and the outlying area. However, the financial cost is also a resource which is subject to competative demands from ever-changing priority needs. As such, the use of the tax dollar affects all political levels - from the study area to the national budget.

An estimate of costs, both capital and annual has been prepared for each of the five alternatives. These costs are basic to any financial cost-sharing consideration and essentially include all economic factors that ultimately must be considered. In essence these costs are really comparative in nature and are designed to display the economic implications involved in such related management considerations as regionalization, treatment technology, sludge utilization and water reuse. The cost comparison also underscores the economic impact inherent in upgrading our current water quality standards as part of the natural objective to improve our total environment.

COST OMISSIONS

There are several cost items which are not included in the estimates. These items have been excluded because of an inability to determine actual costs with any degree of relevancy. Information concerning these omissions are discussed below.

INTERCONNECTION WITH EXISTING SYSTEM

The cost relationships identified in the four NDCP alternatives represent an extension of the current, local planning objectives for consolidation as expressed in the Reference Plan, Alternative 1. What is not included are the costs for modifying the present system to comply with the 64 plant layout contained in the Reference Plan. At present some 130 wastewater treatment plants exist in the study area. The local planning agencies have examined these plants and have recommended the retention of some, the abandonment of others and the building of some new plants. To what extent this degree of consolidation is to be achieved, particularly in light of the new NDCP standards and its total implications can not be ascertained at this time. The actual costs incurred will be identified only when those State and local entities responsible for this decision select the degree of regionalization most acceptable to the area's total needs. In the interim however, an estimate of the capital cost required for the interconnection has been made based on anticipated 2020 flow conditions. The cost amounts to some $28.8 million.

PLANTS RETIRED FROM SERVICE

Another cost factor of concern is the outstanding bonded indebtedness of the existing treatment plants that would be abandoned if any of the five alternatives were implemented. A listing of those plants contained in the Reference Plan and which ones would be abandoned if any of the four NDCP alternatives were implemented is presented in Appendix B. No attempt, however, was made to ascribe the amount of indebtedness associated with each plant, primarily because the information was not available. Instead, an estimate was made of the total outstanding indebtedness in order to determine the overall magnitude of cost involved. The records of most operating entities do not discriminate the indebtedness between plant and the collection and conveyance facilities. In the few instances where the proportion was known, the amount allocated to the treatment facilities represented about two-thirds of the total. This factor was then related to the estimated population of the service area in order to determine a multiplier value per person served for those systems where the indebtedness was not known. The total outstanding indebtedness for the existing treatment facilities was estimated at approximately $401,500,000 or $23,700,000 per year if amortized over a 50-year period at 5 1/2 percent interest. This represents the maximum cost level which would be incurred if Alternative IV, the pure land system, would be implemented. As such, it represents approximately four percent of the alternative's total annual costs and would be of lesser comparative value for the other alternatives. The inability to apply this cost to the other alternatives, however, precluded its use overall.

The cost of dismantling and scrapping the abandoned plants also is not included in the estimates for the alternatives. Instead it was assumed that the salvage value of the existing treatment facilities and especially the land made available would equal or exceed the cost.

COST OF ALTERNATIVE PLANS

The costs, both capital and annual, for each of the five alternatives are summarized in Table G-IX-1. The annual costs were computed using the current Federal* interest rate of 5.5 percent. There were seven special cost considerations that were incorporated into the design of these estimates that warrant special mention because subsequent economic conditions may warrant a change. The cost implications in changing some of these design considerations and the interest rate are discussed in Appendix D.

The main line conveyance systems were designed for 2020 flow to recognize the economics inherent in the construction. This was based on the assumption that treatment facilities planned for 1990 would be expanded over time to accept the projected increased flows. Thus definite cost savings could be achieved by avoiding phased construction of this particular system component.

Table G-IX-1
ALTERNATIVE COST COMPARISONS
Costs ($ Million) a/

	Alternative I		Alternative II		Alternative III		Alternative IV		Alternative V	
	Total Capital Cost	Annual Cost	Total Capital Cost	Annual Cost	Total Capital Cost	Annual Cost	Total Capital Cost	Annual Cost	Total Capital Cost	Annual Cost
Treatment System										
Capital Costs	1,310	61	4,078	191	5,611	264	2,508	118	4,376	206
O, M & R Costs b/	-	27	-	230	-	235	-	98	-	197
Total Costs		88		421		499		216		403
Conveyance System										
Capital Costs	846	45	995	53	1,055	56	1,942	103	1,551	83
O, M & R Costs	-	5	-	6	-	6	-	9	-	7
Total Costs		50		59		62		112		90
Storm Water Management System										
Capital Costs	834	39	2,534	123	2,534	123	2,582 d/	125	2,582	125
O, M & R Costs	-	4	-	44	-	44	-	44	-	44
Total Costs		43		107		167		169		169
Sludge Management System										
Capital Costs	262	12	1,231	58	343	16	206	6	294	14
O, M & R Costs	-	9	-	21	-	13	-	5	-	12
Total Costs		21		79		29		11		26
Reuse										
Capital Costs	-	-	327	12	325	12	1,376	64	930	42
O, M & R Costs	-	-	-	7	-	6	-	21	-	15
Total Costs				19		18		85		57
Total Plan										
Capital Costs	3,252	157	9,165	437	9,868	471	8,614	416	9,733	470
O, M & R Costs		45		308		304		177		275
Total Costs		202		745		775		593		745

a/ Total capital cost is equivalent to the investment expenditure required for the alternative to be operational and treat 1990 flows. Annual costs were computed using a phased schedule of implementation with capital and annual costs discounted (present worth) to the base year of 1975 and amortized over a 50-year economic life @ 5 1/2 percent.

b/ Operation, maintenance and replacements.

c/ Based on the 1990 average annual flow of 3,651 MGD for the NDCP alternatives and 2,663 MGD for Alternative I.

d/ The diurnal cost of storage at access point included the cost normally associated with smaller plant design.

The treatment system costs were based on the physical layout and capacity required to meet 1990 design flow conditions. However, in all cases except for the land treatment system, the 2020 acreage was acquired initially. This assured the capability to expand in accordance with future needs and minimize any long-range disruption to local land-use planning efforts.

The capital cost for the land treatment systems includes only the lands required for the lagoons and buffer zones needed in conjunction with 1990 level flows. Lands required for the 2020 flows could be safeguarded by negotiating a "first-right-to buy" option. This would not limit the owner from selling at any time but only guarantee the operating entity the first right to negotiate and purchase the land at a mutually agreeable price. At the same time, the payment compensating local interests for the loss of tax revenue on purchased land has been included in the annual operating costs. This amounts to $1.1 million and $0.3 million for Alternatives IV and V, respectively.

The cost for the rock and soil management system included in all five alternatives was based on the option making the maximum commercial use of the material. This would involve strategically stock-piling the material and using the material over time. This would safeguard the resource base of the study area and help hold material costs to a reasonable level.

Option 1 of the potable reuse system was used in the summary estimates. This option requires that the Illinois portion of Lake Michigan withdrawal be maintained within the present 3200 cfs constraint. Otherwise the basic water balance is the same with only minor variations in the summer and winter flows.

The cost estimates do not include any equivalent for interest during construction. Due to the uncertainties of funding and potential variation in implementation scheduling allowances for this type of cost was not included. Somewhat counterbalancing this omission is the use of a comparatively high Engineering and Design factor of 10 percent. This factor was used in recognization of (1) the extensive subsurface and field investigations that will be required in connection with final siting and construction of the major plants, conveyance and redistribution systems; and (2) the extensive amount of coordination required among the many institutional levels in the detailed planning evaluation of all components. Furthermore, use of the high factor will approximate actual costs if subsequent monies and expenditures are limited due to budgetary constraints, and the work effort must be phased over a longer period of time.

An intermix of two sludge options also are involved in the cost summary table. The sludge option involving the utilization of surface mines was used for Alternatives III through V. On the other hand, the option of

agricultural utilization was used for Alternative I and II. Adoption of this latter option follows the current practices (Alternative I) and the use constraint of the sludge from the Physical-Chemical process. Utilization of the surface mine reclamation option would minimize the impact on the resource base of outlying areas, while at the same time providing increased opportunity to meet a range of land-related needs.

COMPARISON OF ALTERNATIVES

OVERVIEW

To meet the goals of PL 92-500 will require approximately three times the capital expenditure needed to consolidate the existing plants and upgrade the remaining plants to meet current standards (Alternative I). At the same time the adjusted annual costs for operation, maintenance and replacement will increase by some 4 to 6 1/2 times, depending upon the technology used. Most of the increase is attributable to three factors: the differential in water quality goals; the necessity to collect and treat storm water runoff; and the reuse and redistribution system provided to meet local needs including potable water supply deficiencies.

Three of the functional components, the treatment, storm water management, and conveyance systems account for 80 to 90 percent of the five alternatives' total capital expenditures. For the Reference Plan, Alternative I, the treatment system is approximately 40 percent of the total capital cost. Correlary figures would be 45 percent for Alternatives II and V; 57 percent for Alternative III; and only 30 percent for Alternative IV. On the other hand the storm water management system relationships are essentially comparable with the percentage ranging from 26 to 29 - only a 3 percent differential. The significant deviations occur in the conveyance system costs and reflect the added cost attributable to regionalization once beyond the 17 plant level; there being little percentage difference between the 33 and 17 plant systems. On a comparative percentage basis, the increment attributable to the extension to land sites is some 1 1/2 to 2 times the 10 percent average for the other NDCP alternatives. The corresponding percentile for Alternative I is 27 percent of the total capital expenditure.

In a similar manner the operational, maintenance and replacement costs were analyzed. Only the annual costs associated with the treatment systems were significant. The annual operating costs for this functional component amounted to 60 percent of the total for Alternative I. The corresponding equivalent percentile was approximately 75 percent for Alternatives II and III; 55 percent for Alternative IV; and 70 percent for Alternative V.

In summary, the foregoing percent relationships indicate a commoness in over-all relationships that one would expect when adjusted for the volume being treated and the technologies and degree of regionalization being considered. To further define the financial impact to the two-State portions of the study area, an applicable proration of component costs are presented in Tables G-IX-2 (capital costs) and G-IX-3 (operational costs).

In the course of the comparative cost analysis, special interest was expressed in a plan comparable to Alternative I, but upgraded to meet the volume and treatment standards of the NDCP goals. The interest stemmed from an optional consideration for attaining the higher water quality in stages. While staging is feasible, it should be understood that due to the large scale nature of the NDCP alternatives, considerable delay could not be avoided in achieving the 1985 goal as set forth in PL 92-500. The rate of resource expenditures including financial for all the NDCP alternatives require commitments beyond a level heretofore required. Consequently, a time-phasing of these commitments might ultimately be preferred. If so, the logical procedure would be to first consolidate the existing plants, upgrading the remaining facilities to current standards. This should comply with the requirements of Section 301b(1)(B) that publicly owned treatment works provide the equivalent of secondary effluent as defined by the USEPA. As such, this requirement would be met by implementing Alternative I. In addition, the same alternative may also comply, at least to some degree, with the interim national water quality goal set forth in Section 101 a(2). This interim water quality goal provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983. The degree with which Alternative I meets this interim goal must rely on the judgment of the USEPA. That agency is required to establish effluent limitations which (1) require application of the best practicable waste treatment technology and (2) that will result in reasonable further progress toward the NDCP goal. See Sections 201g(2) and 301(b).

Based on the foregoing, it is feasible to envision reaching the ultimate (NDCP) goal in at least two stages. If this were done, the question would naturally arise as to the economic implications of upgrading those plants to the NDCP treatment standards. To realistically assess this question required adoption of a basic assumption. That the first stage, upgrading to current standards (Alternative I) would be accomplished first and within a 10-year period, starting in 1975. This would closely approximate the July 1983 deadline and assumes that the resultant water quality would at least partially satisfy the interim national goal. The second stage, upgrading to the NDCP goal would follow and again be completed within a 10-year period. If this second stage immediately followed the first, the NDCP national goal would not be met until 1995, a minimum delay of 10 years.

Table G-IX-2
Proration of Alternative Capital Costs
Cost ($Million)a/

	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Treatment System	1,018	292	1,310	3,382	696	4,078	4,672	939	5,611	1,323	1,185	2,508	3,537	839	4,376
Conveyance System	840	6	846	968	27	995	1,018	37	1,055	1,765	177	1,942	1,436	115	1,551
Storm Water Management System	721	113	834	1,879	655	2,534	1,879	655	2,534	1,919	663	2,582	1,922	670	2,582
Sludge Management System b/	218	44	262	1,033	198	1,231	288	55	343	105	101	206	247	47	294
Reuse System c/	0	0	0	314	13	327	312	13	325	1,129	247	1,376	782	148	930
Total	3,797	455	3,252	7,576	1,589	9,165	8,169	1,699	9,868	6,241	2,373	8,614	7,924	1,819	9,733

a/ Total capital cost, not discounted to reflect present worth of investment due to construction phasing.

b/ Based on agricultural utilization for Alternatives I and II and surface mine reclamation for Alternatives II, IV and V.

c/ Based on Reuse Option 1, Lake Michigan withdrawals for Illinois area within the 3200 cfs (2068 MGD) constraint).

Table G-IX-3
Proration of Alternative Operating Costs
Cost ($Million) a/

	Alternative I			Alternative II			Alternative III			Alternative IV			Alternative V		
	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total	Ill.	Ind.	Total
Treatment System	22.0	5.0	27.0	194.0	36.0	230.0	190.0	45.0	235.0	52.0	46.0	98.0	163.0	34.0	197.0
Conveyance System	3.9	1.1	5.0	4.7	1.3	6.0	4.7	1.3	6.0	7.0	2.0	9.0	5.5	1.5	7.0
Storm Water Management System	3.1	0.9	4.0	34.2	9.8	44.0	34.2	9.8	44.0	34.2	9.8	44.0	34.2	9.8	44.0
Sludge Management System b/	7.5	1.5	9.0	17.6	3.4	21.0	10.9	2.1	13.0	2.5	2.5	5.0	10.0	2.0	12.0
Reuse System c/	-	-	-	6.4	0.6	7.0	5.6	0.4	6.0	17.2	3.8	21.0	12.6	2.4	15.0
Total Plan	36.5	8.5	45.0	256.9	51.1	308.0	245.4	58.6	304.0	112.9	64.1	177.0	225.3	49.7	275.0

a/ Total annual costs for operation, maintenance and replacement costs discounted (present worth) to the base year of 1975 and amortized over a 50-year economic life at 5.5 percent.

b/ Based on agricultural utilization for Alternatives I and II and surface mine reclamation for Alternatives III, IV and V.

c/ Based on Reuse Option 1, Lake Michigan withdrawals for Illinois area within the 3200 cfs (2068 MGD) constraint.

Prior to implementing the suggested second stage under this alternative timing, a major decision will have to be made as to what technology is to be employed in the transition from current standards to the NDCP goal. Either of the plant technologies, Advanced Biological and Physical-Chemical, can be used to upgrade the 64 plant facilities. Additionally, the decision could also be made to abandon the plant sites and employ either the pure land or a combination of the Advanced Biological and land technologies. The costs involved in this type of staged implementation are shown in Table G-IX-4. As with the other cost estimates, plant abandonments; salvage and other costs items are not included, even though substantial write-offs would be involved in this option. The incremental capital costs shown in the table are the additions required to upgrade the 64 plants or meet the higher water quality goal by other means. The results of the analysis indicate that the two-stage implementation will increase the capital costs for achieving the NDCP goal. This increase or savings foregone will range from $601,000,000 to $2,076,000,000, depending upon the technology employed. Several factors are worth noting:

(1) The savings attributable to regionalization (economies of scale) of the treatment plants will be foregone when upgrading the 64 plants in place.

(2) The sludge management system for Alternative I will not be usable for the higher water quality plans if any but the Advanced Biological treatment system is used. The composition (Physical-Chemical) or location of the treatment facilities would require a write-off of the disposal system for Alternative I and installation of a new system.

(3) The add-on costs for the storm water management, conveyance and the re-use systems will be essentially the same as that required for the NDCP alternatives. This is true no matter when implemented or whatever treatment technology is employed.

A comparable relationship applies for the operational costs. In this case, the savings foregone range from $21,000,000 to $60,000,000 annually. These figures are discounted to the base year of the two, 10-year time stages and were computed using 5.5 percent over 50 years.

NATURE OF COSTS

The system related costs discussed in the previous paragraph are only part of the financial consideration. Very few of the costs are single purpose and hence related only to the water quality control. Multiplicity exists in many of the functional components- for example, the storm water management program. This program will not only be responsive to the need

Table G-IX-4
Cost Implications, Two Stage Implementation
Capital Cost ($Million)

SYSTEM COMPONENTS	First Stage Alternative I	Second Stage 64 PLANT TREATMENT PROCESSES PHYSICAL-CHEMICAL Increment a/	PHYSICAL-CHEMICAL Total	ADVANCED BIOLOGICAL Increment a/	ADVANCED BIOLOGICAL Total	LAND TREATMENT Increment a/	LAND TREATMENT Total	ADVANCED BIOLOGICAL/LAND Increment a/	ADVANCED BIOLOGICAL/LAND Total
Treatment System	1,310	4,486	5,796	4,862	6,172	2,508	3,818	4,078	5,388
Conveyance System	846	185	1,031	245	1,091	1,132	1,978	741	1,587
Storm Water Management System	834	1,700	2,534	1,700	2,534	1,748	2,582	1,748	2,582
Sludge Management System	262	1,231	1,493	25	287	206	468	294	556
Reuse System	-	387	387	385	385	1,376	1,376	930	930
Total Plan	3,252	7,989	12,241	7,217	10,469	6,970	10,222	7,791	11,043
Expenditure Differential b/			2,076		601		1,608		1,310

OPERATING COSTS ($ Million)

	First Stage Alternative I	PHYSICAL-CHEMICAL Increment a/	PHYSICAL-CHEMICAL Total	ADVANCED BIOLOGICAL Increment a/	ADVANCED BIOLOGICAL Total	LAND TREATMENT Increment a/	LAND TREATMENT Total	ADVANCED BIOLOGICAL/LAND Increment a/	ADVANCED BIOLOGICAL/LAND Total
Treatment System	27	253	280	232	254	38	125	187	214
Conveyance System	5	1	6	1	6	5	10	2	7
Storm Water Management System	4	40	44	40	44	40	44	40	44
Sludge Management System	9	21	30	-	9	5	14	12	21
Reuse System	-	8	8	7	7	23	23	17	17
Total Plan	45	323	368	280	325	171	216	258	303
Operational Differential a/			60		21		39		28

a/ Incremental cost to achieve NDCP goal.

b/ Cost differential between the total cost for the two stage plan of implementation and those costs required for immediate implementation of the NDCP goal. Capital costs are not discounted. Operational costs are discounted (present worth) based on a 5.5 interest rate for 50 years for the 2 10-year stages.

for the capture and treatment of a non-point source of pollution but also provide significant reductions in urban water damage problems as well as a source for water supplies. The program also establishes the basis for meeting other needs as is implicit in the two water reuse options. Both reuse options are structured with the objectives of meeting the study area's needs including water supply deficiencies. It is within the broader framework of fulfilling part of the area's total needs that the alternatives' cost must be assessed. Moreover, it is because of the multiple-purpose nature of the alternatives that the actual extent of the Federal, State and local interest participation and cost sharing cannot be determined at this time. To develop this type of information is beyond the scope of study. What is required is a detailed investigation as to the economic justification and cost effectiveness of project element in meeting a multiplicity of needs. However, in the absence of this type of input, the costs for each alternative should be apportioned in relation to the guidelines set forth in PL 92-500. This will provide at least some indication of the costs to the people at the national, state and local levels.

SECTION X - CONTRIBUTIONS TO NATIONAL GOALS

In improving the water quality of the area's waterways, specific improvements or bases for improvements were provided that would enhance the general welfare. The degree of this enhancement is reflected by the contributions made to the national goals for Regional and National Economic Development, Environmental Quality and Social Well-Being. In assessing the alternatives, it also is necessary to consider the extent to which each can contribute to the national goals.

REGIONAL AND NATIONAL ECONOMIC DEVELOPMENT

The water and related land requirements used for this study were reflective of the need inventories established for the Upper Mississippi River and Great Lakes Basins. As such they provided an interrelationship between the nation and a region with its subareas for the production of goods and services and population distribution. Consequently, any proposals to meet these needs would contribute to the development of both the region and the nation.

All five alternatives contribute to the conservation of our natural resource base with the recycling of industrial waters and the sludge from the wastewater treatment processes. The manner in which the latter is achieved varies, however, between the technology employed for treatment. All provide the potential for effecting savings (regionalization) in the cost of wastewater treatment, though again the degree of economies varies with the alternatives.

All four NDCP alternatives will provide (1) a significant degree of areawide flood control, (2) the capability of meeting projected water supply requirements, (3) enhanced in-stream recreational usage including fishing and (4) an improved flow regimen to sustain commercial navigation in the Upper Illinois Waterway System. All these contributions are responsive to the regional need inventory and would preclude additional investments on the part of the nation, state and local governments. The impacts, including costs, will differ considerably between alternatives. On the other hand similar contributions from Alternative I, current standards would be limited at best. Flood control would be affected only in those areas where existing combined sewers are in operation. In these areas, however, the degree of flood control would be comparable. The potential for meeting future water supply requirements would not be realized nor would the improved flow regimen for in-stream recreational usage and commercial navigation. For all four water need categories, additional levels of investment would be required in order for Alternative I to provide the equivalent degree of service or contribution.

In addition all four NDCP alternatives provide the base resources to meet urban recreational demands. The improved flow regimen, quantity and quality, enhances the potential for providing recreational land corridors along the area's streams. Moreover, the degree of flood control provided concurrently would also increase the number of days and usage of the add-on land-based recreational developments. An additional level of investment would be required for development of the corridors. This represents but one use which could be applied to the flood plain, once the adopted level of flood control is achieved. Other uses would require higher levels of investment and cause other types of impacts which would have to be assessed. At the same time, the NDCP plant alternatives have the added potential of providing sufficient through-flows to sustain specially constructed impoundments for quality game fish. None of these gains can be provided by Alternative I without additional financial investments for augmenting and redistributing the stream flows.

The land treatment systems in Alternative IV and V provide a resource base with which to meet the specific needs of: regional parks, wildlife and waterfowl areas, and the cooling water requirements for power generation. The treatment system also has the potential for enhancing agricultural production. In each, an additional investment would be required but the level of investment would be less than if undertaken on a single-purpose basis.

ENVIRONMENTAL QUALITY

All five alternatives enhance the water quality and environmental status of the area. However, the degree to which this is achieved, the costs and the impacts are significantly different. Alternative I meets current water quality standards and guidelines and, as previously discussed, may meet to some degree the interim (1983) but not the higher water quality goal established by Public Law 92-500. The four NDCP alternatives do. The NDCP alternatives achieve a higher degree of phosphorus and nitrogen removal (from the wastewater) than that required for the current standards. Thus, the NDCP alternatives reduce the potential for algal bloom. While there are variations in performance levels (constituent levels of removal) between the NDCP alternatives, particularly in phosphorus, no differential in impact on the aquatic ecosystem could be determined.

Implicit in the design of the NDCP alternatives is an increase in the standing water biotic (aquatic organisms) communities. This in turn provides the potential for also increasing the birds and wildlife that feed on the aquatic organisms in the streams and standing water impoundments. Concurrent with this enhancement will be a reduction in the terrestrial (flora and fauna) communities. Most of the reduction will be attributable to the surface disruption caused by construction of the system components. Nevertheless, the negative effects on the distribution and diversity of the biotic communities should not be severe since most of the areas have already been extensively modified by man.

Air quality impacts will be associated with the Advanced Biological and Physical-Chemical technologies. Both use incineration as part of the treatment process and discharge chemicals and particulates into the air. The discharge from the Advanced Biological System will meet current USEPA air emission standards, while the Physical-Chemical process does not. The nitrogen oxides exceeds current standards, only because the technology is not presently available to effectively remove the ammonia in a pure physical-chemical process. On the other hand, both the Advanced Biological and the land systems will have aerosols present as does the Conventional Biological system now being employed to meet current water quality standards. In addition, there will be a potential for infrequent odors in the spring from the storage lagoons used in the land treatment system.

There is a potential for establishing recreational parks and wildlife areas with the sludge reclamation program for the surface mines. This applies to all of the alternatives except Alternative II which utilizes the Physical-Chemical technology. The sludge from the Physical-Chemical is limited to essentially agricultural usage; since the organic and humus-building qualities have been lost through incineration.

SOCIAL WELL-BEING

The contribution to the study area's social well-being will be comparable for all alternatives. There will be temporary inconveniences to public access and traffic flows and interim aesthetic blights caused by noise, dust, and visual contrasts with present conditions. A key contribution to regionalization is the opportunity to control development and balance open space with areas of intensified growth. This can be done by controlling access to the conveyance systems and using the storm water management systems (NDCP alternatives only), to provide greenbelt areas.

Location of the treatment facilities for either the plant or land technologies will be a disruptive factor to the social pattern in the immediate area. There is a general public aversion to living near such a facility. As a result there is a temporary drop in property values in and around the adjacent area. This will continue until land demands become great enough to change the sociological attitude and obtain an acceptance on the part of the citizenry. The impact of the land treatment system is even greater in that it will also effect the community political structure of the outlying area. The scale of Alternative IV is such as to cause the residents in those areas to forego many of their own social and growth desires. Also implicit is the general reluctance of the agricultural areas to use their resources to solve an urban problem. Similar concerns will apply to the sludge management programs especially the agricultural option.

SECTION XI - STATE OF THE ART

The design of the three advanced treatment technologies, i.e., Advanced Biological, Physical-Chemical and the Land Treatment System are based on a level of information consistent with today's state of the art. Sufficient scientific knowledge together with engineering and performance data are available to make this type of study a meaningful planning framework.

The basic feasibility of these technologies have been demonstrated, but, as yet, there are no universally accepted design criteria for the unit processes of the treatment systems. Consequently, in developing the design of these treatment systems, a great deal of reliance had to be placed on theory now being applied at the "drawing board" or obtained from pilot plant and resource studies. In many cases, this was supplemented by actual information on specific unit processes recently placed in service. However, certain basic assumptions had to be made. The most important relate to the unit process concept and the design criteria for rated treatment performance under peak loads. Critical to both these aspects are the sequential order in which the treatment components are placed and the reliability for maintaining a fixed level of treatment effectiveness.

Implicit in these assumptions are some technical uncertainties that must be resolved prior to final design and implementation. These uncertainties primarily relate to the large scale operations and management problems associated with monitoring and controlling the treatment process. In essence, these uncertainties are similar in nature to engineering issues that have arisen in the past as other new technological objectives were being faced. Present experience with advance treatment operations has been limited to small scale facilities. Currently, many medium-sized facilities are being designed and constructed, based upon extrapolations of experience. Little work, though, is being done to investigate the potential of large scale operations and the adoption of new unit processes to minimize costs. However, as the environmental clean-up continues on a national scale, these uncertainties will be resolved as a matter of priority. Nevertheless, until these new facilities and pilot programs demonstrating the efficiencies and effectiveness of the different unit processes become operational, certain questions concerning performance characteristics will remain.

There are many examples of concern that must be resolved before final design of the three technologies is undertaken. For example, the biological process for ammonial removal is subject to being upset by toxics, hydraulic surges and temperature variants. On the other hand, the physical-chemical process for ammonia nitrogen removal is still subject to technical problems and if some form of "stripping" is used, the resultant nitrogen oxide becomes a serious air pollutant. The best method for phosphorus removal is

also a subject of technical debate and centers over whether to use lime or metallic salts. Again, insufficient experience clouds the issue. Correlary to this issue is the concern regarding the use of chemicals and the inherent potential for increasing the total dissolved solids concentration level of the effluent. In a similar manner, there are questions regarding the land treatment system. One concern is the long-range impact that heavy metals and other constituents held in the soil may have in relation to maintaining a positive soil environment in order to avoid undesirable uptake by the cover crop. Another concern is the limit on the application rate that can be utilized during the growing season, contrary to what the hydraulic, unit process theories indicate. Still other areas of technology which require added consideration include:

1. Ultimate disposal of inorganic solids and concentrated brines in an environmentally sound and economic fashion.

2. The ability of conventional and advance waste treatment plant processes to remove trace amounts of heavy metals.

3. The effects of a build-up of refractory materials in the closed cycle systems of the plant processes.

4. The characteristics of organic materials not absorbed by the activated carbon treatment process.

5. A detailed evaluation of varieties of crops and hybrids for use with the land treatment system and confirmation of yields that can be achieved by different crops and farm tillage systems.

The foregoing items are offered to help identify the areas of design and performance that should be investigated. Thus, the universities, private consulting firms and the States will be able to use this information as the basis for pilot model studies within their own field of expertise. Hopefully, these studies can be joint investigative efforts sponsored by those governmental agencies authorized to conduct research and development programs.

Recognizing that time will be required to resolve these uncertainties, implementation of the alternatives has been phased to accommodate undertaking pilot studies, should the need still exist. Construction of the pilot models would be included in the first phase of implementation. This phase involves construction of the functional components that are basic to any system regardless of the technology eventually chosen. It is during this time that the research and development required in conjunction with the selected technology can be undertaken. Once completed, the information and data will be available for the final design of the treatment facilities required in the latter phase of implementation. The results would also have an educational value in demonstrating that the selected technology will (1) meet the desired goals; and (2) not effect the area's environment, life-style and economic structure in ways not previously assessed.

SECTION XII - IMPACT SUMMARY

Based on the previous comparative evaluations of the five alternatives, it is obvious that the implications differ in many ways. Not only do the impacts vary in character and magnitude but also in the degree of impact imposed on other geographical areas and socio-political levels.

For instance the new national policy set forth in Public Law 92-500 indicates that the Federal Government and hence, the Federal taxpayer will finance up to 75 percent of the capital cost of the plan. This assumes that the plan is responsive to area wide management concerns and has been approved by the public and certified by both the regional clearinghouse, the State and the USEPA. On the other hand, all operation and maintenance costs are considered to be totally local in nature and responsibility. Consequently, there is an implied impact on the taxpayer not only in the study area but also throughout the rest of the State and nation.

Similarly from a land use standpoint, the residents in the outlying area of influence would forego much if the all land system, Alternative IV is implemented. At the same time, the same residents as well as the States have the potential for gain if the sludge option for surface mine reclamation is ever implemented, assuming the technology selected permits this.

Therefore, recognizing the complexity involved in listing the various impacts, a summary table has been prepared for each of the five alternatives. Each of the Tables G-XII-1 through G-XII-5, display the impacts in terms of various parameters including ecological, resource requirements, water and land use changes, land values, revenues, employment, institutional, costs and changes in public perception. Furthermore, each table is divided into parts with the impacts cited relative to each of the various groups who are effected by the plans - residents of the Study Area, Outlying Area, the Remaining Portions of the Two States and the Relevant Portions of the Upper-Mississippi River and Great Lakes Regions- and the Rest of the Nation as well as International.

TABLE G-XII-1

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

(64 Conventional Biological Treatment Plant Plan)

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	OWNERS OF SYSTEM REQUIRED LANDS RESIDENTS
I. ECOLOGICAL					
*Water Quality Output (mg/liter)					
BOD - 20					
Phosphorus:					
Ill. R. - 5					
L. Mich. - 1					
Nitrogen - 17					
Suspended Solids - 25					
Total Dissolved Solids - 600					
* Variable, subject to dilution flows.					
1. Water Quality	Produces measurable increase in dissolved oxygen. No reduction in phosphorus content from municipal and industrial sources for streams tributary to the Illinois River. For flows tributary to Lake Michigan, phosphorus content reduced to 90 percent. Intermittant degradation will be effected by untreated storm water runoff.				
2. Air Quality	*Plan would facilitate future efforts to attain* desired ambient levels.				Aerosols will be present but should not constitute a hazard.
3. Aquatic Life: (a) Fishery	Provides an enhanced ecosystem for increased production of desireble species.				
(b) Other Biota	Plant consolidation without redistribution of treated water will adversely effect the ecosystem of small streams in dry periods and cause a reduction in flowing water biotic (aquatic organisms) communities.				
4. Terrestrial Attributes (Wildlife)	Limited increase in birds and other animals which feed on aquatic organims inhabiting the improved water courses.				
II. RESOURCE REQUIREMENTS a/					
1. Electrical (Megawatt Hours/Day)	*Power needs range from some 3,200 (1990) to 3,600 (2020).* The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.				
2. Natural Gas (Million Cubic Feet/Day)	--	--	--		Produce no net fuel needs. Sufficient synthetic gas generated in process to meet treatment needs.
3. Chemicals (Tons/Day)	--	--	--		Chemical needs for treatment range from 44 (1990) to 51 (2020).
III. WATER AND LAND USE CHANGES					
Water Use:					
1. Water Supply	This plan could not meet the area's water supply requirements over the next 50 years nor eliminate current depletion of ground water table in western portion of Illinois area.				
2. Water Damages	Provides some degree of flood control only in those areas served by combined storm water and sewage sewer systems			--	--
3. In-Stream Recreation	Provides limited increase in water-based recreation and use potential on those streams with improved flows.			--	--
4. Commercial Navigation	Provides potential for deficiency in flows necessary to sustain projected waterborne traffic.			--	--
Land Use:					
1. Changed Land Uses:					
a. Fee Purchase b/	--	--	--		Some 1,500 acres required for treatment and storm water management systems.
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--
2. Intensified Land Use:					
a. Irrigation Facilities Contractual	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1- Contractual)	--	--	--	--	--
3. Recreation & Open-Space	Provides limited increase in water based recreation and use potential on those streams with improved flows.			--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	OWNERS OF SYSTEM REQUIRED LANDS RESIDENTS
IV. LAND VALUES a/					
1. Potential Unrecovered Losses c/	Minor losses From property tax rolls for purchased lands.	--	--	Anything in addition to reimbursement for either income protection (leased lands) or the full market value of lands and relocation assistance inherent in the potential displacement of some 3,400 people.	
2. Potential Unpaid for Gains	Tax revenue gain and increase in property values.	Enhanced property values along streams of improved quality.	Provides additional land for other uses due to abandonment of existing treatment plants.	--	--
V. REVENUES FROM RECYCLING & REUSE a/					
1. Agriculture	--	--	--	--	--
2. Industrial Manufacturing	--	--	Industries experience net increase in wastewater treatment cost.	--	--
3. Power Plants	--	--	--	--	--
VI. EMPLOYMENT a/	Potential employment ranges from some 2,610 persons in 1990 to 3,040 persons in 2020 to operate and maintain municipal treatment plants and related works.				
VII. INSTITUTIONAL a/	Represents current planning goals for regionalization. Coordination throughout the study area would be necessary and would involve adoption of contractual and/or consolidation arrangements. Sludge management program would also necessitate cooperative arrangements with the outlying area of influence.				
VIII. COST OF PLAN ($ MILLION) a/ d/					
1. Capital Costs (present worth)	$670				
2. Capital Costs (average annual)	$ 39				
3. Operation, Maintenance & Replacement Costs (average annual)	$ 45				
4. Total Average Annual Costs	$ 84				
5. Industrial Pretreatment Costs (average annual) e/			Ranges from 62.1 (1972) to 142.0 (1990).		
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Decrease in disposable income caused by sewer patterns.	Enhancement of property values and recreational potential on major streams only. Inconvenience during construction and some disruption to community cohesion and growth patterns.		Anxiety from interest acquisition proceedings.	

NOTES:

a/ Applies to the agricultural utilization of sludge.

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level which would be incurred by industry to meet current State standards or guidelines. These costs are not included in the plan's cost estimate. While present expenditures levels may exceed the cited costs, the additional capital investments required would be offset by savings in operating costs.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS			INDIANA		
	OWNERS OF SYSTEM REQUIRED LANDS				OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS	OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	FARMERS	RESIDENTS
I. ECOLOGICAL						
1. Water Quality	--	--	--	--	--	--
2. Air Quality	--	--	--	--	--	--
3. Aquatic Life:						
(a) Fishery	--	--	--	--	--	--
(b) Other Biota	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/						
1. Electrical (Megawatt Hours/Day)	The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	--	--	--
3. Chemicals (Tons/Day)	--	--	--	--	--	--
III. WATER & LAND USE CHANGES						
Water Use:						
1. Water Supply	--	--	--	--	--	--
2. Water Damages	--	--	--	--	--	--
3. In-Stream Recreation	--	--	--	--	--	--
4. Commercial Navigation	--	--	--	--	--	--
Land Use:						
1. Changed Land Uses:						
a. Fee Purchase b/	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--	--
2. Intensified Land Use:						
a. Irrigation Facilities (Contractual)	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1- Contractual)	Phased leasing of acreage from 47,300 in 1990 to 57,000 in 2020.	--	Imposes need for local counties to incorporate long-term agricultural commitments in land-use plans.		Phased leasing of acreage from 9,700 in 1990 to 10,100 in 2020.	--
3. Recreation & Open-Space	--	--	--	--	--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS				INDIANA	
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
IV. LAND VALUES a/						
1. Potential Unrecovered Losses c/	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.		--	--	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.	
2. Potential Unpaid for Gains	--	--	Potential for increase in land values and economic base due to reclamation of surface mines owned by system.		--	--
V. REVENUES FROM RECYCLING & REUSE a/						
1. Agriculture	Potential for net income gain from nutrient recycle in lieu of commercial fertilizer.		Potential for reduction in demand for commercial agri-fertilizer.		Potential for net income gain from nutrient recycle in lieu of commercial fertilizer.	
2. Industrial Manufacturing	--	--	--	--	--	--
3. Power Plants	--	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for employment ranging from some 260 persons in 1990 to 280 persons in 2020 to operate and maintain the sludge management program.			Potential for employment relatively constant, requiring some 60 persons in both 1990 and 2020 to operate and maintain sludge management program.		
VII. INSTITUTIONAL a/	Cooperative arrangements and coordination of sludge utilization sites required in order to insure compliance with Counties' land-use plans.					
VIII. COST OF PLAN ($ MILLION) a/ d/						
1. Capital Costs (present worth)						
2. Capital Costs (average annual)						
3. Operation, Maintenance & Replacement Cost (average annual)						
4. Total Average Annual Costs						
5. Industrial Pretreatment Costs (average annual) e/						
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					

NOTES:

a/ Applies to the agricultural utilization of sludge.

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level which would be incurred by industry to meet current State standards or guidelines. These costs are not included in the plan's cost estimate. While present expenditures levels may exceed the cited costs, the additional capital investments required would be offset by savings in operating costs.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
I. ECOLOGICAL							
1. Water Quality	Meets the current effluent and water quality guidelines for Illinois and Indiana, respectively.		Minor response to level A, Water Resource Council's Comprehensive Basin Studies (MRCCBS) inventoried needs.	Does not meet the 1985 goal of PL 92-500 and only partially achieves 1983 goal.			--
2. Air Quality	Plan would be consistent with current programs for air emission control in both States.		--	Plan consistent with current Federal Air Quality Act Requirements.			--
3. Aquatic Life:							
(a) Fishery	--	--	--	--	Partially fulfills the goals of relevant conservation groups.	--	--
(b) Other Biota	--	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/							
1. Electrical (Megawatt Hours/Day)	Increases the demand for power supply areas 14 & 40 by 2,630 (1990) and 3,960 (2020).	Increases the demand for power supply area 12 by 540 (1990) and 550 (2020).	Imposes need for decision concerning type of fuel (nuclear/fossil) to be used and siting of new power plants.	Requires expansion of Nation's power base. Imposes need for review of policies regarding extent to which this and other competitive power needs will be met.		--	--
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	--	--	--	--
3. Chemicals (Tons/Day)	Increased demand for treatment chemicals will not effect current production markets.			--	--	--	--
III. WATER AND LAND USE CHANGES							
Water Use:							
1. Water Supply	Imposes potnetial need to either reallocate Lake Michigan withdrawals or seek additional supplies.	--	This plan would not contribute to the MRCCBS inventoried need for the study area thereby necessitating the expenditure of an additional capital investment.	--	--	Supreme Court Approval and U.S.- Canada agreement may be required if capture, treatment and reuse of storm water runoff is not necessary before Illinois can obtain an increase in the withdrawal allocation from Lake Michigan.	
2. Water Damages	--	--	Provides a limited response to the inventoried need for flood control in the study area.	May require additional expenditure of capital investment to meet study area needs.	--	--	--
3. In-Stream Recreation	Provides limited potential for meeting State and MRCCBS inventoried deficiencies in water-based recreation.			May require additional expenditure of capital investment to meet study area needs.	--	--	--
4. Commercial Navigation	--	--	Provides potential for additional investment if reallocation of water supplies changes the water regimen in the Upper Illinois Waterway system.	May require additional expenditure of capital investment to meet study area needs.	--	--	--
Land Use :							
1. Changed Land Uses:							
a. Fee Purchase b/	--	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--	--	--
2. Intensified Land Use:							
a. Irrigation Facilities (Contractual)	--	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Potential for retaining more land in agricultural production than might ordinarily be experienced over time.			--	--	--	--
3. Recreation & Open Space	--	--	Plan would not contribute to the MRCCBS inventoried need for the study area thereby necessitating the expenditure of an additional capital investment.	May require additional expenditure of capital investment to meet study area needs.	--	--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE I

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
IV. LAND VALUES a/							
1. Potential Unrecovered Losses c/	--	--	--	--	--	--	--
2. Potential Unpaid for Gains	--	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/							
1. Agriculture	--	--	--	Economic impact of retaining the level of acreage required by this plan in agricultural production could be classified as either beneficial or adverse depending upon the forecast of commodity markets.			
2. Industrial Manufacturing	Potential for incorporating sludge disposal with the recycling of solid wastes and generate synthetic fuel and other recoverable by products.			--	--	Potential for increase in unit price of manufactured items.	--
3. Power Plants	--	--	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for State assistance in job relocation and labor training programs.		--	Increases need for labor training programs.	--	--	--
VII. INSTITUTIONAL a/	Imposes need to coordinate inter-county transfer of sludge. Enabling legislation necessary to modify present institutional and financial constraints.		--	//. . . . Does not meet the intent of PL 92-500. . . . . //			--
VIII. COST OF PLAN ($ MILLION) a/ d/							
1. Capital Costs (present worth)				$2,010		$2,680	
2. Capital Costs (average annual)				$ 118		$ 157	
3. Operation, Maintenance & Replacement Costs (average annual)				--		$ 45	
4. Total Average Annual Costs				$ 118		$ 202	
5. Industrial Pretreatment Costs (average annual) e/							
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Contributes to the States efforts to meet current water quality goals.		--	//. . . . Does not meet the intent of PL 92-500. . . . . //			

NOTES:

a/ Applies to the agricultural utilization of sludge.

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level which would be incurred by industry to meet current State standards or guidelines. These costs are not included in the plan's cost estimate. While present expenditures levels may exceed the cited costs, the additional capital investments required would be offset by savings in operating costs.

TABLE G-XII-2

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

(33 Physical-Chemical Treatment Plant Plan)

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	OWNERS OF SYSTEM REQUIRED LANDS RESIDENTS
I. ECOLOGICAL					
Water Quality Output (mg/liter)					
BOD 3					
Phosphorus 0.1 - 0.2					
Nitrogen 2.5					
Suspended Solids 1					
Total Dissolved Solids 535					
1. Water Quality	Produces measurable increase in dissolved oxygen. Reduces phosphorus and nitrogen discharges from municipal and industrial sources and the first 2.5 - 2.85 inches of storm water runoff by 99 and 97 percent, respectively - - thereby reducing potential for algal blooms.				
2. Air Quality	Emits some 552 to 667 tons of chemicals and particulates daily for 1990 and 2020, respectively. Discharges are within acceptable USEPA air emission standards except for nitrogen oxides, which has potential for being an infrequent source of irritants.				
3. Aquatic Life:					
(a) Fishery	Provides an enhanced ecosystem for increased production of desirable species.				
(b) Other Biota	// . . . Increases the standing water biotic (aquatic organisms) communities. . . . //				
4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organisms inhabiting the improved watercourses and standing water impoundments.				
II. RESOURCE REQUIREMENTS a/					
1. Electrical (Megawatt Hours/Day)	Power needs range from some 10,300 (1990) to 12,300 (2020). The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.				
2. Natural Gas (Million Cubic Feet/Day)	Fuel needs range from 156 (1990) to 169 (2020). Commitment could curtail efforts to supply other competitive needs with higher use priorities. Increased demand would probably increase consumer rates.				
3. Chemicals (Tons/Day)	--	--	--	Chemical needs for treatment range from 4,160 (1990) to 5,030 (2020).	
III. WATER & LAND USE CHANGES					
Water Use:					
1. Water Supply	This plan would meet the area's water supply requirements over the next 50-years and eliminate the current depletion of ground water table in the western portion of the Illinois area.				
2. Water Damages	Provides significant reduction of overflow on some 69,900 flood plain acres.			--	--
3. In-Stream Recreation	Provides enhanced potential for water-based recreational opportunities. Imposes need for decisions regulating flow distribution and stream usage.			--	--
4. Commercial Navigation	Redistribution of flows and lock passage sufficient to sustain projected water-borne traffic.			--	--
Land Use:					
1. Changed Land Uses:					
a. Fee Purchase b/	--	--	--	63,900 acres acquired for the treatment and storm water management systems.	
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--
2. Intensified Land Use:					
a. Irrigation Facilities Contractual	Provides basis to control growth patterns and maintain balance between intensive area developments and open-space usage.			Phased leasing of acreage decreases with changed land use from 116,300 in 1990 to 87,100 in 2020.	
b. Agricultural Sludge Utilization (Sludge Option #1- Contractual)	--	--	--	--	--
3. Recreation & Open-Space	Provides potential for development of recreational and environmental corridors along some 500-miles, or more, of stream. Additional potential is provided by the rural and suburban storm water impoundments, and by treatment plants with sufficient capacity to maintain through flows for selective fishery impoundments.				

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS
IV. LAND VALUES a/					
1. Potential Unrecovered Losses c/	Minor losses from property tax rolls for purchased lands.	--	--	Anything in addition to reimbursement for either income protection (leased lands) or the full market value of lands and relocation assistance inherent in the potential displacement of some 18,800 people.	
2. Potential Unpaid for Gains	Tax revenue gain and increase in property values.	Enhanced property values along streams of improved quality.	Provides additional land for other uses due to abandonment of existing treatment plants.	Potential increase in crop production. Capital improvements to land (drainage and irrigation systems) for rural storm water program.	
V. REVENUES FROM RECYCLING & REUSE a/					
1. Agriculture	--	--	--	Treatment of rural runoff may stimulate agricultural production.	
2. Industrial Manufacturing	--	--	Industries experience net increase in wastewater treatment cost.	Sufficient quality in treated water to meet most industrial process needs.	
3. Power Plants	--	--	--	--	--
VI. EMPLOYMENT a/	Potential employment ranges from some 9,610 persons in 1990 to 10,670 persons in 2020 to operate and maintain highly technical municipal and storm water treatment plants and related works.				
VII. INSTITUTIONAL a/	Exceeds current planning goals for regionalization. Coordination throughout the study area would be necessary and involve adoption of contractual and/or consolidation arrangements. Treatment of a portion of the wastewater and the sludge management program would necessitate cooperative arrangements with the outlying area of influence.				
VIII. COST OF PLAN ($ MILLION) a/ d/					
1. Capital Costs (present worth)	$1,852				
2. Capital Costs (average annual)	$ 109				
3. Operation, Maintenance & Replacement Costs (average annual)	$ 308				
4. Total Average Annual Costs	$ 417				
5. Industrial Pretreatment Costs (average annual) e/			Ranges from $50.0 (1972) to $103.0 (1990).		
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Decrease in disposable income caused by increased sewer charges.	Enhancement of property values and potential for increase in total recreational opportunities.	Inconvenience during construction and some disruption to community cohesion and growth patterns. Anxiety from the effects of air pollution.	Anxiety from leasing and interest acquisition proceedings.	

NOTES:

a/ Applies to agricultural utilization of sludge (Option #1) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,100 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NPDP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS			INDIANA		
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
I. ECOLOGICAL						
1. Water Quality	--	--	--	--	--	--
2. Air Quality	--	--	--	--	--	--
3. Aquatic Life:						
(a) Fishery	--	--	--	--	--	--
(b) Other Biota	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/						
1. Electrical (Megawatt Hours/Day)	The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	--	--	--
3. Chemicals (Tons/Day)	--	--	--	--	--	--
III. WATER & LAND USE CHANGES						
Water Use:						
1. Water Supply	--	--	--	--	--	--
2. Water Dumayes	--	--	--	--	--	--
3. *In-Stream Recreation*	--	--	--	--	--	--
4. Commercial Navigation	--	--	--	--	--	--
Land Use:						
1. Changed Land Uses:						
a. Fee Purchase b/	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--	--
2. Intensified Land Use:						
a. Irrigation Facilities (Contractual)	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1- Contractual)	Phased leasing of acreage from 551,700 in 1990 to 652,600 in 2020.	--	Imposes need for local counties to incorporate long-term agricultural commitments in land-use plans.		Phased leasing of acreage from 97,300 in 1990 to 115,200 in 2020.	--
3. Recreation & Open-Space	--	--	--	--	--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS				INDIANA	
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
IV. LAND VALUES a/						
1. Potential Unrecovered Losses c/	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.		--	--	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.	
2. Potential Unpaid for Gains	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/						
1. Agriculture	Agricultural use of sludge may stimulate crop production.		--	--	Agricultural use of sludge may stimulate crop production.	
2. Industrial Manufacturing	--	--	--	--	--	--
3. Power Plants	--	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for employment ranging from some 1,310 persons in 1990 to 1,570 persons in 2020 to operate and maintain the sludge management program.			Potential for employment ranging from some 250 persons in 1990 to 270 persons in 2020 to operate and maintain the sludge management program.		
VII. INSTITUTIONAL a/	Cooperative arrangements and coordination of sludge utilization sites required in order to insure compliance with Counties' land-use plans.					
VIII. COST OF PLAN ($ MILLION) a/ d/						
1. Capital Costs (present worth)						
2. Capital Costs (average annual)						
3. Operation, Maintenance & Replacement Cost (average annual)						
4. Total Average Annual Costs						
5. Industrial Pretreatment Costs (average annual) e/						
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Anxiety from leasing arrangements and the effects that sludge utilization program would have on land use and future growth patterns.					

NOTES:

a/ Applies to agicultural utilization of sludge (Option #1) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50-years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NDCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
I. ECOLOGICAL							
1. Water Quality	Exceeds States' current effluent and water quality guidelines. This plan would contribute its proportional share of the States' efforts for meeting PL 92-500 goals.		Enhanced flow regimen contributes to potential for meeting this and other related needs inventoried by the Water Resources Council's Comprehensive Basin Studies (NRCCBS).	Meets intent and time-phased goals of PL 92-500.			--
2. Air Quality	Plan would be consistent with current programs for air emission control in in both States, except for nitrogen oxide levels.		--	Plan consistent with current Federal Air Quality Act requirements, except for nitrogen oxide levels.			--
3. Aquatic Life:							
(a) Fishery	Contributes to States' program for improving stream production of sport fishery.		Contributes to meeting a portion of the deficiency in fishing opportunities in the study area.	--	Fulfills goals of relevant conservation groups.	--	--
(b) Other Biota	--	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/							
1. Electrical (Megawatt Hours/Day)	Increases demand for Power Supply Areas 11 & 40 by 8,670 (1990) and 10,560 (2020).	Increases demand for Power Supply Area 12 by 1,660 (1990) and 1,740 (2020).	Imposes need for decision concerning type of fuel (nuclear/fossil) to be used and siting of new power plants.	Requires expansion of nation's power base. Imposes need for review of policies regarding extent to which this and other competitive power needs will be met.			--
2. Natural Gas (Million Cubic Feet/Day)	Potential reduction in available supplies could impose decision to use alternative fuels, thereby increasing costs for air emission controls. Fuel consumption may effect growth patterns, existing contractual arrangements and commodity movements.			Requires expansion of Nation's fuel base. Imposes need for review of policies regarding priority of natural gas and other alternative fuels for boiler (incineration) fuel use.			Import of this or other alternative fuels may be required.
3. Chemicals (Tons/Day)	Increased demand for treatment chemicals will impose added power needs for manufacturing and contribute to a higher resource consumptive rate and possible unit price of chemicals.			--	--	Potential increase in unit prices of mined or manufactured chemicals.	--
III. WATER AND LAND USE CHANGES							
Water Use:							
1. Water Supply	Imposes need for reallocation of Lake Michigan withdrawals and assesment of cost-sharing arrangements.	--	Precludes additional investment to meet NRCCBS inventoried needs for the study area.	--	--	Supreme Court approval and U.S. - Canada agreement may be required for increased withdrawals from Lake Michigan if IIIs. content in Reuse Option #1 proves to be a problem.	
2. Water Damages	Storm water runoff control requires coordination of flood plain management studies and possible supplemental funding.		May preclude additional investment to meet NRCCBS inventoried needs for the study area.	Multiple-purpose design provides potential savings in Federal related programs.	--	--	--
3. In-Stream Recreation	Contributes to potential for meeting States and NRCCBS inventoried needs for water-based recreation.			--	--	--	--
4. Commercial Navigation	--	--	Defer long-term need for investment if reallocation of water supplies in study area changes flow regimen in Upper Illinois Waterway System.	Multiple-purpose design provides potential savings in Federal related programs.	--	--	--
Land Use:							
1. Changed Land Uses:							
a. Fee Purchase b/	--	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--	--	--
2. Intensified Land Use:							
a. Irrigation Facilities (Contractual)	--	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Potential for retaining more land in agricultural production than might ordinarily be experienced over time.			--	--	--	--
3. Recreation and Open Space	--	--	Increases potential for meeting a portion of inventoried recreational deficiency in the study area by reducing the required financial investment.	Imposes potential for additional financial investment to meet needs.	--	--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE II

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES			REST OF NATION			
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGION	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
IV. LAND VALUES a/							
1. Potential Unrecovered Losses c/	--	--	--	--	--	--	--
2. Potential Unpaid for Gains	--	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/							
1. Agriculture	--	--	--	Economic impact of retaining the level of acreage required by this plan in agricultural production could be classified as either beneficial or adverse depending upon forecast of commodity markets.			--
2. Industrial Manufacturing	--	--	--	--	--	Potential for increase in unit prices of manufactured items.	--
3. Power Plants	--	--	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for State assistance job relocation and labor training programs.		--	Increases need for labor training programs.	--	--	--
VII. INSTITUTIONAL a/	Imposes need to coordinate intercounty transfer of sludge. Enabling legislation necessary to modify present institutional and financial constraints.		--	//. . . . . Meets the intent of PL 92-500. . . . . //			
VIII. COST OF PLAN ($ MILLION) a/ d/							
1. Capital Costs (present worth)				$5,555		$7,407	
2. Capital Costs (average annual)				$ 338		$ 432	
3. Operation, Maintenance & Replacement Costs (average annual)				--		$ 308	
4. Total Average Annual Costs				$ 328		$ 745	
5. Industrial Pretreatment Costs (average annual) e/							
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Contributes to the States' efforts to meet water quality goals.		Responsive to and increases potential for concurrently meeting an array of water and related land needs.	//. . . . . Meets the intent of PL 92-500. . . . . //			

NOTES:

a/ Applies to agricultural utilization of sludge (Option #1) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,100 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased land; and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs *and that the study area* taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs, provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NSCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

TABLE G-XII-3

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

(17 Advanced Biological Treatment Plant Plan)

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN		STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	RESIDENTS
I. ECOLOGICAL						
Water Quality Output (mg/liter)	1. Water Quality	Produces measurable increase in dissolved oxygen. Reduces phosphorus and nitrogen discharges from municipal and industrial sources and the first 2.5 - 2.85 inches of storm water runoff by 99 and 97 percent, respectively - - thereby reducing potential for algal blooms.				
BOD 3						
Phosphorus 0.1-0.2						
Nitrogen 2-5	2. Air Quality	Emits some 10 to 11 tons of chemicals and particulates daily for 1990 and 2020, respectively. Discharges are within acceptable USEPA air emission standards.				
Suspended Solids 1						
Total Dissolved Solids 500	3. Aquatic Life: (a) Fishery	Provides an enhanced ecosystem for increased production of desirable species.				
	(b) Other Biota	Increases the standing water biotic (aquatic organisms) communities.				
	4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organims inhabiting the improved watercourses and standing water impoundments.				
II. RESOURCE REQUIREMENTS a/						
	1. Electrical (Megawatt Hours/Day)	Power needs range from some 11,600 (1990) to 13,900 (2020). The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.				
	2. Natural Gas (Million Cubic Feet/Day)	Fuel needs range from 85 (1990) to 102 (2020). Commitment could curtail efforts to supply other competitive needs with higher use priorities. Increased demand would probably increase consummer rates.				
	3. Chemicals (Tons/Day)	--	--	--	--	Chemical needs for treatment range from 2,700 (1990) to 3,270 (2020).
III. WATER & LAND USE CHANGES						
Water Use:	1. Water Supply	This plan would meet the area's water supply requirements over the next 50 years and eliminate the current depletion of ground water table in the western portion of the Illinois area.				
	2. Water Damages	Provides significant reduction of overflow on some 69,900 flood plain acres.			--	--
	3. In-Stream Recreation	Provides enhanced potential for water-based recreational opportunities. Imposes need for decisions regulating flow distribution and stream usage.			--	--
	4. Commercial Navigation	Redistribution of flows and lock passage sufficient to sustain projected water-borne traffic.			--	--
Land Use:						
1. Changed Land Uses:						
	a. Fee Purchase b/	--	--	--	--	66,700 acres acquired for the the treatment and storm water management systems.
	b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--
2. Intensified Land Use:						
	a. Irrigation Facilities (Contractual)	Provides basis to control growth patterns and maintain balance between intensive area developments and open-space usage.				Phased leasing of acreage decreases with changed land use from 116,300 in 1990 to 87,100 in 2020.
	b. Agricultural Sludge Utilization (Sludge Option #1 Contractual)	--	--	--	--	--
	3. Recreation & Open-Space	Provides potential for development of recreational and environmental corridors along some 500-miles, or more, of stream. Additional potential is provided by the rural and suburban storm water impoundments, and by treatment plants with sufficient capacity to maintain through flows for selective fishery impoundments.				

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS
IV. LAND VALUES a/					
1. Potential Unrecovered Losses c/	Minor losses from property tax rolls for purchased lands.	--	--	*Anything in addition to* reimbursement for either income protection (leased lands) or the full market value of lands and relocation assistance inherent in the potential displacement of some 29,600 people.	
2. Potential Unpaid-for Gains	Tax revenue gain and increase in property value.	Enhanced property value along streams of improved quality.	Provided additional land for other uses due to abandonment of existing treatment plants.	Potential increase in crop production. Capital improvements to land (drainage & irrigation systems) for rural storm *water program.*	
V. REVENUES FROM RECYCLING & REUSE a/					
1. Agriculture	--	--	--	Treatment of rural runoff may stimulate agricultural production.	
2. Industrial Manufacturing	--	--	Industries experience increase in wastewater treatment costs.	Sufficient quality in treated water to meet most industrial process needs.	
3. Power Plants	--	--	--	--	--
VI. EMPLOYMENT a/	Potential employment ranging from some 11,130 persons in 1990 to 12,510 persons in 2020 to operate and maintain highly technical municipal and storm water treatment plants and related works.				
VII. INSTITUTIONAL a/	Exceeds current planning goals for regionalization. Coordination throughout the study area would be necessary and would involve adoption of contractual and/or consolidation arrangements. Sludge management program would also necessitate cooperative arrangements with outlying area of influence.				
VIII. COST OF PLAN ($MILLION) a/d/					
1. Capital Costs (Present Worth)	$1,993				
2. Capital Costs (Average Annual)	$118				
3. Operation, Maintenance & Replacement Costs (Average Annual)	$304				
4. Total Average Annual Costs	$422				
5. Industrial Pretreatment Costs (Average Annual) e/			Ranges from $50.0 (1972) to $103.7 (1990)		
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Decrease in disposable income caused by increase in sewer charges.	Enhancement of property values and potential for increase in total recreational opportunities. Inconvenience during construction and some disruption to community cohesion and growth patterns.		Anxiety from leasing and interest acquisition proceedings.	

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines and Water Reuse Option #1 (2068 MGD (3200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayer will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by the designated regional clearinghouses and the States and approved for funding under the construction grant program of the USEPA. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than that required if industry would totally pretreat its waste load on site to NECP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

IMPACTS OR CHANGES PRODUCED BY PLAN	OUTLYING AREA OF INFLUENCE					
	ILLINOIS				INDIANA	
	OWNERS OF SYSTEM REQUIRED LANDS				OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS	OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	FARMERS	RESIDENTS
I. ECOLOGICAL						
1. Water Quality	--	--	--	--	--	--
2. Air Quality	--	--	--	--	--	--
3. Aquatic Life: (a) Fishery	--	--	--	--	--	--
(b) Other Biota	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/						
1. Electrical (Megawatt Hours/Day)	The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	--	--	--
3. Chemicals (Tons/Day)	--	--	--	--	--	--
III. WATER & LAND USE CHANGES						
Water Use:						
1. Water Supply	--	--	--	--	--	--
2. Water Damages	--	--	--	--	--	--
3. In-Stream Recreation	--	--	--	--	--	--
4. Commercial Navigation	--	--	--	--	--	--
Land Use:						
1. Changed Land Uses:						
a. Fee Purchase b/	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	Increases use potential of 42,500 acres by 2020.	Increases use potential of 8,700 acres by 2020.	--	--
2. Intensified Land Use:						
a. Irrigation Facilities (Contractual)	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Phased leasing of acreage ranging from 47,300 (1990) to 57,000 (2020).		Imposes need for local counties to incorporate long-term agricultural commitments in land-use plans.		Phased leasing of acreage ranging from 9,700 (1990) to 10,100 (2020).	
3. Recreation & Open-Space	--	--	--	--	--	--

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

IMPACTS OR CHANGES PRODUCED BY PLAN	OUTLYING AREA OF INFLUENCE: ILLINOIS — OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS	ILLINOIS: OTHER CONCERNED GROUPS	INDIANA: OTHER CONCERNED GROUPS	INDIANA — OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS
IV. LAND VALUES a/						
1. Potential Unrecovered Losses c/	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.		--	--	Anything in addition to reimbursement for both income protection and long-term capital gains (alternative uses) for leased lands.	
2. Potential Unpaid for Gains		--	Potential for increase in land values and economic base due to reclamation of surface mines.		--	--
V. REVENUES FROM RECYCLING & REUSE a/						
1. Agriculture	Potential for net income gain from nutrient recycle in lieu of commercial fertilizer.		Potential for reduction in demand for commercial agri-fertilizer.		Potential for net income gain from nutrient recycle in lieu of commercial fertilizer.	
2. Industrial Manufacturing	--	--	--	--	--	--
3. Power Plants	--	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for employment ranging from some 380 persons in 1990 to 410 persons in 2020 to operate and maintain the sludge management program.			Potential for employment ranging from some 70 persons in 1990 to 80 persons in 2020 to operate and maintain the sludge management program.		
VII. INSTITUTIONAL a/	Cooperative arrangements and coordination of sludge utilization sites required in order to insure compliance with Counties' land-use plans.					
VIII. COST OF PLAN ($ MILLION) a/ d/						
1. Capital Costs (present worth)						
2. Capital Costs (average annual)						
3. Operation, Maintenance & Replacement Cost (average annual)						
4. Total Average Annual Costs						
5. Industrial Pretreatment Costs (average annual) e/						
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Anxiety from leasing arrangements and the effects that sludge utilization program would have on land use and future growth patterns.					

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the *Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970*.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50-years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NRCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES			REST OF NATION			
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
I. ECOLOGICAL							
1. Water Quality	Exceeds States' current effluent & water quality guidelines. This plan would contribute its proportional share of the states efforts for meeting PL92-500 goals.		Enhanced flow regimen contributes to potential for meeting this and other water-related needs inventoried by the Water Resources Council's *Comprehensive Basin Studies* (WRCCBS).	Meets intent and time-phased goals of PL92-500.			--
2. Air Quality	Plan consistent with current programs for air emission control in both States.		--	Consistent with current Federal Air Quality Act requirements.			
3. Aquatic Life: (a) Fishery	Contributes to States' programs for improving stream production of sport fishery.		Contributes to meeting a portion of the deficiency in fishing opportunities in the study area.	--	Fulfills goals of relevant conservation groups.	--	--
(b) Other Biota	--	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	--	--	--	--	--
II. RESOURCE REQUIREMENTS a/							
1. Electrical (Megawatt Hours/Day)	Increases demand for Power Supply Areas 14 & 40 by 9,770 (1990) and 11,900 (2020).	Increases demand for Power Supply Area 12 by 1,870 (1990) and 2,000 (2020).	Imposes need for decisions concerning type of fuel (nuclear/fossil) to be used and siting of new power plants.	Requires expansion of nation's power base. Imposes need for review of policies regarding extent to which this and other competitive power needs will be met.			--
2. Natural Gas (Million Cubic Feet/Day)	Potential reduction in available supplies could impose decision to use alternative fuels thereby increasing costs for air emission controls. Fuel consumption may affect growth patterns, existing contractual arrangements and commodity movements.			Requires expansion of nation's fuel base. Imposes need for *review of policies regarding priority of natural gas and* other alternative fuels for boiler (incineration) fuel use.			Import of this or *other alternative* fuels may be required.
3. Chemicals (Tons/Day)	Increased demand for treatment chemicals will impose added power needs for manufacturing and contribute to a higher resource consumption rate and possible unit price of chemicals.			--	--	Potential increase in unit prices of mined or manufactured chemicals.	--
III. WATER AND LAND USE CHANGES							
Water Use:							
1. Water Supply	Imposes need for reallocation of Lake Michigan withdrawals & assessment of cost-sharing arrangements.	--	Precludes additional investment to meet WRCCBS inventoried need for study area.	--	--	Supreme Court approval and U.S.-Canada agreement may be required for increased withdrawals from Lake Michigan if TDS content in Reuse Option #1 proves to be a problem.	
2. Water Damages	Storm water runoff control requires coordination of flood plain management studies and possible supplemental funding.		May preclude additional investment to meet WRCCBS inventoried need for study areas.	Multiple-purpose design provides potential savings in Federal-related programs.	--	--	--
3. In-Stream Recreation	Contributes to potential for meeting States and WRCCBS inventoried needs for water-based recreation.			--	--	--	--
4. Commercial Navigation	--	--	Defers long-term need for investment if reallocation of water supplies in study area changes regimen in Upper Illinois Waterway System.	Multiple-purpose design provides potential savings in Federal-related programs.	--	--	--
Land Use:							
1. Changed Land Uses a. Fee Purchase b/	--	--	--	--	--	--	--
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	Enhances the aesthetics of the surface mines and increases the potential for meeting local and State land-related needs at a reduced investment level.			--	--	--	--
2. Intensified Land Use a. Irrigation Facilities (Contractual)	--	--	--	--	--	--	--
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Potential for retaining more land in agricultural production than might ordinarily be experienced over time.			--	--	--	--
3. Recreation & Open Space	--	--	Increases potential for meeting portion of inventoried recreational deficiency in study area by reducing the required financial investment.	Imposes potential for additional financial investment to meet needs.			

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE III

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	*RELEVANT PORTIONS OF* UPPER MISSISSIPPI RIVER AND GREAT LAKES REGION	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
IV. LAND VALUES a/							
1. Potential Unrecovered Losses c/	--	--	--	--	--	--	--
2. Potential Unpaid *for Gains*	--	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/							
1. Agriculture	Potential for increasing crop and beef production and enhancing agri-economic base with reclamation of surface mines.			Economic impact of retaining the level of acreage required by this plan in agricultural production could be classified as either beneficial or adverse depending upon forecast of commodity markets.			
2. Industrial Manufacturing	Potential for incorporating sludge disposal with the recycling of solid wastes and generate synthetic fuel and other recoverable by-products.			--	--	Potential for increase in unit prices of manufactured items.	
3. Power Plants	--	--	--	--	--	--	
VI. EMPLOYMENT a/	Potential for State assistance in job relocation and labor training programs.			Increases need for labor training program.	--	--	
VII. INSTITUTIONAL a/	Imposes need to coordinate inter-county transfer of sludge. Enabling legislation necessary to modify present institutional and financial constraints.			Meets the intent of PL92-500.			
VIII. COST OF PLAN ($ MILLION) a/ d/							
1. Capital Costs (present worth)				$5,980		$7,973	
2. Capital Costs (average annual)				$353		$471	
3. *Operation, Maintenance* & Replacement Costs (average annual)				--		$304	
4. Total Average Annual Costs				$353		$775	
5. Industrial Pretreatment *Costs* (average annual) e/							
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Contributes to the States' efforts to meet water quality goals. Provides potential for improving the stream quality and aesthetics in surface mine areas.		Responsive to and increases potential for concurrently meeting an array of water and related land needs.	Meets the intent of PL92-500			

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the *operation, maintenance* and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to MRP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with *additional capital investments estimated* to be offset by operational savings.

TABLE G-XII-4

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

(5 Land Treatment Sites)

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	RESIDENTS
I. ECOLOGICAL					
Water Quality Output (mg/liter)					
BOD 2					
Phosphorus* 0.01					
Nitrogen 2					
Suspended Solids 0					
Total Dissolved Solids 500					
*Without any consideration for background level in soil column.					
1. Water Quality	Produces measurable increase in dissolved oxygen. Reduces phosphorus and nitrogen discharges from municipal and industrial sources and the first 2.5 - 2.85 inches of storm water runoff by 99 and 97 percent, respectively - - thereby reducing potential for algal blooms.				
2. Air Quality	Plan would facilitate efforts to attain desired ambient levels.			Aerosols will be present, but should not constitute a hazard.	
3. Aquatic Life: (a) Fishery	Provides an enhanced ecosystem for increased production of desireble species.				
(b) Other Biota	Increases the standing water biotic (aquatic organisms) communities.				
4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organims inhabiting the improved watercourses and standing water impoundments.				
II. RESOURCE REQUIREMENTS a/					
1. Electrical (Megawatt Hours/Day)	Power needs range from some 22,000 (1990) to 26,000 (2020). The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.				
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	--	--	--	--
3. Chemicals (Tons/Day)	--	--	--	--	--	--	--
III. WATER AND LAND USE CHANGES					
Water Use					
1. Water Supply	This plan would meet the area's water supply requirements over the next 50-years and eliminate the current depletion of ground water table in the western portion of the Illinois area.				
2. Water Damages	Provides significant reduction of overflow on some 69,900 flood plain acres.			--	--
3. In-Stream Recreation	Provides enhanced potential for water-based recreational opportunities. Imposes need for decisions regulating flow distribution and stream usage.			--	--
4. Commercial Navigation	Redistribution of flows and lock pumpage sufficient to sustain projected water-borne traffic.			--	--
Land Use					
1. Changed Land Uses a. Fee Purchase b/	--	--	--	--	--	63,200 acres acquired for the storm water management systems.	
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	--	--	--	--	--
2. Intensified Land Use a. Irrigation Facilities (Contractual)	Provides basis to control growth patterns and maintain balance between intensive area developments and open-space usage.			Phased leasing of acreage decreases with changed land use from 116,300 in 1990 to 87,100 in 2020.	
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	--	--	--	--	--	--	--
3. Recreation & Open Space	Provides potential for development of recreational and environmental corridors along some 500-miles, or more, of stream. Additional potential is provided by the rural and suburban storm water impoundments.				

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS
IV. LAND VALUES a/					
1. Potential Unrecovered Losses c/	Minor losses from property tax rolls for purchased lands.			Anything in addition to reimbursement for either income protection (leased lands) or the full market value of lands and relocation assistance inherent in the potential displacement of some 17,500 people.	
2. Potential Unpaid for Gains	Tax revenue gain and increase in property value.	Enhanced property value along streams of improved quality.	Provides additional land for other uses due to abandonment of existing treatment plants.	Potential increase in crop production. Capital improvements to land (drainage and irrigation systems) for rural storm water program.	
V. REVENUES FROM RECYCLING & REUSE a/					
1. Agriculture	--	--	--	Treatment of rural runoff may stimulate agricultural production.	
2. Industrial Manufacturing	--	--	Industries experience some increase in wastewater treatment costs.	Sufficient quality in treated water to meet most industrial process needs.	
3. Power Plants	--	--	--	--	--
VI. EMPLOYMENT a/	Potential for employment decreasing from some 2,600 persons in 1990 to 2,110 persons in 2020 to operate and maintain storm water management program and the conveyance and redistribution systems.				
VII. INSTITUTIONAL a/	Exceeds current planning goals for regionalization. Coordination throughout the study area would be necessary and involve adoption of contractual and/or consolidation arrangements. Treatment of wastewater and the sludge management program would necessitate cooperative arrangements with the outlying area of influence.				
VIII. COST OF PLAN ($ MILLION) a/ d/					
1. Capital Costs (present worth)	$1,764				
2. Capital Costs (average annual)	$104				
3. Operation, Maintenance & Replacement Cost (average annual)	$177				
4. Total Average Annual Costs	$281				
5. Industrial Pretreatment Costs (average annual) e/			Ranges from 50.0 (1972) to 103.7 (1990).		
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Decrease in disposable income caused by increased sewer charges.	Enhancement of property values and potential for increase in total recreational opportunities. Inconvenience during construction and some disruption to community cohesion and growth patterns.		Anxiety from leasing and interest acquisition proceedings.	

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50-years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NDCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS			INDIANA		
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
I. ECOLOGICAL						
1. Water Quality	--	--	--	--	--	--
2. Air Quality	Aerosols will be present but should not constitute a hazard.		Potential for infrequent odors from lagoons.		Aerosols will be present but should not constitute a hazard.	
3. Aquatic Life:						
(a) Fishery	--	--	--	--	--	--
(b) Other Biota	// . . . . . Increase the standing water biotic (aquatic organisms) communities. . . . . //					
4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organisms inhabiting the lagoons.		Provides potential for increasing available habitat areas through reclamation of surface mines.		Increase in birds and other animals which feed on aquatic organisms inhabiting the lagoons.	
II. RESOURCE REQUIREMENTS a/						
1. Electrical (Megawatt Hours/Day)	The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					
2. Natural Gas (Million Cubic Feet/Day)	Increased crop production will impose added fuel needs for drying.		--	--	Increased crop production will impose added fuel needs for drying.	
3. Chemicals (Tons/Day)	Chemical needs for treatment range from 25 (1990) to 32 (2020).		--	--	Chemical needs for treatment range from 24 (1990) to 28 (2020).	
III. WATER & LAND USE CHANGES						
Water Use:						
1. Water Supply	Ground water in irrigation sites will change and approximate the quality of the treated water.		--	--	Ground water in irrigation sites will change and approximate the quality of the treated water.	
2. Water Damages	Control of storm water runoff on irrigated lands will minimize crop losses during wet years and concurrently provide some reduction in small floods on local streams.					
3. In-Stream Recreation	Potential for change in water balance due to increase in evapo-transpiration rates and control of ground water table in irrigation sites. Current average and low-flow patterns in area's streams would need to be maintained by transfer from C-SELM waters.					
4. Commercial Navigation	--	--	--	--	--	--
Land Use:						
1. Changed Land Uses:						
a. Fee Purchase b/	Phased acquisition of acreage ranges from 32,400 (1990) to 40,700 (2020).		--	--	Phased acquisition of acreage ranges from 31,000 (1990) to 36,000 (2020).	
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	Increases use potential of 128,600 acres by 2020.	Increases use potential of 128,600 acres by 2020.	--	--
2. Intensified Land Use:						
a. Irrigation Facilities (Contractual)	Phased leasing of acreage ranging from 153,100 (1990) to 192,300 (2020).		Imposes potential for long-term constraint on land use patterns and economic base in the surrounding geographical area ranging in size from 195,900 acres in 1990 to 243,500 acres in 2020.	Imposes potential for long-term constraint on land use patterns and economic base in the surrounding geographical area ranging in size from 221,100 acres in 1990 to 256,300 acres in 2020.	Phased leasing of acreage ranging from 146,900 (1990) to 170,700 (2020).	
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Phased leasing of acreage ranging from 28,000 (1990) to 33,600 (2020).		Imposes added commitment for local counties to incorporate into land-use planning objectives.		Phased leasing of acreage ranging from 29,000 (1990) to 33,500 (2020).	
3. Recreation & Open Space	Lagoons would reduce open-space supplies but irrigation sites would preserve long-term farm base.		Potential for increase in recreational lands and wildlife preserves through reclamation of surface mines.		Lagoons would reduce open-space supplies but irrigation sites would preserve long-term farm base.	

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

IMPACTS OR CHANGES PRODUCED BY PLAN	OUTLYING AREA OF INFLUENCE: ILLINOIS — OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS	ILLINOIS: OTHER CONCERNED GROUPS	INDIANA: OTHER CONCERNED GROUPS	INDIANA — OWNERS OF SYSTEM REQUIRED LANDS: FARMERS	OWNERS OF SYSTEM REQUIRED LANDS: RESIDENTS
IV. LAND VALUES a/						
1. Potential Unrecovered Losses c/	Anything in addition to reimbursement for both income protection & long-term capital gains (alternative uses) for leased lands or the full market value of lands inherent in the potential displacement of 1,665 persons in 1990 and 2,120 persons in 2020.		--	--	Anything in addition to reimbursement for both income protection & long-term capital gains (alternative uses) for leased lands; or the full market value of lands inherent in the potential displacement of 1,085 persons in 1990 and 1,260 persons in 2020.	
2. Potential Unpaid for Gains	Potential increase in crop production and net income. Capital improvements to cropped lands with drainage and irrigation systems.		Potential for increase in land values and economic base due to reclamation of surface mines.		Potential increase in crop production and net income. Capital improvements to cropped lands with drainage and irrigation systems.	
V. REVENUES FROM RECYCLING & REUSE a/						
1. Agriculture	Potential for net income gain from nutrient recycle of over $40/acre/year. Agricultural use of sludge may further stimulate production.		Potential for reduction in demand for commercial agri-fertilizer.		Potential for net income gain from nutrient recycle of over $40/acre/year. Agricultural use of sludge may further stimulate production.	
2. Industrial Manufacturing	--	--	--	--	--	--
3. Power Plants	Water quantity in storage lagoons provide potential for use as cooling water & pump-back peak power generation.		Provides potential for increase in local assessed valuation base.		Water quantity in storage lagoons provide potential for use as cooling water & pump-back peak power generation.	
VI. EMPLOYMENT a/	Potential for employment ranging from some 1,460 persons in 1990 to 1,810 persons in 2020 to operate and maintain the treatment facilities and sludge management program.			Potential for employment ranging from some 1,400 persons in 1990 to 1,620 persons in 2020 to operate and maintain the treatment facilities and sludge management program.		
VII. INSTITUTIONAL a/	Coordination of the siting, management and operation of the treatment facilities and sludge management program is required. Institutional and cooperative (contractual) arrangements required to safeguard local interests and planning objectives.					
VIII. COST OF PLAN ($ MILLION) a/ d/						
1. Capital Costs (present worth)						
2. Capital Costs (average annual)						
3. Operation, Maintenance & Replacement Cost (average annual)						
4. Total Average Annual Costs						
5. Industrial Pretreatment Costs (average annual) e/						
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Produces anxiety from leasing and interest acquisition proceedings; inconvenience from construction; disruption to community cohesion; and changes in current farming practices. Provides potential for increase in agricultural economic base. Reluctance to commit local resources to treat metropolitan wastes and forego own desired land use and socio-economic patterns.					

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50-years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NPDP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES: ILLINOIS	REST OF STATES: INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	REST OF NATION: FEDERAL TAXPAYERS	REST OF NATION: OTHER CONCERNED GROUPS	REST OF NATION: THE NATION A SUMMARY	INTERNATIONAL
I. ECOLOGICAL							
1. Water Quality	Exceeds States' current effluent and water quality guidelines. This plan would contribute its proportional share of the States' efforts for meeting PL92-500 goals.		Enhanced flow regimen contributes to potential for meeting this and other water related needs inventoried by the Water Resources Council's Comprehensive Basin Studies (WRCCBS).	Meets intent and time-phased goals of PL92-500.			--
2. Air Quality	Plan would be consistent with current programs for air emission control in both States.		--	Plan consistent with current Federal Air Quality Act requirements.			--
3. Aquatic Life:							
(a) Fishery	Contributes to States' program for improving stream production of sport fishery.		Contributes to meeting a portion of the deficiency in fishing opportunities in the study area.	--	Fulfills goals of relevant conservation groups.	--	--
(b) Other Biota	--	--	--	--	--	--	--
4. Terrestrial Attributes (Wildlife)	--	--	Provides potential for contributing to the migratory waterfowl needs.	--	--	--	--
II. RESOURCE REQUIREMENTS a/							
1. Electrical (Megawatt Hours/Day)	Increases demand Power Supply Areas 14 & 40 by 11,200 (1990) and 13,800 (2020).	Increases demand for Power Supply Area 12 by 10,800 (1990) and 12,200 (2020).	Imposes need for decision concerning type of fuel (nuclear/fossil) to be used and siting of new power plants.	Requires expansion of nation's power base. Imposes need for review of policies regarding extent to which this and other competitive power needs will be met.			--
2. Natural Gas (Million Cubic Feet/Day)	--	--	--	Increases demand on nation's fuel base. Imposes need for review of policies regarding priority of natural gas or other alternative fuels for use in meeting agricultural-related needs.			Import of this or other alternative fuels may be required.
3. Chemicals (Tons/Day)	Increased demand for treatment chemicals will not affect current production markets.			--	--	Insignificant.	
III. WATER AND LAND USE CHANGES							
Water Use:							
1. Water Supply	Imposes need for reallocation of Lake Michigan withdrawals and assessment of cost-sharing arrangements.	--	Precludes additional investment to meet WRCCBS inventoried needs for study area.			Supreme Court approval and U.S.-Canada agreement may be required for increased withdrawals from Lake Michigan if TDS content in Reuse Option #1 proves to be a problem.	
2. Water Damages	Storm water runoff control requires coordination of flood plain management studies and possible supplemental funding.		May preclude additional investment to meet WRCCBS inventoried needs for study area.	Multiple-purpose design provides potential savings in Federal-related programs.	--	--	--
3. In-Stream Recreation	Contributes to potential for meeting States and WRCCBS inventoried needs for water-based recreation.			--	--	--	--
4. Commercial Navigation	--	--	Defer long-term need for investment if reallocation of water supplies in study area changes regimen in Upper Illinois Waterway System.	Multiple-purpose design provides potential savings in Federal-related programs.	--	--	--
Land Use:							
1. Changed Land Uses:							
a. Fee Purchase b/	--	--	--	--	--		
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	Enhances the aesthetics of the surface mines and increases the potential for meeting local and State land-related needs at a reduced investment level.						
2. Intensified Land Use:							
a. Irrigation Facilities (Contractual)	Areal extent of acreage affected directly or indirectly imposes need for decision by the Counties and States whether to retain basic agricultural-related economy and life-style and forego other types of socio-economic gains.		Potential for retaining more land in agricultural production than might ordinarily be experienced over time.	--	--		
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Increases potential for retaining more land in agricultural production than might ordinarily be experienced over time.			--	--	--	--
3. Recreation & Open-Space	Preservation of open-space, agricultural usage will be counter to current trends in some areas.		Increases potential for meeting a portion of inventoried recreational deficiency in the study area by reducing required financial investment.	Imposes potential for additional financial investment to meet needs.			

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE IV

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES			REST OF NATION			
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
IV. LAND VALUES a/							
1. Potential Unrecovered Losses c/	--	--	--	--	--	--	--
2. Potential Unpaid for Gains	--	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/							
1. Agriculture	Potential for increasing crop and beef production and enhancing agri-economic base with land technology and reclamation of surface mines.		--	Economic impact of increased production and retaining the level of acreage required by this plan in agricultural production could be classified as either beneficial or adverse depending upon forecast of commodity markets.			--
2. Industrial Manufacturing	Potential for incorporating sludge disposal with the recycling of solid wastes and generate synthetic fuel and other recoverable by-products.			--	--	Potential for increase in unit prices of manufactured items.	--
3. Power Plants	Co-siting of power plants with storage lagoons would remove potential source of heat pollution from Lake Michigan and other major watercourses.			--	--	--	--
VI. EMPLOYMENT a/	Potential for state assistance in job relocation and labor training programs.		--	Increases need for labor training programs.	--	--	--
VII. INSTITUTIONAL a/	Proposed Inter-State and inter-county transfers will impose necessity for approval by both State legislatures and the Counties (land use). Enabling legislation also necessary to modify present institutional and financial constraints.		Inter-State compact required.	Meets the intent of PL92-500.		Congressional approval required for inter-State transfer.	
VIII. COST OF PLAN ($ MILLION) a/ d/							
1. Capital Costs (present worth)				$5,293		$7,057	
2. Capital Costs (average annual)				$312		$416	
3. Operation, Maintenance & Replacement Cost (average annual)				--		$177	
4. Total Average Annual Costs				$312		$593	
5. Industrial Pretreatment Costs (average annual) e/							
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Concern over the socio-economic effects implicit in the long range extensive land commitments necessary to meet water quality goals. Provides potential for improving the stream quality and aesthetics in surface mine areas.		Imposes potential for delay in meeting the time phased goals of PL92-500 since an interim time frame would be required to demonstrate workability and its comparative socio-economic advantages to the agricultural community.	Meets the intent of PL92-500			

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NDCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

TABLE G-XII-5

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

(Combination 5 Land Treatment Sites and
5 Advanced Biological Treatment Plants)

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	OWNERS OF SYSTEM REQUIRED LANDS RESIDENTS
I. ECOLOGICAL					
1. Water Quality Output (mg/liter)					
BOD 2 - 3					
Phosphorus* 0.01 - 0.2					
Nitrogen 2 - 5					
Suspended Solids 0 - 1					
Total Dissolved Solids 500					
* Without any consideration for background level in soil column.					
1. Water Quality	Produces measurable increase in dissolved oxygen. Reduces phosphorus and nitrogen discharges from municipal and industrial sources and the first 2.5 - 2.85 inches of storm water runoff by 99 and 97 percent, respectively - - thereby reducing potential for algal blooms.				
2. Air Quality	Emits some 6.8 to 7.1 tons of chemicals and particulates daily for 1990 and 2020, respectively. Discharges are within acceptable USEPA air emission standards. Aerosols also will be present, but should not constitute a hazard.				
3. Aquatic Life:					
(a) Fishery	Provides an enhanced ecosystem for increased production of desirable species.				
(b) Other Biota	// . . . Increases the standing water biotic (aquatic organisms) communities. . . . //				
4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organisms inhabiting the improved watercourses and standing water impoundments.				
II. RESOURCE REQUIREMENTS a/					
1. Electrical (Megawatt Hours/Day)	Power needs range from some 14,700 (1990) to 18,500 (2020). The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.				
2. Natural Gas (Million Cubic Feet/Day)	Fuel needs range from 61 (1990) to 65 (2020). Commitment could curtail efforts to supply other competitive needs with higher use priorities. Increased demand would probably increase consumer rates.				
3. Chemicals (Tons/Day)	--	--	--		Chemical needs for treatment range from 1,970 (1990) to 2,110 (2020).
III. WATER & LAND USE CHANGES					
Water Use:					
1. Water Supply	*This plan would meet the area's water supply requirements over the next 50 years and* eliminate the current depletion of ground water table in the western portion of the Illinois area.				
2. Water Damages	Provides significant reduction of overflow on some 69,900 flood plain acres.			--	--
3. In-Stream Recreation	Provides enhanced potential for water based recreational opportunities. Imposes need for decisions regulating flow distribution and stream usage.			--	--
4. Commercial Navigation	Redistribution of flows and lock passage sufficient to sustain projected water-borne traffic.			--	--
Land Use:					
1. Changed Land Uses:					
a. Fee Purchase b/	--	--	--		65,100 acres acquired for the the treatment and storm water management systems.
b. Restoration of Surface Mines (Sludge Option #2 Contractural)	--	--	--	--	--
2. Intensified Land Use:					
a. Irrigation Facilities (Contractural)	Provides basis to control growth patterns and maintain balance between intensive area developments and open-space usage.				Phased leasing of acreage decreases with changed land use from 116,300 in 1990 to 87,100 in 2020.
b. Agricultural Sludge Utilization (Sludge Option #1- Contractural)	--	--	--	--	--
3. Recreation & Open Space	Provides potential for development of recreational and environmental corridors along some 500 miles, or more, of stream. Additional potential is provided by the rural and suburban storm water impoundments, and by treatment plants with sufficient capacity to maintain through flows for selective fishery impoundments.				

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

CHICAGO - SOUTH END OF LAKE MICHIGAN STUDY AREA

IMPACTS OR CHANGES PRODUCED BY PLAN	STUDY AREA TAXPAYERS	LANDOWNERS ALONG STREAMS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS FARMERS	OWNERS OF SYSTEM REQUIRED LANDS RESIDENTS
IV. LAND VALUES a/					
1. Potential Unrecovered Losses c/	Minor losses from property tax rolls for purchased lands.	--	--	Anything in addition to reimbursement for either income protection (leased lands) or the full market value of lands and relocation assistance inherent in the potential displacement of some 25,620 people.	
2. Potential Unpaid for Gains	Tax revenue gain and increase in property values.	Enhanced property values along streams of improved quality.	Provides additional land for other uses due to abandonment of existing treatment plants.	Potential increase in crop production. Capital improvements to land (drainage and irrigation systems) for rural storm water program.	
V. REVENUES FROM RECYCLING & REUSE a/					
1. Agriculture	--	--	--	Treatment of rural runoff may stimulate agricultural production.	
2. Industrial Manufacturing	--	--	Industries experience net increase in wastewater treatment cost.	Sufficient quality in treated water to meet most industrial process needs.	
3. Power Plants	--	--	--	--	--
VI. EMPLOYMENT a/	Potential employment ranges from some 8,840 persons in 1990 to 8,810 persons in 2020 to operate and maintain highly technical municipal and storm water treatment plants and related works.				
VII. INSTITUTIONAL a/	Exceeds current planning goals for regionalization. Coordination throughout the study area would be necessary and involved adoption of contractual and/or consolidation arrangements. Treatment of a portion of the wastewater and the sludge management program would necessitate cooperative arrangements with the outlying area of influence.				
VIII. COST OF PLAN ($ MILLION) a/ d/					
1. Capital Costs (present worth)	$1,986				
2. Capital Costs (average annual)	$ 118				
3. Operation, Maintenance & Replacement Costs (average annual)	$ 275				
4. Total Average Annual	$ 393				
5. Industrial Pretreatment Costs (average annual) e/			Ranges from 50.0 (1972) to 103.7 (1990).		
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Decrease in disposable income caused by increased sewer charges.	Enhancement of property values and potential for increase in total recreational opportunities. Inconvenience during construction and some disruption to community cohesion and growth patterns.		Anxiety from leasing and interest acquisition proceedings.	

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50-years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to NEEP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS			INDIANA		
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
I. ECOLOGICAL						
1. Water Quality	--	--	--	--	--	--
2. Air Quality	Aerosols will be present but should not constitute a hazard.		Potential for infrequent odors from lagoons.		Aerosols will be present but should not constitute a hazard.	
3. Aquatic Life:						
(a) Fishery	--	--	--	--	--	--
(b) Other Biota	// . . . . . Increase the standing water biotic (aquatic organisms) communities. . . . . //					
4. Terrestrial Attributes (Wildlife)	Increase in birds and other animals which feed on aquatic organisms inhabiting the lagoons.		Provides potential for increasing available habitat areas through reclamation of surface mines.		Increase in birds and other animals which feed on aquatic organisms inhabiting the lagoons.	
II. RESOURCE REQUIREMENTS a/						
1. Electrical (Megawatt Hours/Day)	Power needs range from some 14,700 (1990) to 18,500 (2020). The associated investment program may increase both the area's prime loan interest rates and the consumers' power rates.					
2. Natural Gas (Million Cubic Feet/Day)	Increased crop production will impose added fuel needs for drying.		--	--	Increased crop production will impose added fuel needs for drying.	
3. Chemicals (Tons/Day)	Chemical needs for treatment range from 14 (1990) to 17 (2020).		--	--	Chemical needs for treatment is essentially a constant of 3.	
III. WATER & LAND USE CHANGES						
Water Use:						
1. Water Supply	Ground water in irrigation sites will change and approximate the quality of the treated water.		--	--	Ground water in irrigation sites will change and approximate the quality of the treated water.	
2. Water Damages	Control of storm water runoff on irrigated lands will minimize crop losses during wet years and concurrently provide some reduction in small floods on local streams.					
3. In-Stream Recreation	Potential for change in water balance due to increase in evapo-transpiration rates and control of ground water table in irrigation sites. Current average and low-flow patterns in area's streams would need to be maintained by transfer from C-SELM waters.					
4. Commercial Navigation	--	--	--	--	--	--
Land Use:						
1. Changed Land Uses:						
a. Fee Purchase b/	Phased acquisition of acreage ranges from 15,600 (1990) to 23,700 (2020).		--	--	Phased acquisition of acreage ranges from 1,600 (1990) to 3,600 (2020).	
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	--	--	Increases use potential of 251,100 acres by 2020.	Increases use potential of 46,700 acres by 2020.	--	--
2. Intensified Land Use:						
a. Irrigation Facilities (Contractual)	Phased leasing of acreage ranging from 73,600 (1990) to 112,500 (2020).		Imposes potential for long-term constraint on land use patterns and economic base in the surrounding geographical area ranging in size from 77,500 acres in 1990 to 123,600 acres in 2020.	Imposes potential for long term constraint on land use patterns and economic base in the surrounding geographical area ranging in size from 6,400 acres in 1990 to 16,200 acres in 2020.	Phased leasing of acreage ranging from 7,500 (1990) to 16,800 (2020).	
b. Agricultural Sludge Utilization (Sludge Option #1 Contractual)	Phased leasing of acreage ranging from 47,300 (1990) to 57,000 (2020).		Imposes added commitment for local counties to incorporate into land-use planning objectives.		Phased leasing of acreage ranging from 9,700 (1990) to 10,100 (2020).	
3. Recreation & Open-Space	Lagoons would reduce open-space supplies but irrigation sites would preserve long term farm base.		Potential for increase in recreational lands and wildlife preserves through reclamation of surface mines.		Lagoons would reduce open-space supplies but irrigation sites would preserve long term farm base.	

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

OUTLYING AREA OF INFLUENCE

IMPACTS OR CHANGES PRODUCED BY PLAN	ILLINOIS			INDIANA		
	OWNERS OF SYSTEM REQUIRED LANDS		OTHER CONCERNED GROUPS	OTHER CONCERNED GROUPS	OWNERS OF SYSTEM REQUIRED LANDS	
	FARMERS	RESIDENTS			FARMERS	RESIDENTS
IV. LAND VALUES a/						
1. Potential Unrecovered Losses c/	Anything in addition to reimbursement for both income protection & long-term capital gains (alternative uses) for leased lands or the full market value of lands inherent in the potential displacement of 860 persons in 1990 and 1,310 persons in 2020.		--	--	Anything in addition to reimbursement for both income protection & long-term capital gains (alternative uses) for leased lands; or the full market value of lands inherent in the potential displacement of 60 persons in 1990 and 130 persons in 2020.	
2. Potential Unpaid for Gains	Potential increase in crop production and net income. Capital improvements to cropped lands with drainage and irrigation systems.		Potential for increase in land values and economic base due to reclamation of surface mines.		Potential increase in crop production and net income. Capital improvements to cropped lands with drainage and irrigation systems.	
V. REVENUES FROM RECYCLING & REUSE a/						
1. Agriculture	Potential for net income gain from nutrient recycle of over $40/acre/year. Agricultural use of sludge may further stimulate production.		Potential for reduction in demand for commercial agri-fertilizer.		Potential for net income gain from nutrient recycle of over $40/acre/year. Agricultural use of sludge may further stimulate production.	
2. Industrial Manufacturing	--	--	--	--	--	--
3. Power Plants	Water quantity in storage lagoons provide potential for use as cooling water & pump-back peak power generation.		Provides potential for increase in local assessed valuation base.		Water quantity in storage lagoons provide potential for use as cooling water & pump-back peak power generation.	
VI. EMPLOYMENT a/	Potential for employment ranging from some 960 persons in 1990 to 1,320 persons in 2020 to operate and maintain the treatment facilities and sludge management program.			Potential for employment ranging from some 140 persons in 1990 to 210 persons in 2020 to operate and maintain the treatment facilities and sludge management program.		
VII. INSTITUTIONAL a/	Coordination of the siting, management and operation of the treatment facilities and sludge management program is required. Institutional and cooperative (contractual) arrangements required to safeguard local interests and planning objectives.					
VIII. COST OF PLAN ($ MILLION) a/ d/						
1. Capital Costs (present worth)						
2. Capital Costs (average annual)						
3. Operation, Maintenance & Replacement Cost (average annual)						
4. Total Average Annual Costs						
5. Industrial Pretreatment Costs (average annual) e/						
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Produces anxiety from leasing and interest acquisition proceedings; inconvenience from construction; disruption to community cohesion; and changes in current farming practices. Provides potential for increase in agricultural economic base. Reluctance to commit local resources to treat metropolitan wastes and forego own desired land-use and socio-economic patterns.					

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and the regional system will be less than required if industry would totally pretreat its wasteload on site to NEQP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
I. ECOLOGICAL							
1. Water Quality	Exceeds States' current effluent and water quality guidelines. This plan would contribute its proportional share of the States' efforts for meeting PL 92-500 goals.		Enhanced flow regimen contributes to potential for meeting this and other related needs inventoried by the Water Resources Council's Comprehensive Basin Studies (WRCCBS).	Meets intent and time-phased goals of PL 92-500.			
2. Air Quality	Plan would be consistent with current programs for air emission control in both States.			Plan consistent with current Federal Air Quality Act requirements.			
3. Aquatic Life:							
(a) Fishery	Contributes to States' program for improving stream production of sport fishery.		Contributes to meeting a portion of the deficiency in fishing opportunities in the study area.		Fulfills goals of relevant conservation groups.		
(b) Other Biota	--	--					
4. Terrestrial Attributes (Wildlife)	--	--	Provides potential for contributing to the migratory waterfowl needs.				
II. RESOURCE REQUIREMENTS a/							
1. Electrical (Megawatt Hours/Day)	Increases demand Power Supply Areas 14 & 40 by 12,500 (1990) and 15,800 (2020).	Increases demand for Power Supply Area 12 by 2,400 (1990) and by 2,700 (2020).	Imposes need for decision concerning type of fuel (nuclear/fossil) to be used and siting of new power plants.	Requires expansion of nation's power base. Imposes need for review of policies regarding extent to which this and other competitive power needs will be met.			
2. Natural Gas (Million Cubic Feet/Day)	--	--		Increases demand on nation's fuel base. Imposes need for review of policies regarding priority of natural gas or other alternative fuels for use in meeting agricultural-related needs.			Import of this or other alternative fuels may be required.
3. Chemicals (Tons/Day)	Increased demand for treatment chemicals will impose added power needs for manufacturing and contribute to a higher resource consumptive rate and possible unit price of chemicals.					Potential increase in unit prices of mined or manufactured chemicals.	
III. WATER AND LAND USE CHANGES							
Water Use:							
1. Water Supply	Imposes need for reallocation of Lake Michigan withdrawals and assesment of cost-sharing arrangements.		Precludes additional investment to meet WRCCBS inventoried needs for the study area.			Supreme Court approval and U.S.-Canada agreement may be required for increased withdrawals from Lake Michigan if ITIS content in Reuse Option #1 proves to be a problem.	
2. Water Damages	Storm water runoff control requires coordination of flood plain management studies and possible supplemental funding.		May preclude additional investment to meet WRCCBS inventoried needs for the study area.	Multiple-purpose design provides potential savings in Federal related programs.			
3. In-Stream Recreation	Contributes to potential for meeting States and WRCCBS inventoried needs for water-based recreation.						
4. Commercial Navigation	--	--	Defer long term need for investment if reallocation of water supplies in study area changes flow regimen in Upper Illinois Waterway System.	Multiple-purpose design provides potential savings in Federal related programs.			
Land Use:							
1. Changed Land Uses:							
a. Fee Purchase b/	--	--					
b. Restoration of Surface Mines (Sludge Option #2 Contractual)	Enhances the aesthetics of surface mines and increases the potential for meeting local and State land-related needs at a reduced investment level.						
2. Intensified Land Use:							
a. Irrigation Facilities (Contractual)	Areal extent of acreage affected directly or indirectly imposes need for decision by the Counties and States wheather to retain basic agricultural-related economy and life-style and forego other types of socio-economic gains.		Potential for retaining more land in agricultural production than might ordinarily be experienced over time.				
b. Agricultural Sludge Utilization (Sludge Option #1 - Contractual)	Increases potential for retaining more land in agricultural production than might ordinarily be expected over time.						
3. Recreation & Open Space	Preservation of open space, agricultural usage could be counter to current trends in some areas.		Increases potential for meeting a portion of inventoried recreational deficiency in the study area by reducing the required financial investment.	Imposes potential for additional financial investment to meet needs.			

SUMMARY OF IMPACTS PRODUCED BY ALTERNATIVE V

IMPACTS OR CHANGES PRODUCED BY PLAN	REST OF STATES		REST OF NATION				
	ILLINOIS	INDIANA	RELEVANT PORTIONS OF UPPER MISSISSIPPI RIVER AND GREAT LAKES REGIONS	FEDERAL TAXPAYERS	OTHER CONCERNED GROUPS	THE NATION A SUMMARY	INTERNATIONAL
IV. LAND VALUES a/							
1. Potential Unrecovered Losses c/	--	--	--	--	--	--	--
2. Potential Unpaid for Gains	--	--	--	--	--	--	--
V. REVENUES FROM RECYCLING & REUSE a/							
1. Agriculture	Potential for increasing crop and beef production and enhancing agri-economic base with land technology and reclamation of surface mines.		--	Economic impact of increased production and retaining the level of acreage required by this plan in agricultural production could be classified as either beneficial or adverse depending upon forecast of commodity markets.			--
2. Industrial Manufacturing	Potential for incorporating sludge disposal with the recycling of solid wastes and generate synthetic fuel and other recoverable by-products.			--	--	Potential for increase in unit prices of manufactured items.	--
3. Power Plants	Co-siting of power plants with storage lagoons would remove potential source of heat pollution from lake Michigan and other major watercourses.			--	--	--	--
VI. EMPLOYMENT a/	Potential for State assistance in job relocation and labor training programs.		--	Increases need for labor training programs.	--	--	--
VII. INSTITUTIONAL a/	Imposes need to coordinate inter-county transfer of sludge. Enabling legislation also necessary to modify present institutional and financial constraints.		--	//. . . . Meets the intent of PL 92-500. . . . .//			
VIII. COST OF PLAN ($ MILLION) a/ d/							
1. Capital Costs (present worth)				$5,956		$7,942	
2. Capital Costs (average annual)				$ 352		$ 470	
3. Operation, Maintenance & Replacement Costs (average annual)				--		$ 275	
4. Total Average Annual Costs				$ 352		$ 745	
5. Industrial Pretreatment Costs (average annual) e/							
IX. CHANGES IN PUBLIC PERCEPTION CONCERNING WORTH OF CLEAN WATER AND IMPACTS FROM PLAN a/	Concern over the socio-economic effects implicit in the long range land commitments necessary to meet water quality goals. Provides potential for improving the stream and aesthetics in surface mine areas.		Imposes potential for delay in meeting the time phased goals of PL 92-500 since an interim time frame would be required to demonstrate workability and its comparative socio-economic advantages to the agricultural community.	//. . . . Meets the intent of PL 92-500. . . . .//			--

NOTES:

a/ Applies to utilization of sludge for reclamation of surface mines (Option #2) and Water Reuse Option #1 (2,068 MGD (3,200 cfs) constraint).

b/ Based on 2020 requirements being purchased in 1990 unless phasing indicated. Excludes some 1,190 acres already owned in the study area that would be incorporated into system (plant or access points).

c/ Potential unrecovered losses are generally considered to be any real or imagined losses in excess of net average annual income for owners of leased lands; or in excess of the full market value for the purchased lands and relocation assistance available under the provision of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

d/ Assumes that the Federal taxpayers will finance 75 percent of the capital costs and that the study area taxpayer will finance the remaining 25 percent of the capital cost (less any assistance the States may elect to contribute) plus 100 percent of the operation, maintenance and replacement costs; provided the plan is certified by designated regional clearinghouses and the States and approved for funding under the construction grant program of the U.S. E.P.A. All costs are computed over 50 years at 5.5 percent interest rate.

e/ Cost level incurred by industry for pretreatment prior to discharge into regional system. This cost is not included in the cost estimate. Reimbursable cost (user fee) incurred by regional system and included in the project estimate varies with treatment technology. However, total cost level to both industry and regional system will be less than required if industry would totally pretreat its wasteload on site to MDCP quality goals. Furthermore, the total cost represents a level of investment which is generally less than that required to meet current standards with additional capital investments estimated to be offset by operational savings.

ANNEX A

CORRESPONDENCE

ANNEX A
CORRESPONDENCE

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FEDERAL POWER COMMISSION
REGIONAL OFFICE
United States Custom House
610 S. Canal Street, Room 1051
Chicago, Illinois 60607

September 15, 1972

Colonel R. M. Wells
District Engineer
U. S. Army Engineer District, Chicago
219 S. Dearborn Street
Chicago, Illinois 60604

Dear Colonel Wells:

In accordance with a telephone conversation of September 14 with James Maas, we have looked at the projections of power requirements for the C-SELM Area and offer the following comments:

The electric power projections for the C-SELM area as given in the Phase 1 report "Study of Wastewater Management Chicago-South End Lake Michigan Area" (page 11-7) appear to be very conservative as related to those given in the FPC National Power Survey (NPS) to the year 1990 and the Upper Mississippi River Comprehensive Basin Study, Appendix M (prepared by the FPC) given to the year 2020.

There is no scientific method in forecasting electric energy requirements as far off as 50 years hence, and much reliance must be placed on historic trends. The growth rates subsequent to the year 1990 were progressively diminished. One difficulty in arriving at load requirements in the distant future is that the nature of the specific loads cannot be defined since many will no doubt be as a result of future developments. For example, one could not have predicted in a short time as 10 years ago, the large requirements for electric energy now envisioned for use in accomplishing environmental goals.

We would like to present some pertinent observations in connection with consideration of the concept of encouraging reduction in the rate of growth of per capita power consumption. First, however, it is emphasized that we do not intend to imply that conservation of energy should not be encouraged wherever possible through such measures as dissemination of information on wise use of electricity, better building construction, increased efficiency of equipment, etc.

There are many implications in the concept of reduced growth rate of per capita energy use which are not readily apparent. These are summarized quite effectively and convincingly in a statement made by

D. Bruce Mansfield, Chairman, Edison Electric Institute on June 6, 1971, pertaining to the role of electric energy in solving environmental problems. Following are some of the points he presented:

1. So-called frivolous uses of electricity, such as small appliances like electric toothbrushes, hair dryers, vacuum cleaners, clocks, toasters, etc. in 1970 amounted to less than 4 percent of the total kilowatt-hours used.

2. Residential customers use less than 1/3 of the total electricity, the remaining 2/3 being used for industrial and commercial applications which relieve human drudgery in the home, on the farm and in industry and result in countless job opportunities, economic growth, and an environment of higher quality than would have been possible had air-polluting factory boilers continued to multiply.

3. Electric energy is fundamental to solving the environmental problems:

   (1) A recent sampling of 85 manufacturers showed they used annually 1.5 billion kWh exclusively for pollution control, which was 8.4 percent of their total use.

   (2) Expansion of sewage treatment facilities for water pollution reduction will require massive quantities of electric power for pumping, etc.

   (3) Much electricity is required in the solid-waste recycling field for machines using as much as 10,000 horsepower.

   (4) Large amounts of electricity are required by industries to meet the states' environmental standards.

4. Mr. Mansfield quotes Senator Jennings Randolph (D-W.Va.) as stating in the Congressional Record:

   "The quality of life and the use of energy are inextricably tied together. For one to improve, the other must increase."

   And the Chairman of the Federal Power Commission has stated "Without dynamic growth, we cannot improve the welfare of the poor, meet our international commitments, maintain our national security, raise our standard of living, meet the full employment goals of our society or, for that matter, our undertaking to preserve our environmental heritage."

Colonel R. M. Wells

The foregoing illustrate that an abundance of electric power is required if environmental goals are to be reached.

Sincerely yours,

Lenard B. Young
Regional Engineer

FEDERAL POWER COMMISSION
REGIONAL OFFICE
United States Custom House
610 S. Canal Street, Room 1051
Chicago, Illinois 60607

September 15, 1972

Colonel R. M. Wells
District Engineer
U. S. Army Engineer District, Chicago
219 S. Dearborn Street
Chicago, Illinois 60604

Dear Colonel Wells:

This is to confirm comments furnished Messrs. James Maas and Carl Hessel by telephone on September 14 relative to the proposed installation of 11 nuclear power plants at storage ponds proposed under the Chicago-South End Lake Michigan (C-SELM) land disposal plans. The following comments cover items raised at a meeting in the Chicago District office on September 8:

I. We believe that the dispersed land disposal plan wherein six sites are proposed rather than the single site plan would be more satisfactory from standpoints of Civil Defense and location of the supply closer to the load centers.

II. The projected revenue of $200,000,000 annually from the power companies which would build and operate the power plants appears reasonable.

III. According to load studies made by this office in connection with the Upper Mississippi and Great Lakes Basin, the proposed 55,000 MW could be used in the market area by the year 2020.

IV. The assumption that the power would be generated within the study area is a valid assumption for the reasons stated above that the generation would be near the load centers.

V. The proposed plan for the installation of the power plants at the storage ponds would have environmental advantages as brought out in the Phase I report. There would not be the public reaction such as results from power plants located on Lake Michigan because of possible thermal pollution effects on fish. Also, with nuclear power plants, there would be no air pollution or use of low sulfur coal or gas which are in short supply.

These comments are of a general nature and not the result of a thorough study of the plan. They are the views of this office and do not necessarily represent the views of the Commission itself.

Sincerely yours,

Lenard B. Young

Lenard B. Young
Regional Engineer

MID-WEST COAL PRODUCERS INSTITUTE, INC.
Suite 220, Reisch Building
117 South Fifth Street
SPRINGFIELD, ILLINOIS 62701
Area Code 217 — Telephone 528-2092

March 5, 1973

Mr. James M. Maas, Chief
Planning Division
U.S. Army Corps of Engineers
219 S. Dearborn Street
Chicago, Illinois 60604

Re: Corps of Engineers
Region V, C-SELM
Wastewater Management Study

Dear Mr. Maas:

This communication is submitted on behalf of the Mid-West Coal Producers Institute, Inc. with reference to the Chicago-South End Lake Michigan Wastewater Management Study with particular reference to that phase involving the disposal of sludge. The Mid-West Coal Producers Institute appreciates the opportunity the Corps has afforded it to participate in the various discussions, your conference with our representatives and particularly its membership on the Commerce and Industry Advisory Committee.

We have reviewed the draft of your suggested statements to be included in the Corps' report on its Study of this Wastewater Management Program and believe with the minor changes which we have made in the attached draft copy, that it reflects the attitude of our membership engaged in surface mining. We also feel that this reflects sound cooperative efforts in the recycling of sludge and for the potential enhancement of the fertility of mined lands in the areas involved.

The past activities of the coal industry in mined land reclamation reflects its interest, concern and desire to continue to improve the productivity and enhance land use whether it be for agriculture, recreation or other legitimate uses. This draft reflects the coal industry's interest in this particular phase of the Corps' Study in connection with the Wastewater Management Study.

We shall appreciate being advised of subsequent efforts and activities of the Corps in this general direction in order that the coal industry may continue to recognize potential values in recycling wastes combined with the improvement and protection of our environment.

Sincerely,

Otis J. Gibson

Otis J. Gibson,
President

OJG:jlh

Attchm:

COAL MINING - SLUDGE MANAGEMENT CONSIDERATIONS

1. Assume, for purposes of the Chicago South End of Lake Michigan study, that the land involved in sludge disposal would be retained in private ownership. Furthermore, it would be practical to assume that the coal companies which owned the land would be the private entities involved.
2. The above assumptions are based on the concept that, with the combined reclamation efforts of both the coal companies (per applicable laws) and the sludge-production entity, then:
   a) The land could and would be developed by the coal company for optimum income producing potential. This could include, but not be limited to, agricultural, recreational (fee-based), or any other usage consistent with the applicable County land-use planning. And
   b) If the coal companies' proposed (future) usage were unacceptable to the County(s), then the Coal Company(s) could elect to follow either of two options:
      (1) Sell the land at fair market value to a private entity that would agree to develop the land in consonance with the County(s) land-use objectives. Or
      (2) Lease the land to a developer who would agree to develop the land in consonance with the County(s) land-use objectives. Under this arrangement the Coal Company(s) could exercise approval authority as to the quality of development in order to protect the land's assessed value and its long-range contribution to the County's life style.

3. If the land owned by the Coal Company(s) could not be mined due to reclamation requirements (under current state laws) that precluded economic mining operations, then the following would be assumed:

   The Coal Company(s) would

   a) Retain ownership of the land. And

   b) Contract to accept sludge for disposal on the land. The sludge would be stable and suitable for agricultural usage.

4. Before any aspects of the sludge management proposal are instituted the following would be required:

   a) Certification (permit approval) for integrating sludge into approved land usage. This certification would have to satisfy the then-current state and/or Federal regulations governing surface and ground water runoff. The responsibility for obtaining such certification would have to be that of the sludge entity.

   b) Some form of indemnification to the coal company(s) by the sludge producing entity to insure that the placement of sludge would not cause any adverse health, pollution or social effects.

   c) The amount, time-frame for placement and manner of incorporation shall preclude any interference with the mining operation and/or future land usage. These operational factors would apply equally to all lands owned by the coal companies including (1) land where the surface mining is already completed and (2) land currently being surface mined and (3) land that may or may not be surface mined.

Two types of contractural agreements with the Coal Companies are feasible:

   a) Wherein the Coal Company enters into a service (concept) type of agreement with the individual sludge entity to accept the sludge for integration into their present and future land use. And

   b) Wherein the Coal Company leases the land to the individual sludge

entities with both the use, manner of incorporation, and duration of sludge application specified. Land ownership would be fully restored to the Coal Company, upon expiration of the lease.

In exchange for both the internal benefits attainable by reclamation of the surface mined areas and for the fertilizer value of the sludge, the coal company would provide the use of land at no cost to the sludge entity. However, the entire cost for delivery and in situ placement of the sludge would be paid by the sludge entity.

COOPERATIVE EXTENSION SERVICE
COLLEGE OF AGRICULTURE

March 12, 1973

James Maas, Chief, Planning Division
Chicago District
Corps of Engineers
219 South Dearborn Street
Chicago, Il 60604

Dear Mr. Maas:

The objective of the Northeastern Illinois Planning Commission Open Space Plan is to maintain a low ratio of building (development) coverage to the total land area in the 6 northeastern Illinois counties. The Northeastern Illinois Planning Commission projections are for a population of 10 million for 1990. Any and all plans hinge on population forecasts.

Open space would be needed for these additional people and it would probably come from agricultural or non-developed lands in the urban-suburban area. Little variation is expected from this pattern. The major efforts in Open Space preservation must come from the rural portions of the outlying counties. Using agricultural land as a method of treatment could be of value as a means of saving open space. The "living filter," as outlined by the Army Corp of Engineers in its agricultural paper, should help to retain these lands in current use, namely that of agricultural production.

The institutional, political and social implications involved in this method of preservation would have to be totally acceptable and integrated to the land-use plans of the individual counties concerned with the comprehensive General Plan for Northeastern Illinois.

In an effort to study preservation of Open Space, the Northeastern Illinois Planning Commission and the University of Illinois have joined in a rural conservation study. The results of this effort should be added to the comprehensive plan of NIPC.

In this endeavor I have been loaned to NIPC to try to develop some guidelines for preserving agricultural lands. To my knowledge it is a first attempt to preserve rural land in an urbanized area. Many methods, guidelines, alternatives, economic costs and social impacts are being considered before the agricultural land preservation policy can be integrated into a revised Comprehensive Plan for Northeastern Illinois.

Yours truly,

A. A. Wicklein
Senior Extension Adviser, Resource Development
Will County
100 Manhattan Road
Joliet, Il 60433

AAW:ig

THE PEOPLES GAS LIGHT AND COKE COMPANY

122 SOUTH MICHIGAN AVENUE

CHICAGO 60603

JOSEPH P. THOMAS
VICE PRESIDENT

AREA CODE 312 431-4300

March 19, 1973

Mr. James M. Maas
Chief, Planning Division
U.S. Army Engineer District, Chicago
219 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Maas:

In response to your question regarding the ability of The Peoples Gas Light and Coke Company to provide energy (gas) for the processing of waste water in the Chicago-South End of Lake Michigan (C-SELM) region, your specific goal as explained is to prepare a report on the planning for future waste water management for the C-SELM region.

The Gas Industry does not have adequate supplies at the present to meet the increasing consumer demands. This increasing demand for natural gas is primarily the result of its artificially low price and the demand for clean fuels for meeting air pollution abatement standards. The Peoples Gas Light and Coke Company is confident that it can meet the requirements of its on-line firm customers. However, the lack of new gas supplies, the curtailment of existing gas supplies from our pipeline suppliers and the greatly increased demand for natural gas service as a result of governmental adoption of stringent air pollution controls, compelled Peoples in 1970 to file before the Illinois Commerce Commission a plan to control the attachment of all new firm and off-peak space heating, industrial processing and power generation loads. The plan was designed to protect Peoples ability to serve the present loads of our existing firm customers and to provide a fair and orderly procedure for adding enlarged loads to existing customers and the loads of new customers consistent with available gas supplies and efforts to solve the air pollution problem. To that end, the plan creates a series of categories designed to give preference to those of our existing or propective customers who are immediately and most critically subject to the Chicago air pollution ordinance and within each classification to smaller customers who are less able to use an alternate fuel.

The Federal Power Commission on the other hand in its proposed policy statement on Utilization and Conservation of Natural Resources in F.P.C. Docket R-467 is proposing a priority scheme which consists of eight "priorities-of-service" categories which is to be applied in the allocation of the available natural gas supplies of pipeline systems on the basis of the end-use made of such supplies by the customers of the distribution companies buying from such pipeline systems. The proposed rulemaking designates Boiler Fuel use as the lowest priority use of natural gas with the largest size boilers having the least priority. These proceedings have regional implications in the allocation of available natural gas supplies.

In brief, natural gas is in short supply and even in the long run is not likely to be available in adequate quantity to meet the demands for this clean energy. The priority systems which are in effect and/or have been proposed show preference for small use application for residential and commercial consumers where air pollution standards are most difficult to meet and control. The broad fuel applications such as you propose where alternate fuels can readily suffice would be of lowest priority under such priority schemes.

Yours very truly,

J. P. Thomas

STATE of INDIANA

DEPARTMENT OF NATURAL RESOURCES
GEOLOGICAL SURVEY
611 NORTH WALNUT GROVE
BLOOMINGTON, INDIANA 47401

AREA CODE: 812
TELEPHONE:

April 30, 1973

Mr. James Maas
Chief Planning Division
U.S. Army Corps of Engineers
219 South Dearborn
Chicago, Illinois 60604

Dear Mr. Mass:

On April 18, 1973, Lt. Thomas H. Blankenship called this office requesting an opinion on Dr. Mark Reshkin's proposal to use unconsolidated tunnel boring materials (CSELM project) as fill for the various sand and clay borrow pits in the northern Calumet Region of northwest Indiana. The following points are my evaluation of the impacts of Dr. Reshkin's suggestions:

(1) Many of the borrow pits, especially in the Gary-Hammond area, are presently being considered as potential sites for sanitary landfills. These borrow pits are located in sand deposits of glacial Lake Chicago origin, and, as all sandy sediment units, make poor sanitary landfill locations due to the high leachate transmission potential of such permeable materials. Filling the pits with clay, sand, or glacial till derived from the tunneling operation would negate the likelihood of using the pits for sanitary landfilling purposes.

(2) The borrow pits provide excellent, nearby, locations for disposing of the sediments removed by the tunneling operation.

(3) The hazards associated with the presence of the various borrow pits would be eliminated by the filling and grading of the existing depressions.

(4) Local drainage could be more easily controlled if the pits were filled and graded to conform to the existing terrain.

My recognition of the impact of Dr. Reshkin's proposal is limited to the geologic feasibility of the project and to the positive geohydrologic effects of such filling on the environment.

If there are further geologic questions regarding the proposal of borrow pit fill operations in conjunction with your proposed project, please feel free to contact me.

Sincerely,

John R. Hill

John R. Hill
Glacial Geologist

JRH/jb

cc: Maurice E. Biggs, Asst. State Geologist
Robert H. Shaver, Head, Geology Section

ANNEX B

RESOURCE DEVELOPMENT PLAN

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ANNEX B - RESOURCE DEVELOPMENT PLAN

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FIGURES

A RESOURCE DEVELOPMENT PLAN
FOR
RECREATIONAL-ENVIRONMENTAL CORRIDOR

SECTION I - INTRODUCTION

PURPOSE

The purpose of this annex is to provide a basis for development of a recreational-environmental land corridor, should residents of the Chicago-South End of Lake Michigan (C-SELM) area elect to maintain the flood plain in open-space usage. Many of the local, multi-county and State planning agencies have urged that the flood plains be developed to meet the area's needs for in-close recreational pursuits. This would prove beneficial, provided the usage was planned along with allied environmental concerns.

As the nation upgrades the water quality of its streams, the recreational value of these watercourse will be increased. Moreover, as storm water runoff is controlled, treated, and used to augment the stream flow, the opportunity to utilize the adjacent flood plain land for recreational and environmental purposes is enhanced. Therefore, this special study was undertaken to provide the basis for incorporating an effective recreation and conservation program in the open space lands bordering the area's streams.

This planning effort is designed to illustrate a way to increase and enhance the potential recreation benefit expected by improving water quality and controlling stream flows. The plan of improvement calls for controlling permanent development within the flood plain, placing major emphasis on satisfying as much of the concentrated urban demand for recreational opportunities as is possible, and providing the basis for an effective preservation and resource restoration program. The major streams in the study area include the DuPage, DesPlaines, Chicago, Little Calumet, Grand Calumet, and Deep Rivers, and their tributaries.

ACKNOWLEDGEMENT

Much of the working effort was provided by members of the community and local planning agencies. Those who assisted in the development of this plan included: (1) members of the Citizens Advisory Committee for Conservation and Environmental Interests, a voluntary group who participated in the wastewater management study, (2) officials from Counties, Park and Forest Preserve Districts, communities and local planning agencies located within the study area, and (3) other Federal and State agencies concerned with water resource developments, particularly recreation and conservation practices. It was only through the efforts of these participants that the plan of improvement was developed.

SECTION II - FRAMEWORK FOR DEVELOPMENT

PLANNING PROCESS

In order to provide a realistic framework for development, it was decided to select a stream for detailed analysis. In this case, the North Branch of the Chicago River was used. Then a questionnaire was prepared to determine what types of stream-related problems exist and what remedial, conservation and recreational programs should be considered. This questionnaire was furnished to citizens, primarily conservationists, with intensive knowledgeable of that area. In this way the input to the study was comprehensive and reflective of the type of information which would be received from a much larger sampling.

The foregoing information was then used as a framework for designing a plan of improvement for the North Branch. This plan in turn, was used as a prototype and the findings applied to the other streams in order to define the potential available to the residents of the total area. While the use of the urban streams and adjacent lands are closely related to the physical condition of the stream and property ownership, there are sufficient similarities to justify this approach. If and when recreational usage of the urban watercourses becomes a planning priority, the basic efforts to balance recreational and environmental programs will be comparable.

BASIS FOR DESIGN

The North Branch of the Chicago River was selected because: (1) it involves an area where the residents are actively promoting specific conservation and recreation programs and thus are knowledgeable of the local problems; (2) the nature and diversity of the stream and land-related problems are such as to be considered typical of those expected to occur over time throughout the study area; and, (3) the demographic conditions (population characteristics) are considered representative of the urban area. Consequently, any plan which would be responsive to the problems and opportunities for recreational and conservation programs for this river would be feasible for being implemented elsewhere.

As previously indicated the responses to the questionnaire served as the basis for establishing the planning framework. Seventy-three percent of the responses to the questionnaire indicated inadequate flow in the North Branch during the recreational season as one of the major problems. Since each response was site specific, this percentage had a great relevance to the wastewater management study. It was also interesting to note that one hundred percent of the responses cited poor water quality as a critical problem. Eighty-five percent also expressed concern about an inadequate or non-existent fish population and seventy-eight percent cited lack of public access to the river. While a range of improvements were suggested, major emphasis was placed on the use of the stream and the need for access to the stream and provision of public facilities. The results of the questionnaire survey are summarized in Table GB-II-1.

TABLE GB-II-I

SURVEY RESULTS
NEED INVENTORY
NORTH BRANCH OF THE CHICAGO RIVER

PROBLEM INDICATED	No.	SUGGESTED IMPROVEMENT	No.
Poor water quality	41	Improved waste treatment	--
Dam in disrepair (one location)	1	Repair dam or replace with wing deflector	1
Crumbling Revetments (nine locations)	9	Repair or Replace	8
		Cover with vines	1
Poor quality fishery	13	Grow water plants for habitat	1
No fishery	21		
Good fishery-carp	1	Flow augmentation	--
Inadequate flow during recreational season	30	Flow augmentation	--
		Planting to encourage scouring action	--
Bank erosion	15	Planting to prevent erosion	6
(Poor Access)	20	Bank Fishing sites	20
	1	Bridge Fishing site	1
	11	Boat launching and Take/out	11
(Ignoring river as a resource)	--	Public awareness of the value of a stream	--
Litter, Natural and Man-made debris	8	Clean-up	1
		Planting and fencing	3
(Esthetic quality)	11	Beautification planting	11
	1	Beaches	1
(Lack of facilities)	2	Boat portage	2
	11	Trails or walkways	11
	1	Park-playground	1
	3	Picnic areas	3
	1	Footbridge	1
	2	Acquire land	2
	2	Stream-use zoning	2
PROBLEMS INDICATED (Categories)	205 (11)	SUGGESTED IMPROVEMENTS (Categories)	87 (19)

PLANNING CONSIDERATIONS

Certain assumptions were made as part of the plan-formulation process. These included the basic requirements that both the water quality and aquatic ecosystem would be upgraded. Implicit in this basic assumption was the establishment of an effective program to capture and treat storm water runoff in order to avoid a degradation of the stream quality. In addition, it was assumed that the treated storm water and wastewater would be distributed in such a way as to (1) maintain a minimum stream base flow and (2) provide supplemental increased flows during the recreational season. All of these requirements would be met by the NDCP alternatives.

The primary planning effort thus involves the delineation of selected river frontage for public usage and conservation practices; thereby providing a balanced framework for resource utilization. Formulation was based on incorporating the following in any proposed plan of improvement: (1) a base of stream-oriented and related land recreation facilities; and, (2) a greenbelt for instituting a program for restoration and enhancement of the existing environment. Creation of such a managed environment would, in turn, require the consideration of two other factors: (1) existing usage of the land bordering the river; and, (2) optimum usage of the river and the adjacent lands in order to avoid an over-use and subsequent degrading in the quality of recreational experience and/or environmental enhancement. Effective implementation would include: fee acquisition of those areas suitable for stream-related fishing and general recreational activities, recreational use zoning, open space zoning, controlled access, application of cultural or land-use control easements, and vegetative management to achieve separation between different programs and resource commitments. Other specific developments considered were: planting to control flood plain erosion, repair of existing dams and bank revetments, construction or restoration of impoundments and lagoons, and the provision of riffles, deep pools, and shade trees to encourage in-stream production of desirable fish species.

DEVELOPMENT REQUIREMENTS

Achievement of the program's objectives would require control of land on either side of the stream, with adequate length to assure a base large enough to incorporate good management practices. Certain sites on the stream would be preserved or restored and then retained in their natural state; others would be developed for fishing and general recreational opportunities. It is suggested that sites for general recreational use be located within city or village limits whenever possible. This would facilitate providing adequate parking spaces and help control public access. Construction of small impoundments which could be used for various recreational pursuits should be encouraged on public lands. Location of these water bodies would be up to the discretion of the local land holding agency involved. Interest in these type of clean water impoundments have been expressed by numerous park and forest preserve districts in the area.

Since a good portion of the flood plain acreage is still undeveloped and in some cases is in public ownership, river corridors are conceptually feasible throughout the area. Preserve land would remain "preserved" largely for hiking trails or wildlife habitat. Additional lands would have to be purchased, and supplemented by easements and zoning ordinances in order to insure a continuity of control and use. Lands may also have to be purchased at the perimeter of recreation areas for parking. The corridor would be a mix of public and private ownership, with restricted-use easements (for preservation) required on certain acreages retained in private ownership. A strip of land 40 to 300 ft. in depth from the high bank on both sides of the stream is considered a sufficient working acreage for management and development programs. Dedication of this land would be variable, i.e. the depth would not be constant. No relocation and resettlement would be considered where residences and industry now exist.

Land outside the areas of intense recreational development, especially between communities, would be retained as open space with emphasis on restoration and/or preservation of the undeveloped lands. Allied with this environmental control program would be the provision of certain types of recreational activities that would complement the constrained land use. These recreational programs would include hiking trails, bicycle trails nature trails, bank fishing and the like. Adjacent lands presently in public usage including golf courses would remain committed to that use. Where these lands are being considered for conversion to other uses, every effort should be made to purchase these lands and retain them in public ownership.

Specific landscaping with adequate buffer zones also must be provided to separate the green belt areas from the recreational areas. In addition, plantings will be needed along the banks to enhance the stream's aesthetic value. Recreational-use zoning should be extensively used - both on the stream and in relation to the land developments. This should help control noise pollution and excessive usage in areas that are essentially residential and where present development precludes providing a sufficient buffer zone. This concept also applies to in-stream usage, particularly boating and its impact on other pursuits such as swimming and fishing. Zoning for different types of boating will also be required and must be correlated to the depth of flow and stream environment.

SECTION III - NORTH BRANCH PROTYPE MODEL

OVERVIEW

Three specific land corridors would be established for the North Branch and its tributaries as is shown in Figure GB-III-1. The first corridor would extend some 24.5 miles from the confluence of the river with the North Shore Channel, proceed up the main stem of the North Branch and along the Skokie River to Highland Park. A second corridor, some 13 miles long would extend from the confluence of the West Fork with the Main Stem, and proceed up the West Fork to Half Day Road, near Lincolnshire. The third corridor would proceed up the Middle Fork from its confluence with the Skokie River to half Day Road. There is justification for stopping the river corridors at these points, since the size of the three streams restricts usage. A corridor beyond Half Day Road would have to focus on the land related developments only.

Intensified recreational developments would be planned within or adjacent to the community limits. The lands would be purchased in fee and developed for fishing sites, general recreational facilities and boat launching and take-out areas. No vehicular traffic should be allowed in the recreational and conservation areas. Rather, off-site parking should be provided. Bridges, or road crossing points could serve as center points for access to the recreational areas. However, as a general rule, recreation areas should be located between rather than immediately adjacent to major road crossings. A turn-out area at a road crossing may entice someone to explore the corridor but should not be considered a major focal point for access.

DEVELOPMENT PROPOSALS

Two types of developments were considered for incorporation within the land corridors. The first was responsive to an intensive type of general recreational usage; the second was for environmental enhancement.

A range of recreational programs were considered, with adoption dependent upon the size of acreage available for development. All told, five different programs were considered for use on those lands which would be purchased in fee. A summary description of these five is presented below.

1. County Park. This type of development program would be designed to help meet the recreational needs of a multiple number of adjacent communities. Primary beneficiaries would be those communities located within a time-distance traveled equivalent of from 10 to 20 minutes. An extremely diversified array of recreational pursuits would be provided and as such would require a fairly large area, ranging in size from 500-800 acres. Additional water-related opportunities other than those oriented to in-stream usage would be provided by construction of excavated lagoons and swimming pools. An artist concept of this type of development is shown in Figure GB-III-2. A cost estimate for development of this type recreational package is presented in Table GB-III-1.

NORTH BRANCH, CHICAGO RIVER
PROTOTYPE STUDY AREA

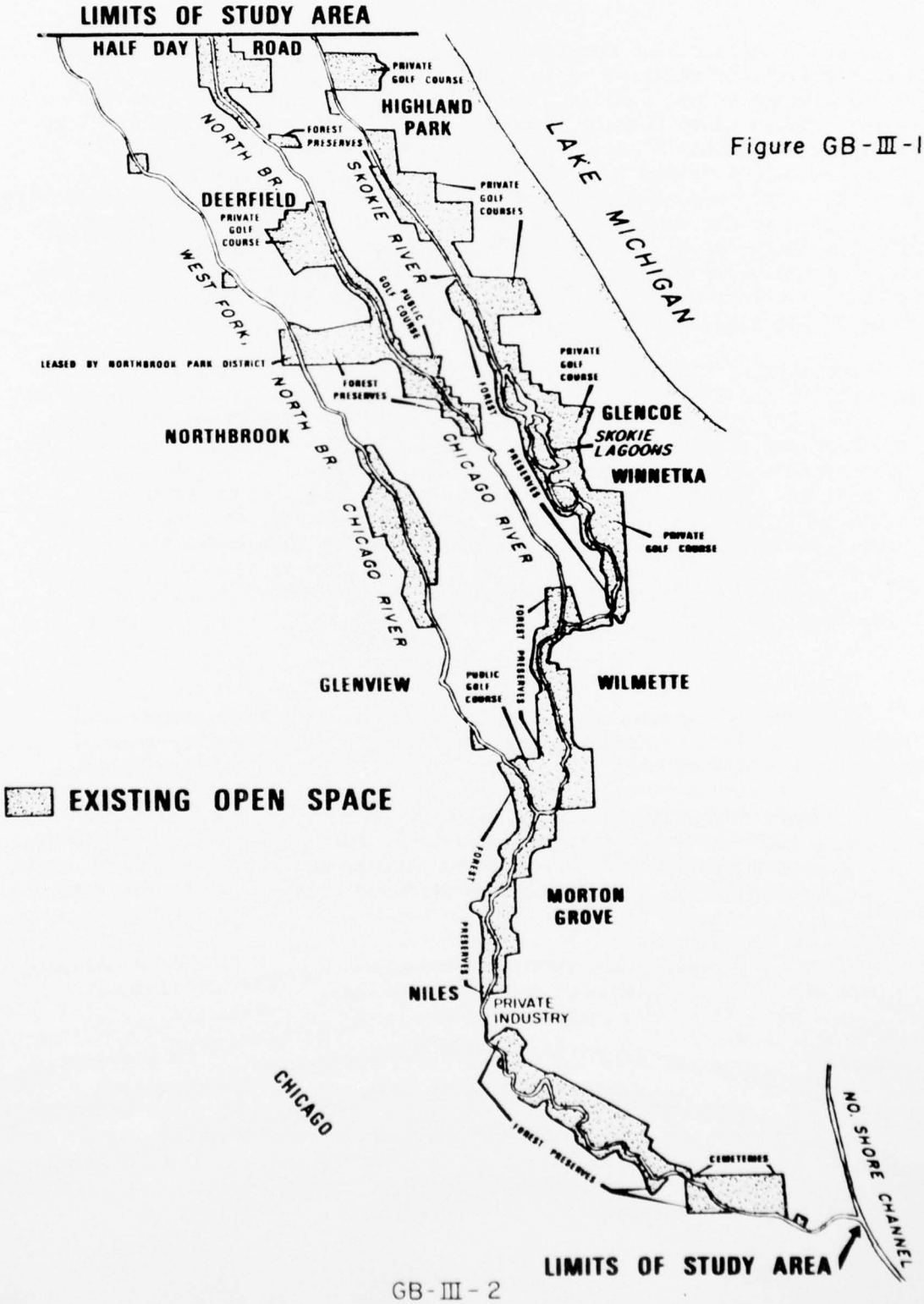
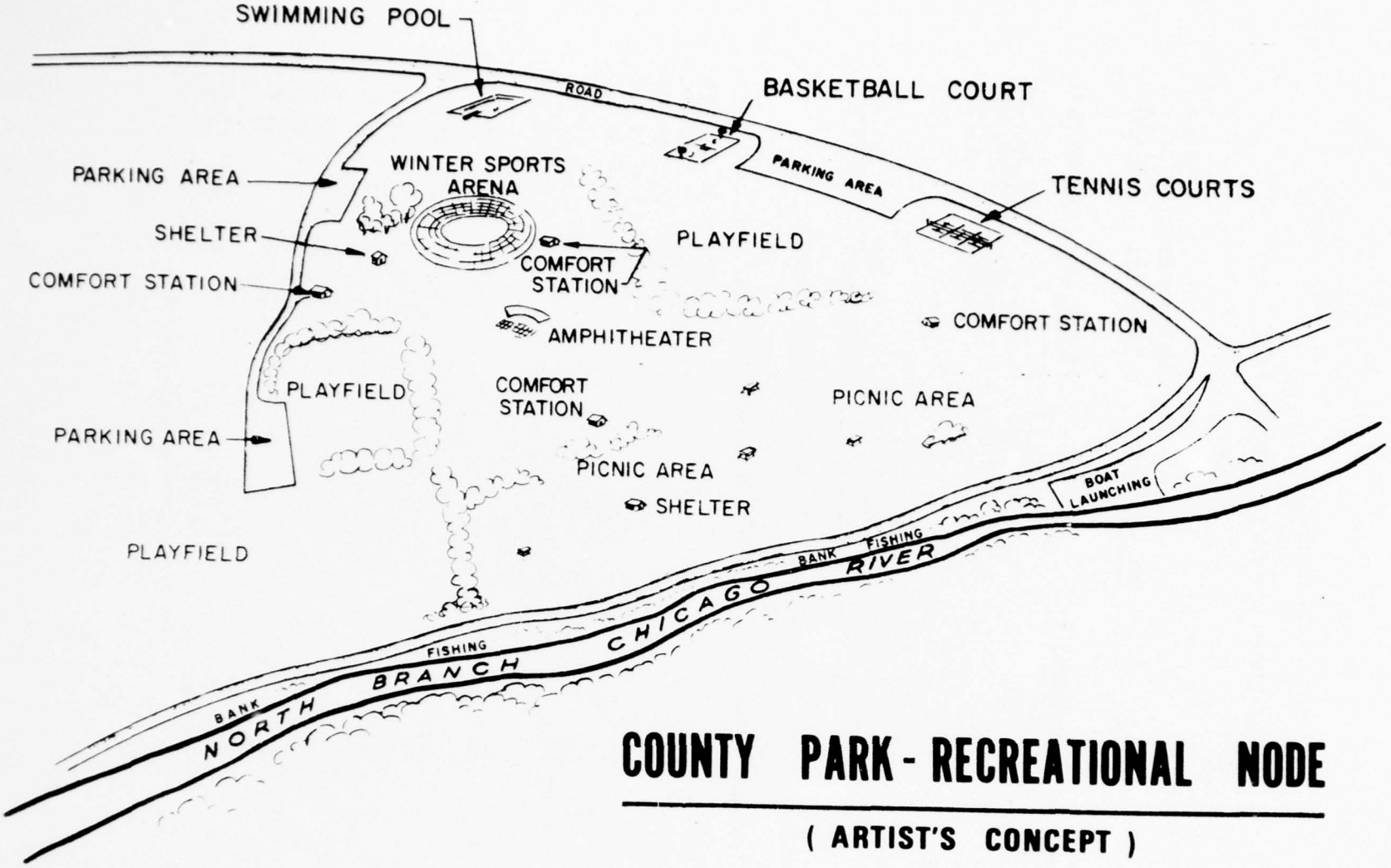


Figure GB-III-1



COUNTY PARK - RECREATIONAL NODE

(ARTIST'S CONCEPT)

Figure GB - III - 2

TABLE GB-III-1

FACILITIES AND COSTS - COUNTY PARK

Facility	Unit	No. of Units	Unit Costs (Dollars)	Estimated Cost (Dollars)
18-hole golf course	(100 Acres)	1	1,000,000	$1,000,000
Lagoons	Acres	300)		
Earth Molding	Sq. Ft.	300 acres)		5,000,000
Plantings - a	Acre	300 acres	2,500	750,000
Bridges - b	Each	3	15,200	45,600
Walking trail	Li. Ft.)			
Bicycle trail	Li. Ft.)	26,400	10	264,000
		Subtotal, Recreation Base		$7,059,600

a - Trees 8-10 ft. in height, 25 to the acre, various species.

b - 40 ft. long, 6 feet wide, wooden plank, $380/running ft.

Tennis Courts	Pair	8	8,000	$ 64,000
Swimming Pool	Each	1	100,000	100,000
Picnic Units	Each	50	210	10,500
Boat Launch	Ramp	4	3,600	14,400
Asphalt Drive	Li. Ft.	2,500	15	37,500
Parking Area	Sq. Ft.	4,000	5.50	22,000
Comfort Station	Each	2	42,600	85,200
		Subtotal, Rec. Node #1		$ 333,600
Play Field	Each	2	2,400	$ 4,800
Basketball Court	Each	2	5,000	10,000
Baseball Diamond	Each	3	500	1,500
Picnic Units	Each	50	210	10,500
Playground Equip.	Unit	1	10,000	10,000
Comfort Station	Each	2	42,600	85,200
Shelter	Each	1	38,400	38,400
Parking	Sq. Ft.	8,000	5.50	44,000
Roadway	Li. Ft.	5,000	15	75,000
Walkway	Li. Ft.	5,500	10	55,000
		Subtotal, Rec. Node #2		$ 334,400

TABLE GB-III-1 (Cont'd)

Facility	Unit	No. of Units	Unit Costs (Dollars)	Estimated Cost (Dollars)
Outdoor Amphitheatre	Each	1	$48,000	$ 48,000
Boat Launch	Ramp	4	3,600	14,400
Boat Rental	Each	1	50,000	50,000
Information Center	Each	1	6,000	6,000
Picnic Units	Each	30	210	6,300
Comfort Station	Each	1	42,600	42,600
Shelter	Each	1	38,400	38,400
Parking	Sq. Ft.	4,000	5.50	22,000
Roadway	Li. Ft.	3,000	15	45,000
Walkway	Li. Ft.	1,500	10	15,000
		Subtotal Rec. Node #3		$ 287,700
Picnic Units	Each	100	210	$ 21,000
Beach	Sq. Ft.	100,000	.30	30,000
Shelter	Each	3	38,400	615,200
Comfort Station	Each	3	42,600	127,800
Parking Area	Sq. Ft.	5,000	5.50	27,500
Road	Li. Ft.	1,500	10	15,000
		Subtotal, Rec. Node #4		$ 949,000
			SUBTOTAL	$8,964,300
			Contingencies	1,792,700
			Engineering and Design	1,076,000
			Supervision and Administration	967,000
			(June 1972 price level) TOTAL	$12,800,000

2. Community Park. This type of development program would be oriented towards meeting the recreational needs of the immediately adjacent community(s). In essence it represents a scaled-down version of the County Park, being sized to utilize an area of some 100 to 150 acres. Again a diversity in recreational opportunities is maintained but the number of facilities are reduced. Most of the usage will come from the residents who live within a 10 minute time-distance travel equivalent of the park. A cost estimate for this type of development program is presented in Table GB-III-2.

3. Neighborhood Park. This park would be designed to serve those neighborhoods within 5 minutes time-distance travel equivalent. Consequently, the size of the park will be comparatively small, requiring only some 10-20 acres. The park will be oriented to encourage visual enjoyment of the stream and normal park type facilities will be provided for family usage. A cost estimate for this level of development is presented in Table GB-III-3.

4. Vest-Pocket Park. This type of park is designed to advantageously fit into small open space parcels of from 5 to 10 acres located adjacent to high-density urban areas. In most cases the lands will be more linear in character and consequently, stream frontage will be its prime attraction. Because of its size, its function and usage will be similar to the neighborhood park. A cost estimate for this level of recreational development is presented in Table GB-III-4.

The environmental phase of the development program would serve several purposes. Its main function would be to provide green belts along the stream, thereby enhancing the aesthetics of the area and stream's environment. At the same time some of the green belts also would serve as linear recreational development areas inter-connecting the various types of recreational parks. The types of development required for this type of program are primarily constrained to restoration and nature-educational activities. Major emphasis would be to preserve those areas of existing value and to enhance the existing vegetative pattern with an extensive reforestation program. Trees, shrubs and ground cover plants would be introduced that are either native to the area or climate-adapted species. Planting would be designed to provide informality, separation of corridor usage, screening and erosion control, and would take into consideration existing and future land use of the adjoining property. These measures would not only enhance the aesthetic enjoyment of the outdoor recreational activities, but, if properly managed, help improve the aquatic ecosystem of the stream. Shade trees and protection against bank erosion should help maintain a high level of fishery production.

CORRIDOR REQUIREMENTS

Based on input received from local agencies and residents, nine sites were selected for incorporation into the North Branch recreational program. Listed in Table GB-III-5 are the nine site, the acreage required and the type

TABLE GB-III-2

FACILITIES AND COSTS-COMMUNITY PARK

Medium Development	Unit	No. of Units	Unit Costs (Dollars)	Estimated Cost (Dollars
Swimming Pool	Each	1	$200,000	$ 200,000
Play Field	Each	3	2,400	7,200
Winter Sports Arena	Each	1	50,000	50,000
Picnic Units	Each	150	210	31,500
Amphitheater	Each	1	48,000	48,000
Boat Launching (Concrete Ramp)	Each	3	3,600	10,800
Tennis Courts	Each	4	50,000	200,000
Comfort Station	Each	9	42,600	383,400
Shelter	Each	5	38,400	192,000
Utility	Lift	1,000	24	24,000
Signs	Each	20	60	1,200
18' Asphalt Dr.	Lift	10,000	15	150,000
Parking Spaces	Sq. Yd.	16,000	5.50	88,000
Guard Rail	Ft.	20,000	6.00	120,000
Landscaping	Acre	2,400	75	180,000
Miscellaneous			10,000	10,000
			Subtotal	$1,649,100
			Contingencies	329,900
			Engineering and Design	198,000
			Supervision and Administration	193,000
		(June 1972 price level)	TOTAL	$2,370,000

TABLE GB-III-3

FACILITIES AND COSTS-NEIGHBORHOOD PARK

Small Recreation Area	Unit	No. of Unit Costs	Unit Costs (Dollars)	Estimated Cost (Dollars)
Information Center	Each	1	$ 6,000	$ 6,000
Picnic Unit	Each	20	210	4,200
Playground Facilities	Each	2	1,000	2,000
Landscaping	Acre	10	2,400	24,000
Walkways	Li. Ft.	500	10	5,000
Signs	Each	5	60	300
Parking Spaces	Sq. Yd.	2,000	5.50	11,000
Comfort Station	Each	1	42,600	42,600
Miscellaneous	Lump sum		2,000	2,000
			Subtotal	$ 97,100
			Contingencies	19,900
			Engineering and Design	12,000
			Supervision & Admin.	11,000
		(June 1972 price level)	TOTAL	$140,000

TABLE GB-III-4

FACILITIES AND COSTS-VEST-POCKET PARK

Small Recreation Area	Unit	No. of Units	Unit Costs Dollars	Estimated Amount Dollars
Picnic Unit	Each	10	210	$ 2,100
Playground Facilities	Each	1	1,000	1,000
Landscaping	Acre	5	2,400	12,000
Walkways	Li. Ft.	250	10	2,500
Comfort Station	Each	1	42,600	42,600
Miscellaneous	Lump sum		1,000	1,000
			Subtotal	$61,200
			Contingencies	12,800
			Engineering and Design	7,000
			Supervision & Admin.	7,000
			(June 1972, price level) TOTAL	$88,000

TABLE GB-III-5

RECOMMENDED RECREATIONAL DEVELOPMENTS
NORTH BRANCH OF THE CHICAGO RIVER

Site No.	Size	Recreational Facilities
1.	1.9 acres	Neighborhood Tot-Lot (Chicago Park District is considering adding this acreage to existing park)
2.	66.0 acres	Retained as 9-hole golf course
3.	4.0 acres	Vest-Pocket Park Area
4.	797.1 acres	County Park
5.	22.0 acres	Neighborhood Park Area (see Table G-2)
6.	20.0 acres	Neighborhood Park Area (see Table G-2)
7.	110.2	Community Park Area with Linear Development
8.	261.9	Combination of Community Park Linear Development encompassing both a neighborhood park and Nature Center suggested because of preservation of wetlands
9.	20.0	Neighborhood Park Area

of recreational program recommended for each site. Location of these sites are shown in Figure GB-III-3 and reflect optimum usage of the available open space, spatial distribution as well as local planning efforts. In addition, some 6 miles of linear corridor would be purchased in fee to supplement existing Forest Preserve and Park holdings. A system of hiking and bicycling trails would be provided and a base reforestation program would be incorporated, equivalent to replanting some 240 acres.

Supplemental to the foregoing fee purchase program would be the incorporation of restrictive-sized green belts paralleling the stream. The width of the linear green belts would be dependent upon the use-function associated with these lands. For purposes of this study, these lands would serve to establish a buffer zone between the river and existing land usage and enhance the over-all aesthetic and stream environment. As such, cultural (restrictive land use) easements would be required, some 20 feet in depth from high bank. Private ownership would be retained and no public usage would be involved. If, however, a public passage was desired, then the acreage requirements would have to be increased and the lands purchased in fee. The location of these eight linear easement corridors, A through H, are also shown in Figure GB-III-3.

DEVELOPMENT COSTS

The capital costs for establishing the recreational-environmental corridor was determined using the plan of improvement outlined in the previous paragraph. First the land costs were developed as the base step in implementing the plan of improvement. The land costs for the nine recreational parks and 6 miles of linear corridor both of which would be purchased in fee are presented in Table GB-III-6. Also shown are the costs for eight linear sites for which cultural or restrictive use easements would be obtained. Then the costs for the recreational parks, together with the minimum base reforestation program for the 6 miles of linear corridors were combined to establish a total base cost for the North Branch area of the Chicago River. Also included was the cost of river bank clean-up and restoration that would be required to obtain a base level of aesthetics. Cost for this work was based on contractural work previously performed by the Chicago District, Corps of Engineers on a section of the North Branch. Other costs for additional programs could be included as desired. These improvements, however, would be site specific to a need unique to a particular area but not appropriate for consideration in a prototype model. The total cost for the North Branch prototype model is shown in Table GB-III-7. This cost excludes those lands already in public ownership. These lands, particularly those owned by the Forest Preserves and Park Districts, form the framework in which to incorporate the management of the corridors and recreational programs.

AD-A036 649 CORPS OF ENGINEERS CHICAGO ILL CHICAGO DISTRICT F/G 13/2
WASTEWATER MANAGEMENT STUDY FOR CHICAGO-SOUTH END OF LAKE MICHI--ETC(U)
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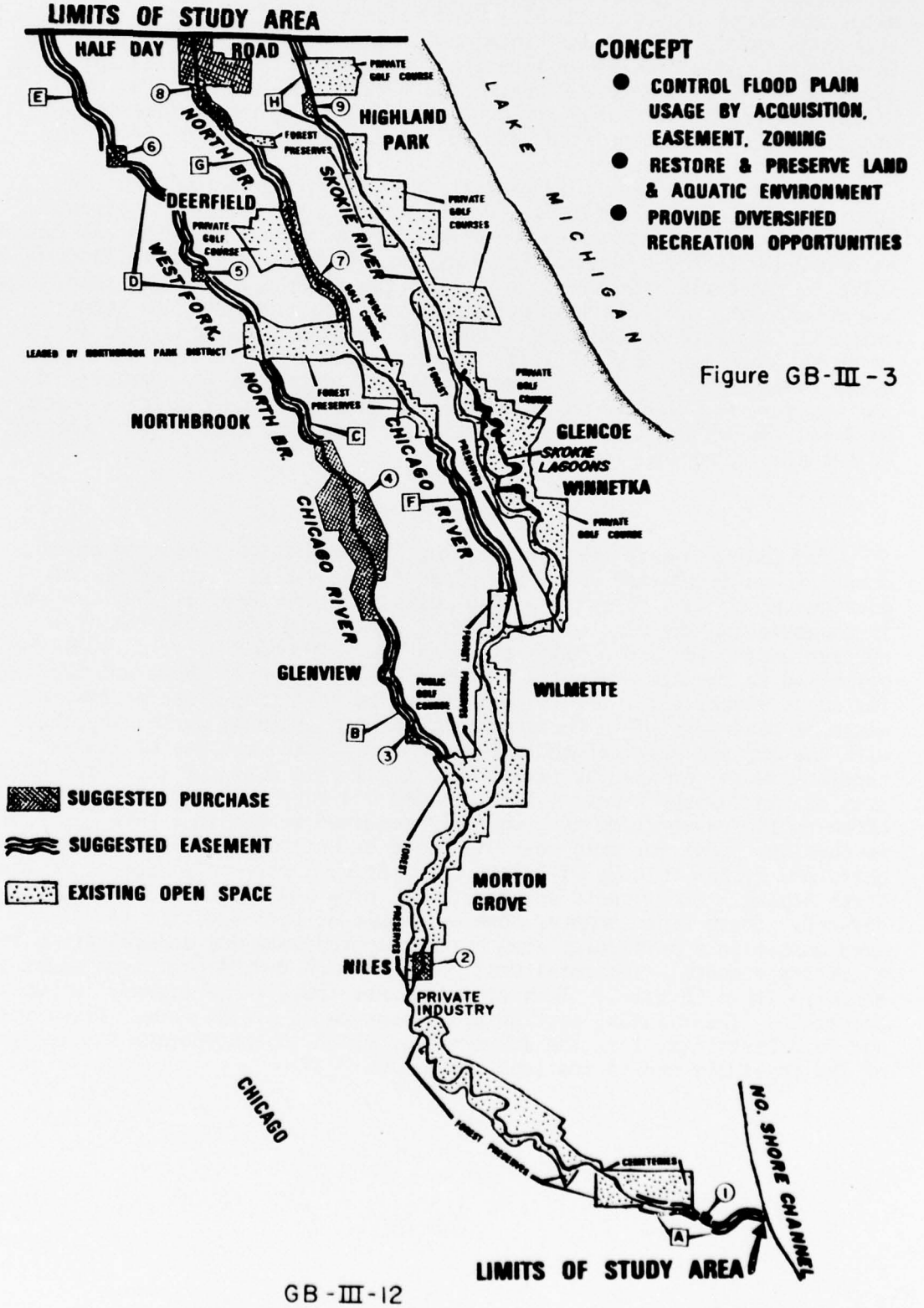
NORTH BRANCH, CHICAGO RIVER

PROTOTYPE STUDY



CONCEPT

- CONTROL FLOOD PLAIN USAGE BY ACQUISITION, EASEMENT, ZONING
- RESTORE & PRESERVE LAND & AQUATIC ENVIRONMENT
- PROVIDE DIVERSIFIED RECREATION OPPORTUNITIES

Figure GB-III-3

TABLE GB-III-6

LAND COST REQUIREMENTS
NORTH BRANCH, CHICAGO RIVER

Recreational Parks-
Fee Acquisition

Site No.	Acres	Approx. Value/Acre 1/	Estimated Cost
1.	1.9	$40,000	$ 76,000
2.	66.0	55,000	3,360,000
3.	4.0	40,000	160,000
4.	797.1	25,000	19,927,500
5.	22.0	25,000	550,000
6.	20.0	12,000	240,000
7.	110.2	25,000	2,755,000
8.	261.9	8,000	2,095,200
9.	20.0	55,000	1,100,000
	1,303.1	Subtotal	$30,533,700
		Contingencies	6,106,300
		Acquisition Cost	2,560,000
		TOTAL	$39,200,000

Linear Corridor - Fee Acquisition

Linear Miles	Cost/mile	Estimated Cost
6 Miles	$40,000	$ 240,000
Contingencies & Acquisition Costs		70,000
	TOTAL	$ 310,000

Green Belt Corridor - Restrictive - Use Easements

Site	Acre 2/	Cost/Acre 3/	Total
A	7.8	$28,000	$218,400
B	12.6	24,000	302,400
C	6.4	20,000	128,000
D	14.2	20,000	284,000
E	11.0	9,600	105.600
F	9.7	20,000	194,000
G	10.6	24,000	254,400
H	7.4	20,000	148,800
	79.7	Subtotal	$1,634,800
	Contingencies & Acquisition Costs		465,200
		TOTAL	$2,100,000

1/ Based on direct or interpolated information from the 1971 Olcott's Land Values Blue Book of Chicago. No allowances have been made for on-site improvements.

2/ Based on linear distance multiplied by a 20-foot width requirement on both sites of stream.

3/ Based on 80% of estimated land value.

TABLE GB-III-7

PROTOTYPE MODEL COST ESTIMATE
NORTH BRANCH, CHICAGO RIVER

I. RECREATIONAL PARKS	
Recreational Facilities	$18,250,000 1/
Land Costs (9 park sites)	39,200,000
Total	$57,450,000
II. LINEAR CORRIDOR	
Fee Acquisition	$ 310,000
Reforestation (240 acres)	24,000
Total	$ 334,000
III. GREEN BELT CORRIDOR	
Easement Cost (8 sites)	$ 2,100,000
IV. RIVER BANK CLEAN-UP/RESTORATION	
48 miles @ $20,000/mile	$ 960,000
Total Cost for Base Corridor	$60,844,000 2/

1/ Based on costs previously cited for range of parks plus $60,000 for Site 1. No developments cost included for golf course.

2/ Excludes present publically-owned lands and developments.

PROTOTYPE ANALYSIS

Subsequent to development of the North Branch prototype, factors were derived that could be applied to other streams within the C-SELM area. Four basic design factors were needed (1) percent of stream feasible of being developed (2) relationship between areas retained for preservation and recreational use (3) unit cost per mile of stream (4) estimated recreational usage as a measure of worth.

Analysis of the North Branch and tributaries indicated that a corridor for recreational and preservation purposes could be incorporated on lands bordering some 80 percent of the streams' length. This amounted to a total of some 48 river miles. Of this developable length of stream, some 60% or 28.8 miles would be preserved, retained as an equivalent of a Forest or Park District. The recreational development and usage would be concentrated in approximately 20 percent or 9.6 miles of stream. The rest, again 20 percent or 9.6 miles of streams would be retained in low-density recreational usage, including golf courses, bicycle and walking trails and the like. This pattern of development seeks to maintain a balance in use. It strives to prevent any extensive recreational usage of the preserve-type lands. These lands should be used for conservation practices and retained in low-density usage.

The extent that the foregoing land-use pattern could be maintained will ultimately be determined by the usage that the recreational areas can sustain. Accordingly, an estimate of the user-days anticipated for each of the nine recreational sites was prepared. These estimates were based on a 6-month use season extending from 15 April to 15 October, seven-day week availability. Since the parks would be close to highly concentrated residential areas, the use rates reflected a high daily turn-over and passive as well as active use patterns. Furthermore, because the parks offered different recreational opportunities, the use rates also varied. The range of usage which can be expected based on the acreage and opportunities available within the nine parks are shown in Table GB-III-8. These figures do not include any recreational usage on forest preserve lands.

To determine an applicable unit cost per linear length of usable stream mile, the cost ($60,844,000) for the add-on features shown in Table GB-III-8 was used. As noted, this was a base cost and did not include an allowance for the linear equivalent of the existing Forest and Park lands. Accordingly, a linear corridor equivalent to 300-foot wide on both sides of the stream and extending for a length of approximately 29 miles was used. This meant a cost addition equivalent to some 730 acres or $37,500,000. Then based on the sum of the foregoing costs or $98,344,000 for some 48 miles of stream, an approximate cost, of 2,100,000 per mile was derived. If the lands to be preserved (Forest lands) were to be increased from 300 to 900 feet on both sides of the streams as some have suggested to more closely approximate current holdings, then the linear cost will be appreciably increased - to some $3,200,000 per mile. Final decisions can only be made after stream inventories are completed.

TABLE GB-III-8

PROJECTED ANNUAL RECREATIONAL USAGE
NORTH BRANCH, CHICAGO RIVER PROTOTYPE MODEL

Site No.	Type Development	Acres	Annual Use Rate/Acre	Projected Usage (Recreation Days) per year)
1	Neighborhood Tot-Lot	1.9	35,000	66,500
2	Golf course	66.0	12,000	792,000
3.	Vest-Pocket Park	4.0	30,000	120,000
4	County Park	797.1	4,300	3,427,500
5	Neighborhood Park	22.0	18,500	407,000
6	Neighborhood Park	20.0	18,500	370,000
7	Community Park a/	110.2	10,800	1,190,200
8	Community Park b/	261.9	8,100	2,121,300
9	Neighborhood Park	20.0	18,500	370,000
	Total Acreage	1,303.1	Projected Usage (per year)	8,864,500
			Say	8,800,000/year

a/ Includes linear development.

b/ Includes linear development encompassing both neighborhood park and nature center.

APPLICABLE CONSERVATION PROGRAMS

Federal grant recreation and conservation funding programs available to State and local agencies for such programs as the land corridor include the Land and Water Conservation Program, the Open Space Land Program, and the Urban Fishing Program. The following discussion will briefly define these programs.

a. Land and Water Conservation Program. The Land and Water Conservation Program is authorized by the Land and Water Conservation Fund Act of 1966 and is administered by the Bureau of Outdoor Recreation, Department of the Interior. Grants are made to states, and through them to local governments for planning, acquisition and development of public outdoor recreation areas and facilities. Grants are made to finance 50 percent of allowable project costs.

b. Open Space Land Program. The Department of Housing and Urban Development administers this program. An Open Space Kit which gives detailed program information is available to interested communities. Briefly described, the Open Space Land Program provides grant assistance (up to 55%) to local public agencies for acquiring and/or developing land for open space purposes. Acquisition of lands in less-than-fee simple is allowable under the program. It is necessary for development or improvement to be carried out on publicly owned or controlled land. The Program will not provide assistance in the form of reimbursement for costs incurred prior to an applicant's reception of a letter authorizing him to proceed at his own risk.

c. The Urban Fishing Program. This program is administered by the Bureau of Sport Fisheries and Wildlife, Department of the Interior. This program by definition is not directly applicable to the prototype program for the North Branch of the Chicago River as such but is worth noting. Recent attempts have been made to introduce fishing as a readily available and functional form of recreation in "core" city areas. Metropolitan area waters open to public use are generally of poor quality, thereby restricting the existence of desirable fish populations and negating satisfactory angling experience. Proper orientation of regional waste treatment systems, as previously discussed, can provide a water supply of sufficient quality and quantity to encourage desirable fish populations and likewise urban fishing in metropolitan areas. The Urban Fishing Program should become more attractive to the Chicago Metropolitan Area when water qualities improve. Two methods have been tried to introduce fishing into certain metropolitan areas: (1) busing city youths to stocked ponds outside the metropolitan area; and, (2) stocking fish in municipal park ponds and lakes within low income neighborhoods.

Of the two methods, bringing the fish to the people was the most effective. In a sample program, St. Louis, Mo. in 1971, wild-trapped carp and bullhead catfish provided city dwellers with 80,000 man-days of recreation angling. In 1971 the total cost per fisherman day was only

38 cents. Tighter management and improved stocking rates should insure that the 1972 program results will show a 25 cents or less cost per fisherman day.

The Illinois Department of Conservation is interested in the use of two of the Chicago Park District's lagoons for an urban fishing "put-and-take" operation. The park district has 72 acres of ponds and lagoons in high priority, low-income neighborhoods. Based on the 4,000 user days per surface acre of water generated in the St. Louis program, if these 72 acres of lagoons were stocked, the Chicago Urban Fishing Program would result in almost 300,000 user days of totally new inner city recreation.

Although these intensive Urban Fishing Programs are extremely effective to introduce angling to the young, unemployed and retired city citizens, even more urban fishing potential exists. This "potential" could be realized by improving water quality in streams, lakes, ponds, quarries and lagoons within and adjacent to metropolitan areas. Water of improved quality, where public access is obtainable, can sustain new and varied types of outdoor recreation to the urban population, such as:

(1) Natural, self-sustaining game fish populations in suitable streams and park impoundments of high quality water.

(2) Put, grow and take fisheries. Small fish are stocked, grown to catchable size, and then harvested under controlled conditions.

(3) Put-and-take fisheries. Catchable sized fish are stocked and harvested with application of enforced creel limits.

(4) Trophy fish waters. Only large sized fish may be creeled. Artificial lures are usually required and the water fished only during daylight periods.

(5) Fish and pay operations. Local villages operate a lake under a minimal daily fee system with monies collected financing the restocking of catchable fish.

(6) Nature interpretive centers. Areas are established and facilities developed for the interpretation of both terrestrial and aquatic ecosystems.

(7) Conservation-education workshops and outdoor classrooms. These classrooms can be designed using programmed teaching facilities for instruction of urban children to basic environmental concepts.

Technical assistance in reusing the reclaimed water, developing recreation facilities and establishing fish populations requires the joint efforts of organizations such as the Department of the Interior and State Conservation Departments of both Illinois and Indiana. Local agencies and local sponsors must be expected to assume much of the financial burden and assist in administering the program. Such a task force can develop valuable and people-oriented outdoor recreation programs, with primary emphasis on the utilization of presently unusable water areas.

COORDINATION

As previously indicated the basis for this plan of improvement were the responses to a questionnaire distributed to conservationists and other interested citizens in the study area. Information gathered from park districts and forest preserve districts through questionnaires and informal meetings were also incorporated in the model. The preliminary and revised drafts were presented to representatives from park districts, forest preserve districts, and villages along the North Branch. They were also presented to representatives from appropriate conservation and planning agencies at regional, State and Federal levels. Responses and comments received on the drafts include:

a. General Comment. The river corridor program is generally acceptable (at all levels of coordination).

b. North Branch Comments Received from Park Districts, Forest Preserve Districts and Villages.

(1) Glenview: The village is very interested in the river corridor concept for the North Branch particularly since it reflects their own "West Fork Green" plans. The land acquisition program recommended by Glenview has been incorporated. It was suggested that consideration be given to "turn-out" areas at road crossings over the stream. These could entice people to explore the corridor.

(2) Wilmette: The park district is interested in the use of a high quality water supply for a small flow-through impoundment which would be incorporated as part of their newly acquired golf course.

(3) Chicago Park District: The park district is presently considering the expansion of Eugene Field Park to include Site 1 identified in Figure GB-III-3.

(4) Lake County Forest Preserve District: The district expressed interest in the river corridor concept. The district has acquired a site adjacent to the North Branch as a preserve which therefore would be in consonance with the proposed plan of improvement. They suggested expansion of Site 7 to allow both preservation and recreational development. This was done.

(5) Cook County Forest Preserve District: A generally favorable response was expressed. The idea of locating a fish hatchery with put-and-take ponds on existing preserve land along the North Branch, however, was not acceptable. It was suggested that use and location of the high quality water for impoundments should be left up to the discretion of the local land-holding agency involved. Mention was made of a bicycle path now being constructed on preserve land from Devon Avenue to Harms' Woods. It was noted that the restricted easements are too small (20 ft. on each side of the river from the high bank) to permit any type of public use; instead the functions were for creation of buffer zones (between river and existing land usage) and for esthetics and enhancement of the stream's environment. Purchased areas would still allow and in most cases encourage public access.

(6) Northfield: The village recommended additional areas for restrictive easement.

(7) North Brook: The park district has leased a 20-acre area along the West Fork of the North Branch from the U. S. Coast Guard, therefore making it unnecessary to purchase the area.

c. Northeastern Illinois Planning Commission (NIPC). NIPC supported the river corridor plan since it is generally consistent with the goals and objectives of the Comprehensive General Plan and the Regional Open Space Plan for their planning area. They supported the specific delineation of recreational areas for purchase in fee on the North Branch. The feasibility of providing connecting trails between river corridors was discussed. While supporting the concept of connecting trails, NIPC also suggested consideration of using power company transmission rights-of-way for the same purpose in order to conserve funds.

d. Lake-Porter Regional Transportation and Planning Commission. Lake-Porter was asked to respond to the resource development model as it might apply to the streams in Northwest Indiana. The agency's reaction was favorable to the river corridor concept and a recently prepared map was obtained depicting the agency's open-space proposals. Coincidentally, their open-space plans encourage the acquisition of open-space along rivers.

e. Illinois Department of Conservation. Although in favor of the river corridor as a conceptual approach, the State did not feel that the put-take ponds included in the Urban Fishing Program should be applied to the area along the North Branch. Instead, this particular proposal was thought to have more value and be more applicable to the inner city areas of Chicago. The Division of Fisheries was also interested in the possibility of providing a small tributary leading into Lake Michigan to support their salmonoid stocking program. They also expressed interest in manageable off-stream impoundments. Furthermore, it was concluded that the North Branch would not require any in-stream structural improvements to encourage fish populations since water quality is the primary degrading factor of this potentially good stream.

"Streams in the Chicago-South End of Lake Michigan Wastewater Management Study area which are of adequate length and width and still possess sufficient stream type habitat (pool and riffle areas) conducive to the improvement of sport fishing through improved water quality and flow control include: the DuPage River and its West Branch, Hickory Creek, North Branch of the Chicago River, Poplar Creek, lower Salt Creek, the upper and lower Des Plaines River, and Thorn Creek. The implementation of adequate water quality and flow regimens on these streams would offer great potential for the redevelopment of an improved stream type fishery, with possible reestablishment of such species of fish as smallmouth bass, rock bass, various darter and stream type minnow species."

f. Indiana Department of Natural Resources. The Division of Outdoor Recreation is in favor of both the river corridor recreational development

concept, and regional planning to satisfy recreational needs. The State at this time is not in favor of the Urban Fishing Program but felt that it offers potential for the future.

g. United States Department of the Interior, Bureau of Sport Fisheries and Wildlife. The Bureau is interested in encouraging various types of fish management programs within urban-suburban areas. If the States express interest in the Urban Fishing Program for the C-SELM area, then the Bureau would respond to that interest. Since the States have expressed limited interest at this time, other fish management programs were suggested for the C-SELM area.

h. United States Department of Housing and Urban Development (HUD). HUD expressed interest in our river corridor planning approach and suggested that we coordinate closely with Northeastern Illinois Planning Commission.

i. United States Department of the Interior, Bureau of Outdoor Recreation. The Bureau's general reaction to our river corridor model was favorable. A great deal of daily recreation use can be expected from urban-suburban recreational development.

j. Other. Electric power companies in the study area were asked to provide statements relating to their interests in and liability concerns for the use of their transmission line rights-of-way for recreational use. These rights-of-way could serve as connecting corridors between river corridors and/or open-space lands.

ADDITIONAL CONSIDERATIONS

CONNECTING TRAILS

Since the concept of river corridor recreational development is acceptable at all levels of coordination, connecting "green-belt" corridors (or connecting trails) between river corridors become logical supplements. Interpretation of the Northeastern Illinois Planning Commission and Lake-Porter County Regional Transportation and Planning Commission open space acquisition plans has shown that connecting corridors are to be encouraged. Concurrently, the potential exists for using electric power company transmission line rights-of-way for this purpose. With this possibility in mind, the views of the utilities were solicited and are listed below:

COMMONWEALTH EDISON COMPANY

Currently the Commonwealth Edison Company has many miles of fee owned and easement rights-of-way in northern Illinois. These rights-of-way were acquired for high voltage electric transmission lines. However, they are being used for many other compatible purposes. Other utilities have purchased rights in these rights-of-way for gas mains, petroleum pipelines and in addition the surface is used in many locations by public bodies, private groups or individuals for various purposes such as parking, lawn and garden, agriculture, roadways and recreation. There are locations where the rights-of-way remain in a relatively undisturbed state and they are used for hiking trails.

Edison's rights-of-way are currently being used for recreational purposes at many locations. The rights-of-way are leased by school districts, park districts, youth baseball groups, home associations, forest preserve districts and churches. The uses range from playgrounds and baseball fields to hiking trails.

The best example of a hiking trail on an Edison fee owned right-of-way is the Keepataw Trail south of the Argonne National Laboratory west of Illinois Route 83.

In the case of easement rights-of-way the best example is the Illinois Prairie Path. Edison acquired perpetual easement rights for facilities, including electric tower lines and pole lines, from the Chicago, Aurora and Elgin Railway Company in 1946. In some cases Edison owned the underlying fee title to portions of the Railway's right-of-way. When the Railway's right-of-way was acquired by DuPage County, Edison retained its easement rights. Edison subsequently cooperated with the Illinois Prairie Path people at the time they were negotiating a lease with DuPage County and agreed to conduct its operations on the right-of-way so that there would be a minimum of disruption of the terrain.

The possibility of expanding the use of Edison's rights-of-way for hiking or bike trails or other recreational uses does involve problems---- not from the standpoint of compatibility with Edison's use of the right-of-way for electric transmission or distribution lines,----but from a public relations standpoint.

As an example Edison has many leases outstanding on its rights-of-way for lawn and garden, parking and agriculture and other purposes. If a request to lease a strip of right-of-way is received, the right-of-way may cross many of these leased properties. The concurrence of the lessees would have to be obtained by the group desiring to establish concurrent usage.

In other cases, the rights-of-way are adjoined on both sides by the backyards of residential lots and the neighbors are using the right-of-way for lawn and garden. They view the area as private and subsequently if Edison opens up the area for a hiking or bike trail or for a lineal park, the neighbors view it as an infringement on their privacy. Subsequently, Edison feel that it is the obligation of the party desiring to establish the trail to sell the idea to its neighbors that the establishment of the trail is in the public interest. Many of these people have purchased the lots with the idea that the property is available for their use and they look upon changing the use as an act of bad faith.

Any group desiring to establish a trail on the right-of-way as a connection between two parks or between a park and a forest preserve, should make a request to the company outlining the length of right-of-way desired

with details of the proposed use. Edison would in turn make a study of the strip of right-of-way involved, as to what outstanding leases there are, and as to what problems it would expect to encounter with its neighbors. Subsequently, a meeting would be arranged and ways discussed to overcome the problems. One provision worth noting specifically is the requirement that the group establishing the trail take out an insurance policy in the name of Edison in the limits prescribed. This is required in all cases and has not proved to be a problem to any of the groups presently using Edison's right-of-way.

NORTHERN INDIANA PUBLIC SERVICE CORPORATION (NIPSCO).

Comments relating to use of transmission line rights-of-way were limited to those owned in fee. Urban rights-of-way are mowed on a regular basis and permission has been granted to use them for some recreational areas including tennis courts and other sports. City park areas in at least one municipality have been planned where the city acquires property on both sides of the right-of-way to increase the effective park area. Permanent construction on the right-of-way was not planned. Rural area rights-of-way are generally continued in agricultrual use by the farmer. NIPSCO would be interested in the utilization of right-of-way for recreational purposes, consistent with the safeguarding of transmission facilities. Recreational uses which appear permissible include fishing, picnicking, and park facilities. While more permanent recreational facilities such as tennis courts may be installed in certain areas, the need to install additional and maintain present facilities involves financial risk to the governmental agency. Repair of any recreational facilities are at the expense of the party using the right-of-way. Hiking or bicycle trails could be developed. Many unfavorable complaints have been received by NIPSCO from adjacent property owners and local police departments when powered units such as mini-bikes, all terrain vehicles, and snowmobiles are used on the right-of-way. On this basis permission would not be granted for gas or electric powered vehicles. The governmental agency developing the corridor for recreational uses would be expected to assume all liability which may arise from personal injury, death, or property damage as a result of use of the right-of-way for these purposes. One of the big objections to permitting public use of the company's real estate is the potential liability the company could incur for personal injury or death resulting to the persons using the right-of-way with its permission. This is a widely held fear on the part of utilities and there needs to be legislation that would remove the prospect of civil liability in damages for those instances where utilities permit public use of their properties. Consequently, the utilities feel that it would be of great value to have legislation of this type proposed in the States involved.

REHABILITATION OF SKOKIE LAGOONS.

It has been suggested that a model study and restoration project be undertaken for the Skokie Lagoons. These lagoons are an integral part of the North Branch aquatic ecosystem and should be restored. A research study should define: (1) the existing status of the lagoons, (2) the best method of rehabilitating the lagoons, (3) monitoring results during rehabilitation, and (4) monitoring results after rehabilitation. This project would be of value to other areas of the nation faced with possible in-stream rehabilitation.

SECTION IV - APPLICATION OF PROTOTYPE FINDINGS

IMPLEMENTATION

To date, most of the lands encompassed by the proposed river corridors have been earmarked for open space either by the Northeastern Illinois Planning Commission (NIPC) or the Lake Porter County Regional Transportation and Planning Commission. The open space concept of these planning commissions has not been fully implemented by necessary ordinances, nor have all the economic consequences of removing these lands from the tax rolls been ascertained. Therefore, additional studies will be required before acquisition and development are undertaken. Since the use value of the corridors is directly related to the water quality and flow regimen control which would be achieved by adoption of an appropriate regional waste treatment alternative, development of these corridors should be phased and made part of a total development plan. An appropriate study beyond this planning effort should establish design controls relative to: acreage; usage; costs, including annual charges for operation and maintenance of the various stream reaches; and the zoning, type of ownership, and adjusted tax structure necessary to encourage local participation. Implementation funding should be time-phased to coincide with construction of the regional treatment system. Participating State and local agencies would be offered the option of cost-sharing the acquisition and development of the corridor lands under current Federal programs and acquire land deeds, subject to an administrative agreement to be defined.

LAND CONTROL

Since establishment of the corridors will cause a minor reduction in assessed land values which serve as the counties' tax bases, it is recommended that ownership of these lands be varied. This would help minimize the loss. As previously mentioned, all land developed for fishing and general recreational use should be bought in fee. The remaining land portions not already in public ownership can be controlled through the use of special development set-backs (easement or zoning) restrictive in nature, but at the same time designed to offer the owner a special inducement (payment or tax reduction) to insure participation. Basin residents must make a decision concerning the amount of acreage to be acquired in the development of the river corridors. Open space zoning is an effective supplement to purchase in fee or the use of restrictive easements. Restrictive easements will guarantee preservation, while not allowing public access. Care should be taken to insure that land-use planning is restrictive in nature and that flood plain intrusion such as residential and industrial development (if allowed) be restricted and buffered by vegetation from the rest of the corridor. To enhance the environmental aspects of these corridors, planting should be in concentrations of selected timber and other vegetative cover. Management of the vegetation will affect the wildlife, recognizing that only wildlife habitat can be managed. Nut producing trees should be encouraged. Planting should include white oak,

red oak, burr oak (oaks confined to larger land holdings away from flooding), white birch, black walnut, various ash species, shaking aspen, and black willow. The species listing for other rivers in the C-SELM area would vary to a limited extent from the aforementioned plantings. Planting of smaller shrubs and tree species such as red and yellow twig dogwood, multiflora rose, honeysuckle, and mulberry should also be encouraged. This together with selected herbaceous species and grasses should provide adequate cover to resist soil erosion, as well as good wildlife habitat. An additional constraint to the prototype concept is the stipulation that purchase in fee of areas for general recreation use be restricted to existing "open space" lands. Restricting acquisition to open space (not already in public ownership) will minimize community disruption. Therefore, the corridor should be considered variable in width, suggesting purchase where land is now available while still maintaining a continuous corridor. This variability has and will occur; nevertheless, the corridors on other streams should strive to create continuity wherever possible.

APPLICATION OF PROTOTYPE MODEL

Aside from the North Branch of the Chicago, the redistribution system for each of the NDCP alternatives had provided an enhanced flow regimen on some 25 other streams within the C-SELM study area. Consequently, the implications of establishing a recreational-environmental corridor on these streams was assessed.

Shown in Table GB-IV-1 are the streams, the linear miles of usage corridor (80% factor) and approximate acreage suggested for purchase. These figures are indicative of a potential and would have to be adjusted; subject to a detailed, on-site environmental assessment. This assessment would correlate such factors as stream width, availability of open-space lands, environmental quality of the flood plain, current and projected use trends of adjoining lands and recreational needs of the communities within 10-20 minutes driving time of the streams' various increments.

Assuming the purchase of the required acreage (some 17,400 acres) sufficient recreational facilities could be provided to meet some 100,000,000 user-days per year. See Table GB-IV-2. The cost required to meet these needs would vary, depending on the extent of the preservation program adopted. Using the two unit values per linear mile previously determined in Section III, the costs could range from $949,300,000 to $1,449,600,000. If the North Branch costs were also included, the total cost would increase to $1,050,100,000 and $1,603,200,000, respectively. While these figures seem extremely high, these two costs average about $0.56 and $0.86 per user day, respectively, when amortized over a 50-year period at a 5.5 percent interest rate. This unit value of capital cost excludes any consideration of the worth of the lands set aside for preservation purposes. Aside from any visitation creditable to the use of these latter lands, the intangible worth from an environmental and social well-being standpoint is incalcuable.

TABLE GB-IV-1

PROTOTYPE REQUIREMENTS - OTHER C-SELM STREAMS

Stream	Linear Measure (Miles) of Corridor		Approximate Acreage* Suggested for Purchase
DuPage River	77		2910
DesPlaines River	93		3491
Weller Creek	10		364
Willow Creek	7		291
Silver Creek	6		218
Salt Creek (Illinois)	42		1600
Addison Creek	10		364
Lily Cache Creek	19		727
Hart Ditch	10		364
Deer Creek	6		218
Tinley Creek	6		218
Hickory Creek	23		873
Thorn Creek	10		364
Butterfield Creek	14		509
Calumet Slough	6		218
Turkey Creek	14		509
Deep River	17		655
Salt Creek (Indiana)	10		364
Mill Creek	6		218
Avon-Fremont Drainage Ditch	3		72
Indian Creek	11		436
Buffalo Creek	9		364
Spring Creek	11		800
Jackson Creek	14		509
Grand Calumet River	19		727
	453	Total	17,383
		say	17,400

* Acreage figures are based on acquisition relationships established in prototype.

TABLE GB-IV-2

PROJECTED ANNUAL RECREATIONAL USAGE
OTHER STREAMS IN C-SELM AREA

Stream	Total Acreage		Approx. * Projected Annual Usage
DuPage River	2,910		16,686,000
Des Plaines River	3,491		18,429,200
Weller Creek	364		2,511,600
Willow Creek	291		2,182,500
Silver Creek	218		1,874,800
Salt Creek (Illinois)	1,600		9,490,000
Addison Creek	364		2,511,600
Lilly Cache Creek	727		3,416,900
Hart Ditch	364		2,511,600
Deer Creek	218		1,874,800
Tinley Creek	218		1,874,800
Hickory Creek	873		4,316,000
Thorn Creek	364		2,511,600
Butterfield Creek	509		3,003,100
Calumet Slough	218		1,874,800
Turkey Creek	509		3,003,100
Deep River	655		3,209,500
Salt Creek (indiana)	364		2,511,600
Mill Creek	218		1,874,800
Avon-Fremont Drainage Ditch	72		864,000
Indian Creek	436		2,746,800
Buffalo Creek	364		2,511,600
Spring Creek	800		3,440,000
Jackson Creek	509		3,003,100
Grand Calumet River	727		3,416,900
Total Acreage	17,383	Projected Usage	101,270,700
Say	17,400		100,000,000

* Usage Estimates were based on the assumption of similar size land parcels as identified on North Branch

SUPPLEMENTAL NEEDS

The foregoing information provides a long-term implementing framework, should the option to develop the floodplains for open-space and recreational usage be selected. In addition, there will be a need for site-specific remedial measures, both in-stream and/or the adjacent lands. Some of these measures will involve the restoration of damage from bank erosion, clean-up of algae growth and minor dredging to remove the sediment that has degraded the aquatic ecosystem of the streams. All of these problems are reflected in the Need Inventories prepared for the North Branch of the Chicago River (Table GB-II-I) and those received from local conservation groups for the: Des Plaines River, Table GB-IV-3; Salt Creek, Illinois, Table GB-IV-4; and the Little Calumet River, Table GB-IV-5.

In addition, other specific areas have been suggested for consideration and eventual incorporation into an area-wide environmental and recreational program. These sites, together with the suggested usage, are presented in Table GB-IV-6.

TABLE GB-IV-3

CONSERVATION NEED INVENTORY
DES PLAINES RIVER

PROBLEM INDICATED	No.	SUGGESTED IMPROVEMENT	No.
Poor Water Quality	21	Improved Waste Treatment	--
Algae Growth	6		
Siltation	17	Dredge	1
Flooding	12		
Debris (natural or man-made)	21	Clean-Out Rubbish	1
Bank Erosion	5	Related Plantings	14
Inadequate Flow During the Recreational Season	15	Augment Flow	7
Poor Quality Fishery	20	Deep Pool Excavations	16
(Poor Access)	16	Bank Fishing Sites	16
	16	Boat Launching Sites	16
	14	Purchase of Lands	14
(Esthetic Quality)	14	Related Plantings	14
(Lack of Facilities)	3	Picnic Areas	3
	3	Hiking Trails	3
	10	Camping Sites	10
	3	Nature Study Areas	3
	1	Construct Lagoons	1
Usage	10	Stream Use Zoning	10
PROBLEMS INDICATED (Categories)	207 (12)	SUGGESTED IMPROVEMENTS (Categories)	129 (9)

TABLE GB-IV-4

CONSERVATION NEED INVENTORY
SALT CREEK (ILLINOIS)

PROBLEM INDICATED	No.	SUGGESTED IMPROVEMENT	No.
Poor Water Quality	8	Improved Waste Treatment	--
Algae Growth	5		
Siltation	7	Dredge	1
Flooding	6		
Debris (natural or man-made)	6	Clean-out Rubbish	
Bank Erosion	3	Related Plantings	2
Inadequate Flow During the Recreational Season	2	Augment Flow	2
Poor Quality Fishery	7	Deep Pool Excavations	2
(Poor Access)	2	Bank Fishing Sites	2
	2	Boat Launching Sites	2
	3	Purchase of Lands	3
(Esthetic Quality)	2	Related Plantings	2
(Lack of Facilities)	2	Picnic Areas	2
	3	Hiking Trails	3
	2	Camping Sites	2
		Nature Study Areas	
		Construct Lagoons	
Usage	1	Stream Use Zoning	1
PROBLEMS INDICATED (Categories)	53 (12)	SUGGESTED IMPROVEMENTS (Categories)	24 (8)

TABLE GB-IV-5

CONSERVATION NEED INVENTORY
LITTLE CALUMET RIVER

PROBLEM INDICATED	No.	SUGGESTED IMPROVEMENT	No.
Poor Water Quality	9	Improved Waste Treatment	--
Algae Growth	5		
Siltation	9	Dredge	2
Flooding	7		
Debris (natural or man-made)	7	Clean-out Rubbish	3
Bank Erosion	3	Related Plantings	4
Inadequate Flow During the Recreational Season	5	Augment Flow	1
Poor Quality Fishery	8	Deep Pool Excavations	5
(Poor Access)	5	Bank Fishing Sites	5
	4	Boat Launching Sites	4
	6	Purchase of Lands	6
(Esthetic Quality)	4	Related Plantings	4
(Lack of Facilities	3	Picnic Areas	3
	3	Hiking Trails Camping Sites	3
	2	Nature Study Areas Construct Lagoons	2
Usage	4	Stream Use Zoning	6
PROBLEMS INDICATED (Categories	84 (12)	SUGGESTED IMPROVEMENTS (Categories)	48 (9)

TABLE GB-IV-6

CONSERVATION NEED INVENTORY
DESIRED LAND CONSERVATION PROGRAMS

AREA SUGGESTED FOR PURCHASE	POSSIBLE USAGE	LOCATION
1. Hoosier Prairie* (approx. 300-1000 acres)	Scientific Research Education Hiking Birdwatching Photography Living Museum	East of Kennedy Ave., N.& S. of Main St., in Griffith, Highland, and Schererville, Indiana
2. Sand Ridge Nature Center	Education Wildlife Preserve	Calumet City, Illinois
3. Area in South Holland Illinois	Playground Wildflower growth Hiking	Between C&EI R.R. and Indiana Ave., & 162nd & 158th
4. Gensburg Prairie (120 acres)	Education Preservation	Markham, Illinois
5. Illinois & Michigan Canal	Hiking Boating Camping Picnics	From Chicago, Illinois to junction with Illinois River
6. Chicago Portage (no additional purchase necessary)	Historical Museum Nature Trails Geology Trails	49th St. and S. Harlem Ave.
7. Lawndale Dump and Adjacent Area	Recreational	On Des Plaines River
8. Strip along Both Sides of Des Plaines River (Cook County-Will County)	Recreational	Between Stephen St. in Lemont and Romeo Road in Romeoville
9. Boat Launching Area	Recreational	39th St. in Lyons, Illinois

*The Hoosier Priarie has been granted a No. 1 priority rating for preservation by the Indiana Natural Areas Survey. It is included in proposed legislation (HR 10209) to expand the Indiana Dunes National Lakeshore. It is the last area in Indiana where prairie exists as a landscape type.

TABLE GB-IV-6 (Cont'd)

AREA SUGGESTED FOR PURCHASE	POSSIBLE USAGE	LOCATION
10. Drainage Area	Recreational	Long Run Creek
11. Salt Creek Area (approx. 30 acres)	Golf Course Park Flood Plain	West Side of Stream, East of Riverside Drive and North of Commonwealth Lane in Elmhurst
12. Salt Creek (approx. 80 acres)	Recreational	From Eldridge Park to Monroe Street in Elmhurst
13. North Side of Sag Canal (10-20 acres)	Baseball Fields	Near Alsip, Illinois
14. Little Calumet River Flood Plain	Recreation	Highland, Indiana

nevertheless, the corridors on other streams should strive to create continuity wherever possible.