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UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

REGION 5
WATER DIVISION
230 S. DEARBORN STREET
CHICAGO, ILLINOIS 60604

MARCH 1977

# ENVIRONMENTAL IMPACT STATEMENT

DRAFT

## TUNNEL COMPONENT OF THE TUNNEL AND RESERVOIR PLAN PROPOSED BY THE METROPOLITAN SANITARY DISTRICT OF GREATER CHICAGO

## Lower Des Plaines Tunnel System

Summary Report

# SUMMARY REPORT

# DRAFT ENVIRONMENTAL IMPACT STATEMENT

# TUNNEL COMPONENT OF THE

# TUNNEL AND RESERVOIR PLAN

# PROPOSED BY THE

# METROPOLITAN SANITARY DISTRICT

# OF GREATER CHICAGO

## LOWER DES PLAINES SYSTEM


Prepared By The

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

CHICAGO, ILLINOIS

And

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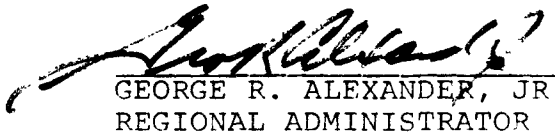

GEORGE R. ALEXANDER, JR.
REGIONAL ADMINISTRATOR

MARCH 1977

# T A B L E  O F  C O N T E N T S
Executive Summary

# I. BACKGROUND INFORMATION

This chapter first defines the legal basis and the scope of the EIS and then describes the authority and program of the applicant for EPA funding, the MSDGC. Finally, the history and objectives of the Tunnel and Reservoir Plan (TARP) are reviewed. This chapter of the executive summary corresponds to Chapter I of the environmental impact statement (EIS).

## 1.1 LEGAL BASIS FOR THE EIS

The U.S. Environmental Protection Agency (EPA) is the administering agency for a major Federal environmental program entitled "Grants for Construction of Treatment Works."[1] This program allows the EPA Administrator to provide financial aid to any state, municipality, intermunicipal agency, or interstate agency for the construction of publicly owned water pollution control facilities. The program will encourage reduction of point sources of water pollution and improve national water quality.

The EPA's granting of funds for a water pollution control facility may require an EIS. Each proposed water pollution control facility is evaluated on a case-by-case basis by the appropriate EPA regional office to determine whether the proposed facility is expected to have significant environmental effects or be highly controversial. The EPA has prepared this EIS because it expects the environmental effects of the tunnel system to be significant.

This EIS is being issued pursuant to PL 91-90, the National Environmental Policy Act (NEPA) of 1969, and Executive Order 11514, "Protection and Enhancement of Environmental Quality" dated March 5, 1970. Both NEPA and Executive Order 11514 require that all Federal agencies prepare such statements in connection with their proposals for major Federal actions significantly affecting the quality of the human environment.

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1 Authorized by Title II, Section 201(g)(1), of the Federal Water Pollution Control Act Amendments of 1972, Public Law 92-500 (FWPCAA)

This EIS has been prepared in accordance with the regulations and guidance set forth in the President's Council on Environmental Quality (CEQ) Guidelines dated August 1, 1973, and the EPA's Final Regulations 40 CFR-Part 6, dated April 14, 1975.

## 1.2 SCOPE OF THE EIS

The EIS addresses the cumulative effects of constructing and operating three conveyance tunnel systems which are part of the total Tunnel and Reservoir Plan (TARP) proposed by MSDGC. These three tunnel systems are:

- Mainstream (59th Street to Addison Street)
- Calumet
- Lower Des Plaines.

Where appropriate, this statement also assesses the effects associated specifically with the Lower Des Plaines Tunnel system route. Two other statements address separately the effects associated with the Mainstream Tunnel system and the Calumet Tunnel system. The Mainstream and Calumet statements have already been developed and issued. These tunnel systems comprise what is referred to in the statement as "TARP, Phase I."

The subject of these statements is confined to the tunnel systems and their associated components because EPA is now considering whether to grant funds to construct these tunnels under its water pollution control authority. Other components of TARP, including the reservoirs, flood relief tunnels, instream aeration, and wastewater treatment plant improvements, are either ineligible for EPA funding or are not now under consideration for construction grants. Therefore, these other components are not considered to be part of the proposed action under review. The effects of these other components on water quality and the likelihood of their being financed is analyzed in this EIS in order to provide a context for evaluating the significance of the water quality improvements expected from the three tunnel systems.

## 1.3 IDENTIFICATION OF THE APPLICANT

The Metropolitan Sanitary District of Greater Chicago (MSDGC) is the construction grant applicant for the component of Tunnel and Reservoir Plan (TARP) addressed by this EIS. The MSDGC was organized in 1889 under an act to create sanitary districts to remove obstructions in the Des Plaines

and Illinois Rivers.[1] Under the provisions of the act, the MSDGC is responsible for providing surface water and sewage drainage within the District's boundaries, which it does by constructing necessary facilities, conveyance systems, and treatment plants. The MSDGC is authorized to treat wastewater, either totally or partially, from any municipality within its designated jurisdiction, as well as to own and operate all wastewater facilities located within the MSDGC jurisdiction.

The MSDGC service area is approximately 860 square miles. Approximately 44 percent of this area, or 375 square miles, is served by MSDGC-owned combined-sewer systems (see Figure I-1) in which wastewater or sewage collected in local sewer systems is conveyed to treatment plants. These systems serve 120 municipalities which have a total population of approximately 5.5 million. The District owns and operates 70.5 miles of navigable canals, 6 wastewater treatment plants, and approximately 440 miles of intercepting sewers. The three major plants (North-Side, West-Southwest, and Calumet) in the MSDGC service area have a secondary capacity of over 1,750 million gallons per day (MGD). The remaining plants have a combined tertiary capacity of over 70 MGD. A water reclamation plant, the John F. Egan plant, is presently under construction and will have a capacity of about 30 MGD.

## 1.4 PROJECT HISTORY

The MSDGC initiated its wastewater facilities planning study in September 1967, with a ten-year clean-up and flood control program. The objectives of the program are to solve the District's flooding problem, protect Lake Michigan from further pollution, and improve the water quality of rivers and streams in the Chicago metropolitan area. The Tunnel and Reservoir Plan (TARP) has evolved from this ten-year program.

Concerned officials from the State of Illinois, Cook County, the MSDGC, and the city of Chicago reactivated a Flood Control Coordinating Committee (FCCC) in November 1970 to investigate the pollution and flooding problems in the Chicago metropolitan area. The Committee's primary assignment was to develop a viable plan to minimize the area's

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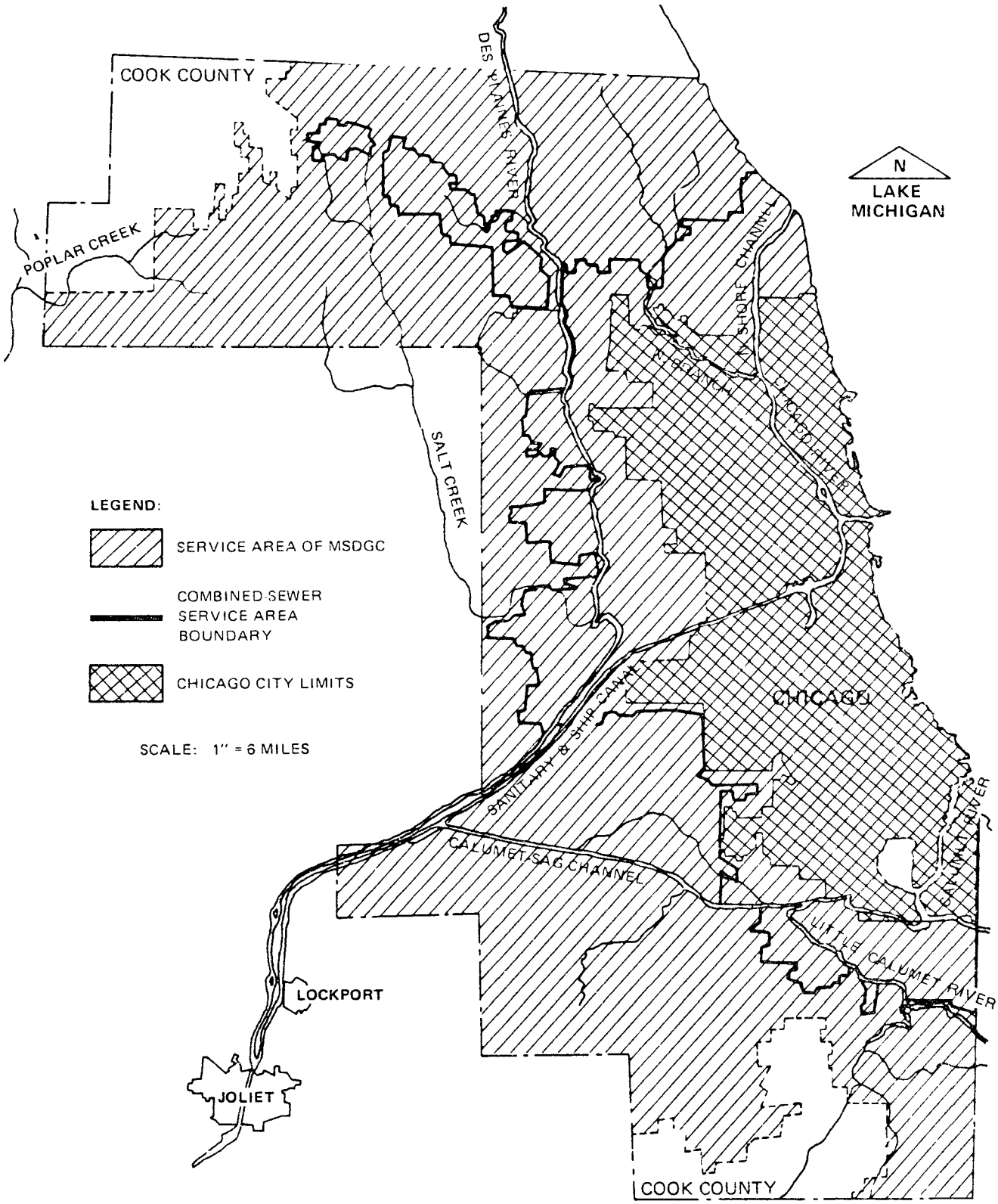
1 Illinois Revised Statutes, Chapter 42, Section 320, approved May 29, 1889.

FIGURE I-1
Metropolitan Sanitary District
of Greater Chicago
Service Area



pollutant discharges and the flooding caused by overflows of mixed sewage and wastewater. Another priority item in the plan was elimination of the need to release polluted river and canal flood waters into Lake Michigan. The Committee's plan was to address the combined-sewer area within Cook County, covering 375 square miles. The deliberations and studies of the FCCC and of a technical advisory committee which they formed resulted in the selection of TARP as less costly and more environmentally acceptable than the other plans they evaluated. The Committee then initiated additional studies to develop and refine TARP.

## 1.5 OBJECTIVES OF TARP

A primary objective of TARP is to improve surface water quality within the planning area. TARP is designed to meet the standards set forth in the "Water Pollution Regulations of Illinois."[1] These regulatory standards were established for three surface water-use classifications: (1) General (primary body contact), (2) Public and Food Processing (drinking water), and (3) Secondary Body Contact and Indigenous Aquatic Life. All surface waters in the State of Illinois have been given a water-use classification by the Illinois Pollution Control Board (IPCB) and should comply with the appropriate water quality standards. Details of these standards are presented in Chapter II of this EIS. Other important objectives of TARP are to:

- Preserve the health and well-being of the population
- Prevent further pollution of Lake Michigan due to backflow
- Utilize treated waste byproducts
- Prevent flooding.

The final TARP is a combination of several alternative plans designed to collect urban runoff during all wet weather conditions except those storms of a magnitude equal to the three most severe storms recorded to date by the U.S. Weather Bureau Service.

# II. EXISTING ENVIRONMENTAL SETTING

To provide a basis for assessing the impacts of a proposed project, an EIS initially describes the existing natural, social, economic, and cultural setting of the area which may be affected by a project. This chapter summarizes the major findings of the EIS with respect to the natural and man-made environments of the Chicago metropolitan area. This chapter is divided into two sections which correspond to Chapters II and III of the EIS text: Natural Environment and Man-made Environment.

## 2.1 NATURAL ENVIRONMENT

The existing natural environment of the Chicago area summarized in this section focuses on those features relevant to impact assessment of the proposed TARP project. This section is divided into the following categories:

- Water Resources
- Land Resources
- Atmospheric Resources.

### 2.1.1 Water Resources

The surface water systems of the Chicago area consist of a network of rivers and canals whose natural flow into Lake Michigan is controlled by a series of locks. These surface water systems include the Chicago River, the Sanitary and Ship Canal, the Calumet River system , and the Des Plaines River system. Lake Calumet and Lake Michigan also constitute an important part of the area's surface water resources.

The quality of the surface water systems is affected by steady-state effluent discharges and by injections or discharges of polluted wastewaters. The polluted wastewater results from overflows of combined-sewer systems during rainfall events of nominal size (approximately 0.1 inches or greater). The frequency of these rainfall events is approximately 100 times per year, and the resulting overflows are discharged directly to the Chicago area's streams and rivers.

Pollutant concentrations in the streams and rivers presently exceed water quality standards established by the State of Illinois Pollution Control Board. Concentration ranges of various pollutants in the Chicago area's surface systems are presented in Table II-1. Further details on the water quality of specific water systems are presented in Section 2.1.1 of the EIS.

Table II-1
Summary of Pollutant Concentration Ranges
in Chicago's Surface Water Systems

| Pollutant | Chicago River — Sanitary and Ship Canal System | Calumet River System | Des Plaines River System | Applicable Illinois Standards* | |
|---|---|---|---|---|---|
| | | | | Secondary Contact | General Use |
| Dissolved oxygen (DO) | 1.2 to 7.7 mg/l | 3.9 to 9.0 mg/l | 6.0 to 10 mg/l | 5.0 mg/l[1]<br>4.0 mg/l (1978)[2]<br>3.0 mg/l<br>4.0 mg/l min.[1]<br>2.0 mg/l min. | 6.0 mg/l<br>5.0 mg/l min.[3] |
| Biochemical oxygen demand (BOD) | 5.2 to 9.2 mg/l | 4.1 to 7.3 mg/l | 5.0 to 6.7 mg/l | 4-20 mg/l[4] | 4-20 mg/l[4] |
| Ammonia (as N) | 0.8 to 6.2 mg/l | 1.3 to 13 mg/l | 0.3 to 1.2 mg/l | 4.0 mg/l (winter)<br>2.5 mg/l (summer) | 2.6 mg/l[3] |
| Suspended solids (SS) | 19 to 54 mg/l | 12 to 73 mg/l | 29 to 68 mg/l | 5-25 mg/l[5] | 5-25 mg/l[5] |
| Fecal coliform | 477 to 12,700 (counts/100 ml) | 152 to 738 (counts/100 ml) | 411 to 8,700 (counts/100 ml) | 1000/100 ml[1] | 200/100 ml[2] |

* Effluent discharge standards apply if water quality standard is not designated.

1 North Shore Channel Standards

2 Chicago River-Sanitary and Ship Canal System and Calumet River system.

3 General Use Standard applicable to Des Plaines River system.

4 4 mg/l-Hanover, Egan, and O'Hare Sewage Treatment Plants
10 mg/l-WSW and Calumet Sewage Treatment Plant
20 mg/l-Lemont Sewage Treatment Plant

5 5mg/l-Hanover, Egan, and O'Hare STP
12mg/l-WSW and Calumet STP
25mg/l-Lemont STP

Serious public health problems involving contamination of Chicago's drinking water supply has led to implementation of regulatory measures to protect Lake Michigan, an important drinking water resource, from pollution. Locks and gates have been installed to divert river flows away from Lake Michigan, allowing eventual drainage into the Illinois River. Lake Michigan supplies most of the drinking water for the Chicago area. The withdrawal amount is approximately 1,600 cubic feet per second (CFS), and the maximum amount that can be withdrawn from Lake Michigan is 3,200 CFS.[1] This withdrawal limit, or allotment, is presently divided into three usage types: domestic water supply, indirect waterway diversion, and direct waterway diversion. The diversion usages allow improved effluent dilution and improved navigation.

1 Supreme Court Decision.

In the Chicago metropolitan area, there are two main aquifer systems: the upper aquifer, which consists of glacial drift and dolomites, and the lower aquifer, which consists of dolomite and sandstone formations. Unconsolidated Quaternary deposits and Silurian dolomites of the upper aquifer are hydraulically connected and function, in most areas, as a single water-bearing unit. Clayey deposits in the glacial drift act as confining layers to create artesian conditions in the upper aquifer. The lower aquifer includes dolomite and sandstone formations extending from the base of the Maquoketa Group to the top of the Eau Claire shales of the Cambrian system. The average thickness of the upper aquifer and lower aquifer is approximately 400 feet and 1,000 feet, respectively. The sources of recharge for the groundwater in the upper aquifer are infiltration of precipitation and influent streams. The lower aquifer is recharged in parts of McHenry, Kane, and De Kalb Counties where the Maquoketa Group outcrops, and further west where the Group has been removed by erosion. With respect to using the aquifers as a water resource, studies indicate that the lower aquifer is capable of producing about 25 Million Gallons per Day (MGD) and the upper aquifer is capable of a potential yield of 108 MGD.

Discharges into the waterways of the Chicago area originate from several sources, including: wastewater treatment facilities, industrial plants, and combined-sewer overflows. Six wastewater treatment facilities currently discharge treated water to existing waterways. The outfalls are located adjacent to the facilities. Most of these facilities are in compliance with the BOD and SS effluent standards (under present permit conditions), and two smaller plants are within the ammonia-nitrogen standard. With respect to industrial plants, wastewater is conveyed to treatment plants and processed before discharging. The industrial waste load averages approximately 195 MGD or equivalent to a population of 4.5 million. Combined-sewer overflows, which occur about 100 times per average year, inject pollutants in large amounts into waterways at approximately 640 outfall points in the Chicago area. During such events, minimum Illinois water quality standards established for restricted-use waters are not met.

Numerous water resource management programs have been initiated to address the flooding and/or pollution problems of the Chicago area. These programs have been or are currently being conducted either regionally or locally. A few of these programs include: the Section 208 Areawide Waste Treatment Management Planning program, the Chicago-South End of Lake Michigan study (C-SELM), the City of Chicago

Sewer Construction program, Thornton Quarry Flood Control project, and the Chicago Metropolitan Area River Basin Plan (CMARBP).

### 2.1.2 Land Resources

The Sanitary and Ship Canal and the Calumet-Sag Channel have significantly altered the natural drainage patterns which are from west to southwest in the area near Lake Michigan. Prior to construction of the Canal and Channel, the drainage flow was toward Lake Michigan. The flow is presently toward the Chicago River and the Sanitary and Ship Canal, which drain into the Illinois Waterway system. The overall low relief of the MSDGC combined-sewer system area makes it prone to flooding caused by sewer system backups and/or overbank flows. The areas with the highest overbank flooding potential lie along the North Branch-Chicago River and in the Calumet River system.

The Chicago area lies on the broad, gently sloping, northwesterly-trending Kankakee Arch. This arch, which connects the Wisconsin Arch to the northwest with the Cincinnati Arch to the southwest, separates the Michigan Basin from the Illinois Basin. The northeast sector of the Chicago area lies on the northeastern side of the Kankakee Arch, while the southwestern sector of the Chicago area lies on the southwest flank of the Arch. In the Chicago area, overall, a number of gentle east-west-trending folds are superimposed on the area's broad regional geologic structures. Numerous minor faults and several major faults have been mapped, including: the Sandwich fault near Joliet and the Des Plaines disturbance near the community of Des Plaines. The uppermost 500 feet of rock layers, particularly the dolomites and shales between the top of the Racine formation and the base of the Brainard formation, will be relevant to the proposed construction of the TARP tunnel systems. The surface layer (glacial deposits) has an average thickness of approximately 80 feet. Drop shaft and construction shaft installations will be constructed within this layer.

Based on 175-year historical earthquake records, four major earthquakes occurred within 100 miles of Chicago with intensities equal to or greater than MMI VIII (Modified Mercalli Intensity scale). These earthquakes originated at Fort Dearborn (Chicago) (1804), near Rockford (1909), near Aurora (1912), and near Amboy (1972). Within the MSDGC combined-sewer service area, there are 30 faults with moderate vertical displacement characteristics and 86 minor faults with small vertical displacement characteristics.

### 2.1.3 Atmospheric Resources

Air quality in the Chicago metropolitan area is presently monitored by the city of Chicago Department of Environmental Control and the Cook County Department of Environmental Control. A total of 61 monitoring stations have been established in Cook County; 30 of these are located within the city limits of Chicago. Based on the 1974 Annual Air Quality Report published by the State of Illinois EPA, ambient air quality standards were frequently violated at one or more stations. The pollutant standards violated include: sulfur dioxide, particulate matter, carbon monoxide, hydrocarbons, and photochemical oxidants (measured as ozone).

The existing outdoor noise levels in most areas of Chicago are caused mainly by street traffic. Other noise sources include trains, aircraft, and industrial plants in city areas, and power lawn mowers, power tools, and other motor-driven equipment in residential areas. Based on a recent EPA study, typical noise levels for the Chicago area ranged from 36.3 dBA (decibels-A scale) (night) to 106.2 dBA (day). The day-night level ($L_{dn}$) ranged from 59.0 dBA to 71.2 dBA (overall average).

### 2.1.4 Biological Resources

Many species of wildlife reside in or migrate to the forest preserves, parks, and other natural areas in the Chicago region. Over 200 species of birds have been sited in these areas and about half of these species are the migratory and waterfowl type. Common mammals residing in the preserves include: whitetail deer, eastern cottontail, opossum, raccoon, gray squirrel, red fox, and woodchuck. Approximately 28 species of reptile and amphibian can also be found in the Des Plaines area. A comprehensive list of the wildlife species is provided in Appendix J of the EIS.

Aquatic life in the rivers and streams of the Lower Des Plaines watershed is currently limited to pollution-tolerant or hardy species. Poor water quality conditions in the Cook County reaches of the Des Plaines River have reduced the diversity and abundance of aquatic life. The major species of fish in the watershed include: goldfish, carp, green sunfish, black bullhead, golden shiner, hybrid sunfish, black crappie, blunt-nosed minnow, pumpkinseed sunfish, northern pike, largemouth bass, yellow bullhead, redfin shiner, white crappie, bluegill and yellow perch.

The natural vegetation normally found in the natural areas of the Des Plaines Tunnel project area consists of a modified form of the beech-maple forest, in the more moist areas, and oak-hickory forests in the more open areas. The transitional flora between these two forest types include maple-basswood and maple-basswood-red oak forest.

In the stretch between the Lake-Cook County line and Summit, Illinois, the Des Plaines River flows through a highly urbanized primarily residential watershed. However, most of the river and adjacent flood plain is owned by the Cook County Forest Preserve District so that some woodlands and wetlands have been preserved, and urban development has generally been kept out of the Des Plaines River flood plain. Thus, the Des Plaines flood plain is an attractive greenbelt. It is composed of several types of vegetation including cottonwood, ash, oak, willow and boxelder.

## 2.2 MAN-MADE ENVIRONMENT

The various components related to man's activities in the Chicago area are summarized in this section. These components include: Socioeconomic, Land Use, Sensitive Areas, Financial and Labor Resources, Transportation, and Major Projects and Programs.

### 2.2.1 Socioeconomic

The Chicago metropolitan area has experienced growth and change in its demographic profile similar to other major cities in the United States. Chicago, the third largest standard metropolitan statistical area (SMSA) in the United States, has experienced typical population redistribution trends within the SMSA. The close-in suburban jurisdictions grew rapidly during the 1950's from a substantial in-migration of population from the south and an out-migration of people from the city of Chicago. During the 1960's, the counties adjacent to Cook County urbanized rapidly. Continued redevelopment of the City, when combined with smaller household trends, uncertainties regarding energy availability and cost, and the increasing cost of suburban new construction,

should result in a strengthening of the urban centers and a lessening of the outward population movements. Chicago's population is expected to stabilize after 1980.

Contract construction income accounts for less than eight percent of total earnings in the Chicago region. While average monthly wages for construction employment are high relative to other industries in the Chicago region, total earnings from contract construction have ranged from 6.5 to 7.7 percent of total earnings over the period 1950 to 1971. The construction industry is heavily unionized, and the current union hourly wage rate averages $11.02. (Refer to Table III-6 of the EIS).

The Chicago area has traditionally sustained strong construction activity in the public and private sectors. Major public redevelopment projects have stimulated private investment and development, particularly within the city of Chicago. Construction employment opportunities have thus attracted and created a large construction labor force. Construction employment in the Chicago SMSA numbered 136,897 people in 1970 or approximately 4.8 percent of the total employed. Construction employment in the Chicago SMSA accounted for 61 percent of total construction employment in the State of Illinois. The Chicago area construction work force is highly flexible and can expand rapidly, given the demand for construction services.

### 2.2.2 Land Use

The predominant land use bordering the Des Plaines tunnel route can be characterized by its residential zoning in which large portions of land are fully developed. Rock taken from the tunnel will probably be disposed of at two sites on Forest Preserve lands as well as at McCook, Stearns, and Thornton quarries. Sludge will be disposed of at a number of sites or by a number of programs, including: the Fulton County project, NuEarth, broker sales, Lawndale Lagoons, and other landfills.

The land areas bordering the proposed tunnel route are expected to remain generally the same along the main and branch segments. Enhanced recreational uses along the riveredges are envisioned as a land improvement by the communities in the Des Plaines area.

### 2.2.3 Sensitive Areas

There are no known archeological or historically significant sites adjacent to or within the Des Plaines Tunnel route. MSD is presently investigating areas adjacent to planned tunnel routes. There are selected sites of historic and architectural interest within the vicinity of the tunnel route, but none within the immediate 500-foot impact area of the tunnel. These sites are listed in Chapter III of the EIS.

### 2.2.4 Financial Resources

Financial resources are currently available to fund the Calumet Tunnel system. TARP's Phase I tunnel system cost breakdown is approximately $1.46 billion[1] for water pollution elements and $0.69 billion for flood control measures. Operation and maintenance of TARP has been estimated at $13.6 million annually. The estimated cost of the Des Plaines system alone is $346.9 million, with an annual maintenance cost of $2.5 million.

Analysis of the funding resources required to finance the Des Plaines Tunnel system reveals that sufficient funds are currently available from the Federal Government, the State, and the MSDGC. (See Section 3.3.1 of the EIS). Additionally Federal Water Pollution Control funds of approximately $456.7 million will be required to meet the implementation plan for all three conveyance tunnel systems. In view of the sound fiscal posture of the MSDGC, the high funding priority assigned TARP by the State, and the very conservative estimates of future Federal appropriations, it can be reasonably assumed that future financing requirements can be satisfied.

Maintenance costs can either be covered through an *ad valorem* property tax, or through a user charge system based on water consumption. EPA favors the latter approach and has awarded the MSDGC two grants to develop such a user charge system.

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1 Cost estimates based on values presented in MSDGC's "Facilities Planning Study—MSDGC Overview Report," Revised, January 1975.

### 2.2.5 Labor Resources

Labor resources are considered adequate to meet construction and implementation needs of TARP and other projects. The diversified labor force in the Chicago metropolitan area is vulnerable to economic recession because of the emphasis upon manufacturing and nonservice employment. Thus, while national unemployment was about 8.4 percent in the third quarter of 1975, Cook County had a 9.6 percent rate, and the city of Chicago sustained a 11.2 percent rate of unemployment. Increasing productivity rates and an expanding labor force should contribute to keeping Chicago unemployment levels higher than the national rate for the next few years. Therefore, new employment opportunities presented by TARP and other projects should not experience a shortage of labor resources.

The labor force is predominantly male, with white collar workers comprising 53 percent of the labor force in the SMSA.

### 2.2.6 Transportation

Implementation of the Des Plaines Tunnel system will involve the use of roadways and waterways. Trucks carrying rock and spoil material from construction sites will utilize several surface streets and expressways in reaching the quarry or disposal site. The roadways range from dirt roads to six-lane divided highways. The Des Plaines tunnel route is proximate to the Des Plaines River although no waterborne commerce is possible since the river is not physically navigable.

### 2.2.7 Major Projects and Programs

There are no planned major projects and programs proposed over the next 10 years in the vicinity of the Des Plaines Tunnel route.

# III. THE PROPOSED ACTION

Identifying and defining a plan and its systems and subsystems establishes the proposed action for which the environmental setting is described and the environmental impacts are assessed. The proposed action identified and defined for this EIS is the Phase I conveyance tunnel systems and their associated subsystems only. The planned storage reservoirs, waste treatment plant upgrading and expansion, on-line reservoirs, and instream aeration facilities were not included.

The information presented in Chapter IV and V of the EIS is summarized in this chapter and divided into seven parts:

- Alternative Plans
- Plan Selector
- TARP Tunnel Systems
- TARP Subsystems
- Des Plaines Tunnel Segments and Branches
- Cost of Tunnel System and Subsystems
- TARP Financing.

## 3.1 ALTERNATIVE PLANS

Many plans to resolve the Chicago area's flooding and water pollution problems were developed during the past two decades by concerned government agencies, local organizations, and individuals. At first, the plans focused primarily on the flood control problem, however, as water quality conditions in the area worsened, more emphasis was placed on controlling the water pollution. A total of 23 plans were formulated, and many were evaluated in detail by a Flood Control Coordinating Committee (FCCC), consisting of representatives from the State of Illinois, Cook County, the MSDGC, and the city of Chicago.

In screening the alternative plans, the FCCC established overall flood and pollution control objectives which provided a basis for evaluating alternative plans. A plan was automatically rejected if it did not:

- Prevent all backflows to Lake Michigan to protect water supply resources
- Reduce pollutant discharges caused by combined-sewer overflows
- Reduce flooding in the combined-sewer and downstream areas.

In the initial screening, 6 plans were eliminated and the remaining 17 were modified to meet the objectives more fully as well as to provide a more quantitative basis for comparison. The modifications were referred to as MODs, and consisted basically of a combination of different storage capacities and waterway improvement actions. The resulting MODs yielded 51 alternative subsystem plans, or subplans, to be evaluated by the FCCC. In the next screening phase, the FCCC defined eight principal parameters, including capital costs (1972 dollars), estimated annual operating and maintenance costs (1972), project benefits, land acquisition acreage, underground easement requirements, resident and business relocations, construction impacts, and operation impacts. A technical advisory committee was organized by the FCCC to evaluate the modified alternatives in detail using the eight parameters. The advisory committee's interim report, "Evaluation Report of Alternative Systems," recommended a 50,000 acre-feet (ac-ft) storage level, which was part of the modified alternative designated as MOD 3. After reviewing the report, the members of the FCCC unanimously concluded that the flood and pollution control plan should be in the form of one of the four Chicago Underflow plans developed (four of the seventeen plans) or a combination of these plans, along with the recommended storage level. The FCCC stated that, "These alternatives are less costly and more environmentally acceptable to the community than any of the other plans presented. Detail studies along the lines of these alternatives should proceed to develop the final plan layout."

## 3.2 PLAN SELECTION

In August 1972, the FCCC members presented their final recommendations in a report with seven technical appendices. The report recommended consolidating the favorable features of the four Underflow plans into the Tunnel and Reservoir Plan (TARP). TARP was developed further and refined, then

evaluated in detail with four selected alternatives and the "no-action" alternative. In this evaluation, 15 significant environmental impact parameters were identified as the basis for evaluation. The FCCC concluded that very few negative impacts are expected for any of the alternatives incorporating conveyance tunnels, and that adverse impacts will occur if the "no-action" alternative is chosen. The FCCC also concluded that the construction impacts of all plans on the environment will most likely be relatively short-term and localized. Finally, the beneficial impacts of the plans will far exceed the adverse impacts. Within the scope of the FCCC analysis, TARP had the highest ranking and was selected as the most suitable plan to solve the flood and pollution problems of the Chicago metropolitan area.

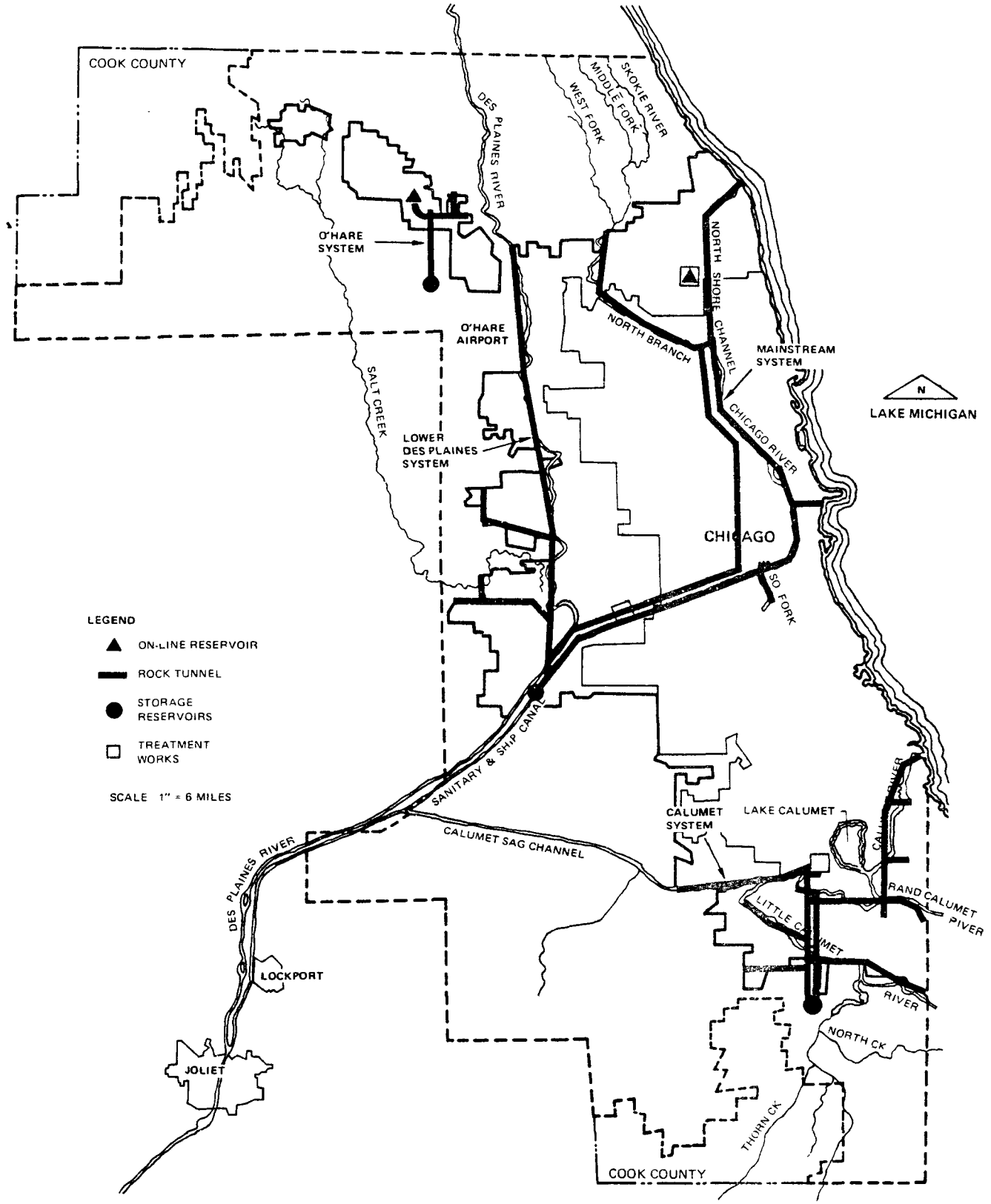
TARP would provide the most benefits for the lowest cost and the least adverse environmental impacts. Field studies and subsurface exploration programs further refined the plan; however, they did not change the original TARP concept. They were conducted only to optimize overall system effectiveness. Presently, TARP will enable collection of runoff water resulting from all but three of the severest rainfall storms recorded during the past 21 years.

## 3.3 TARP TUNNEL SYSTEMS

The four tunnel systems that are a part of the Tunnel and Reservoir Plan are the Mainstream, Calumet, Lower Des Plaines, and O'Hare systems. Each system is a completely independent operating unit with collection, storage, conveyance, and treatment capabilities. Figure III-1 shows the present routes and layout of these systems relative to the MSDGC combined-sewer service area, the MSDGC overall service area, and Cook County. Each of the TARP systems shown in the figure consists of three component systems: reservoirs, conveyance tunnels, and sewage treatment plants. A total of three reservoirs, 120 miles of conveyance tunnels, and four sewage treatment plants are included in the plan.

The TARP systems have two basic features which play a major role in solving the flood and pollution problems. First, the combined storage capacity of the plan is almost 136,800 ac-ft of which 127,600 ac-ft of the total is reservoir capacity and 9,200 ac-ft is tunnel capacity. The planned treatment capacity of TARP will be approximately 2,240 MGD. Second, over 640 existing overflow points will be eliminated within the MSDGC combined-sewer service area by the TARP systems.

FIGURE III-1
Tunnel and Reservoir Plan
System Layout and Routes



The proposed locations for the three reservoirs are: McCook quarry, Thornton quarry, and an area northwest of O'Hare International Airport. The conveyance tunnels, located 150 to 290 feet below ground level, will be constructed under existing waterways and public rights-of-way. Of the sewage treatment plants, three of the four plants are currently activated sludge plants with a combined planned capacity of approximately 2,150 MGD. The remaining plant is the proposed O'Hare-Des Plaines plant which will have a treatment capacity of over 70 MGD. A water reclamation plant, the John F. Egan plant, is presently under construction and the capacity will be 30 MGD.

## 3.4 TARP SUBSYSTEMS

The subsystems common to all TARP tunnel systems include drop shafts, collecting structures, and pumping stations. The drop shafts range from 4 to 15 feet in diameter and have two basic designs. One design features a slotted inner wall to assist in aerating the incoming water. The wall separates the air shaft from the water shaft and allows air either to enter or to escape while water is flowing in or being pumped out. The other design features a separate air shaft, to be installed in areas where high overflow rates prevail. The inside diameter of this drop shaft design ranges from 10 to 15 feet.

Approximately 640 collecting structures will be constructed to collect the overflows at established locations. The collecting structure basically consists of a diversion unit at the overflow point and a connecting pipe to the drop shaft entrance chamber. Most of the new structures will be constructed near curbs or in low points adjacent to major public thoroughfares.

Pumping stations will be constructed underground at the end of all conveyance tunnel routes and adjacent to all storage reservoirs. These stations permit a rate of dewatering of the tunnels and reservoirs which will allow a full tunnel or reservoir to be emptied within two to three days. The stations will also be used to transport bottom sludge dredged from reservoirs to treatment facilities.

## 3. DES PLAINES TUNNEL SEGMENTS AND BRANCHES

The Des Plaines system of TARP consists of: one waste treatment plant with a total capacity of approximately 220 MGD; over 26 miles of conveyance tunnel with a storage volume of 1,668 ac-ft; and onw main storage reservoir with a maximum capacity of 84,000 ac-ft. The component subsystems associated with the Des Plaines system include 55 drop shafts; and one pumping station located near the West-Southwest Sewage Treatment Plant. The system and its component subsystems will be constructed in one pahse.

This EIS addresses the TARP Phase I segments and branches of the Des Plaines system and focuses only on the conveyance tunnel system. The overall length of this tunnel system is approximately 26 miles. The subsystems associated with it include 55 drop shafts, 5 construction shafts, 10 access shafts, 80 collecting structures, and 1 pumping station.

## 3.6 COST OF TUNNEL SYSTEM AND SUBSYSTEMS

The MSDGC estimated cost[1] of a 10-foot diameter tunnel in rock with nominal aquifer protection is $200[2] per lineal foot. In rock with high quality aquifer protection, the cost is $230. Tunnel cost for soft ground construction is $350. Similarly, for a 35-foot diameter tunnel, the estimated costs are $1,030, $1,090, and $1,680 per lineal foot, respectively.

Large rectangular tunnels adjacent to construction shafts will be excavated by the drill and blast method and the estimated cost with nominal aquifer protection is $2,090 per lineal foot

1 MSDGC, January 1975.

2 All cost figures presented in this section are based on 1972 values.

for a 30-foot square tunnel. The same type and size of tunnels with high quality aquifer protection would cost an estimated $2,170 per lineal foot.

The tunnel costs estimated above include the following base figures:

- Cost of muck disposal, estimated to be $4.00 per solid cubic yard
- Nominal grouting[1] for control of infiltration during construction, estimated to be $0.30 per square foot of tunnel wall
- Access and ventilation shaft construction
- Ventilation and hoist equipment
- Grout and grout inspection equipment
- Average aquifer protection costs.

Additional grouting for aquifer protection in unlined tunnel segments in the upper aquifers is estimated to cost $1.50 per square foot of tunnel wall. This grouting would be provided to a depth of about one tunnel diameter beyond the excavated tunnel limit.

The total construction cost for all the Phase I TARP tunnel systems is approximately 1.46 billion. The estimated total costs for the subsystems are: $93 million for collecting/connecting structures, and $38 million for pumping stations. These subsystem costs are based on the following:

- Collecting Structures and Connecting Lines. The cost of the near-surface collection structures leading to the drop shafts includes the gravity interceptor sewers and the necessary connecting structures. Table III-1 lists the costs for these subsystems with respect to the TARP tunnel systems.

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1 Grouting is a procedure whereby a mixture of cement and water is injected under pressure into a drilled hole that intersects a source of seepage such as an open joint, fault, or bedding plane.

Table III-1
Estimated Costs For
Collecting Structures and Connecting Lines

| Tunnel System | Estimated Cost ($ Million) | | |
|---|---|---|---|
| | Intercepting Structures | Collection System | Total |
| Mainstream | 8.701 | 3.648 | 12.349 |
| Calumet | 1.084 | 1.088 | 2.172 |
| Lower and Upper Des Plaines | 1.043 | 3.489 | 4.532 |
| TOTALS | 10.828 | 8.225 | 19.053 |

Drop Shafts. The estimated cost of drop shafts includes all drop shaft components. The costs are related to the shaft diameter and to the depth of penetration into the rock formations. The cost of 250-foot deep drop shafts varies from $80,000 for a shaft two feet in diameter to $1,400,000 for a 20-foot diameter shaft.

Pumping Stations. The estimated construction cost of pumping facilities includes the structure, pumping equipment, power generation for the operation of larger units, and discharge piping to the appropriate treatment plant. The estimates have been based on use of variable-speed, motor-driven units. Total capital costs for pumping vary as follows:

| Lift Height | Estimated Cost ($ Million) Pumping Capacity 1000 cfs | 100,000 cfs |
|---|---|---|
| 300 feet | 5.6 | 200 |
| 525 feet | 5.7 | 300 |

## 3.7 TARP FINANCING

Financing of the entire $3.75 billion MSDGC Flood and Pollution Control Plan over the next 11 years is doubtful. As illustrated in Table III-2, however, the financing requirements for all conveyance tunnels could be met by a modest increase in Federal and MSDGC funding over a period of 11 years, from 1976-1986. An additional $456.7 million appropriation of funds are estimated to be required to

# Table III-2
## Financing Schedule - Tunnel Plan and Other Major Elements of MSDGC Flood and Pollution Control Plan

| Priority List of Projects | Estimated Costs[1] | EPA | | | STATE OF ILLINOIS | | | MSDGC | | | COE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Currently Available[2] | Currently Projected[3] | Additionally Required[4] | Currently Available[5] | Currently Projected | Additionally Required | Currently Available[6] | Currently Projected[7] | Additionally Required | Currently Available[8] | Currently Projected[9] | Additionally Required |
| 1. Conveyance Tunnels | 1,460 | 372.6[10] | 220.0 | 0.0 | 300.0 | 0.0 | 0.0 | 66.3 | 73.5 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2. Instream Aeration | 10.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| 3. Treatment Plant Upgrading[11] | | | | | | | | | | | | | |
| a) Calumet | 356.5 | 0.0 | 267.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 89.2 | 0.0 | 0.0 | 0.0 | 0.0 |
| b) West-Southwest | 774.7 | 0.0 | 292.6 | 288.4 | 0.0 | 0.0 | 0.0 | 0.0 | 6.6 - 187.1 | 187.1-0.0 | 0.0 | 0.0 | 0.0 |
| 4. Reservoirs and Flood Control | 690.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 690.0 |
| Total[12] | 3311.9 | 372.6 | 780.0 | 288.4 | 300.0 | 0.0 | 0.0 | 66.3 | 200 - 387.1 | 187.1-0.0[1] | 0.0 | 0.0 | 690.0 |

FOOTNOTES TO TABLE III-2

1 All cost estimates are based on those presented in the MSDGC's Facilities Planning Study (January 1976) and are escalated 6 percent annually for inflation.

2 These funds represent the remainder of the FY 1975 and FY 1976 PL 92-500 appropriation which are expected to be allocated to MSDGC by the State.

3 These are Federal funds, above and beyond the existing PL 92-500 appropriation, which are expected (in the form of a new appropriation) over the period FY 1977-1982.

4 These are Federal funds above and beyond the additional $780 million expected over the FY 1977-1982 period.

5 These are funds, under the State's current $750 million bonding authorization, which are expected to be available to MSDGC to finance the Tunnel Plan.

6 The funds in this category represented those available by virtue of the unused bonding authority of the MSDGC under the current $380 authorization.

7 This category represents funds expected to be available under an additional $200 to $400 million bonding authority for which the MSDGC is currently formulating plans to ask the State of Illinois.

8 There is no current COE appropriation for any MSDGC Flood and Pollution Control Plan elements.

9 There is no near future COE appropriation expected for any MSDGC Flood and Pollution Control Plan elements.

10 Includes approximately $49.6 million already obligated to the North Shore section of the Mainstream Tunnel Plan (Addison-Wilmette segment).

11 Figure doesn't include the estimated $124 million already obligated for the O'hare treatment plant project.

12 The total estimated cost $3311.9 million differs from the $3750 million (Table III-10 of the main body of the EIS) because of the exclusion of the following projects: sewers, solids disposal, O'Hare Treatment plant, and flood control (non-TARP).

finance the three (Mainstream, Calumet, and Lower Des Plaines) TARP tunnel systems. The additional Federal funds represent a modest portion (58.5 percent) of the conservatively estimated $780 million of new PL 92-500 money which is expected to be forthcoming to MSDGC over the next six fiscal years. Congress, however, has not yet approved any additional appropriation beyond the initial $18 billion which was authorized under PL 92-500 and totally allocated over the FY 1972-1976 period. The $73.5 million of MSDGC funds represents an increase of about 19 percent over the current MSDGC bonding authorization. This amount, however, represents a very modest proportion of the additional $200-400 million bonding authorization for which MSDGC is currently formulating plans to ask the State of Illinois.

If the Phase I tunnels of TARP are not implemented, there is a very high probability that approximately 90 percent of the currently available Federal funds assigned to the MSDGC will be lost by both the State of Illinois and the MSDGC. This potential loss to the MSDGC and state stems from the fact that the Calumet treatment facility expansion project, (which represent the next major project in terms of priority for Federal funds) will not meet the September 30, 1977 deadline for Step 3 funding eligibility. Assuming this project did not qualify in time for existing Federal funds, it is estimated that only approximately 10 percent of the $323.6 million could alternatively be allocated to other MSDGC or statewide prioritized pollution control projects.

The financing feasibility of other key elements (non-Phase I TARP) of the MSDGC's Flood and Pollution Control Plan (see Table III-2), which are closely related to the overall goal of meeting the 1983 water quality standards, ranges from almost certainty to near zero. Addressing these elements in the order of priority specified in the MSDGC's 1975 Facilities Plan, instream aeration stands slightly ahead of the conveyance tunnels. The approximately $30.7 million required for instream aeration can easily be met from existing state and MSDGC funding sources.[1] It is very unlikely, however, that the financing will be available to increase the treatment levels, efficiencies, and capacities at the Calumet and West-Southwest treatment plants. The total required financing ($1.13 billion) would necessitate a significant increase above the additional levels of Federal ($780 million) and MSDGC ($200-400 million) funds expected to be available over the FY 1977-1986 timeframe. The financing feasibility of the Calumet treatment plant expansion, however, is reasonable in view of their combined total

1 As of May 1976, funding for instream aeration has already been authorized.

estimated costs of $356.5 million. The Federal funding portion ($267.4 million) could be provided from the additional $780 million PL 92-500 appropriation expected over the next six years. The MSDGC portion ($89.1 million) could be provided from the anticipated $200-400 million additional bonding authorization. In terms of the West-Southwest treatment plant expansion project (estimated cost of $774.7 million), the financing feasibility is very questionable in view of the requirement for additional funds beyond the levels (Federal and MSDGC) expected to be available over the period FY 1977 to 1986.

The operation and maintenance costs of the TARP tunnel systems will be financed by a user charge system rather than the current ad valorem tax system. PL 92-500 requires the development of a user charge system and the State of Illinois presently has the authority to impose a user charge. This system of financing the annual operations and maintenance costs of the tunnel systems is not expected to have a significant economic impact in the commercial, industrial, and household sectors. The incremental charge in the MSDGC tax rate per $100 of assessed valuation (1975 rate was $.4005) is estimated to be $.0736 (for operations and maintenance) and $.002 (for tunnel construction) by the year 1986. The tunnel construction impact will continually decline after 1986 with the continuing growth of the tax base. Details of this financial system are provided in the EIS in Sections 3.3.1 and 9.3.

## IV. PRINCIPAL FINDINGS CONCERNING THE EFFECTS OF THE PROPOSED ACTION

Chapters VI through IX of the EIS assess the beneficial and adverse effects of the construction and operation of the conveyance tunnel systems on greater Chicago's natural and man-made environments. This chapter presents the principal findings of that analysis only for those effects expected to be relatively significant.

The most significant finding relates to the expected improvement in water quality resulting from the operation of the three Phase I tunnel systems. To assess the significance of this improvement, the EIS includes the consideration of the possible and likely cumulative effects of TARP components which are not a part of the Phase I systems. These other components are the reservoirs, treatment plant improvements, and instream aeration.

The principal findings of the EIS are listed as follows:

(1) Effects of Operation on Water Quality
(2) Funding Uncertainty for TARP
(3) Effects of Rock Spoil Generated During Construction
(4) Effects of Construction on Employment
(5) General Effects of Construction
(6) Effects of Infiltration and Exfiltration
(7) Worker Safety During Construction
(8) Effects of Operation on Land Use
(9) Effects of a Significant Earthquake on Tunnel System
(10) Effects of Flooding on Lake Michigan.

### 1. EFFECTS OF OPERATION ON WATER QUALITY

THE TUNNEL WILL SIGNIFICANTLY REDUCE THE POLLUTANT LOAD CURRENTLY DISCHARGED TO CHICAGO'S WATERWAYS, HOWEVER, THE TUNNELS ALONE WILL NOT RESULT IN ATTAINING APPLICABLE ILLINOIS WATER QUALITY STANDARDS, AND, THEREFORE, WILL NOT ENABLE ADDITIONAL USES OF THE AFFECTED WATERWAYS. THE ATTAINMENT OF ILLINOIS WATER QUALITY STANDARDS DEPENDS ON ADDITIONAL CONTROL MEASURES FOR WHICH THE FUNDING PROSPECTS ARE NOW POOR.

This conclusion is based on the following findings:

. The tunnels will capture approximately 90 percent of the pollutant load now discharged during combined-sewer overflows and will reduce the pollutant load 75 percent overall and the frequency of overflows from 100 to 10 times per year. 1977 Illinois water quality standards will continue to be violated during overflow events because of uncontrolled injections of pollutants into the waterways.

. The tunnels may not result in the attainment of 1977 Illinois standards for ammonia over lengthy reaches of waterway, because high concentrations of this pollutant are discharged from local wastewater treatment plants. Although data are not presently available to allow a more definitive determination of effects on this point, the attainment of water quality standards in the area's major river systems is clearly and intimately tied to the upgrading and expansion of MSDGC treatment plants.

. With the tunnels on line, 1977 Illinois standards of 4 mg/l for dissolved oxygen (DO) will still be violated along approximately 50 of the 80 miles of the Main Channel and of the Calumet River systems during the critical late summer months. Conditions along the Des Plaines River system have not yet been modeled by the MSDGC, but will be completed under the Section 208 planning program.

. 1977 Illinois standards for DO are likely to be met over the entire 80-mile length of the modeled waterways during critical summer dry flow conditions, assuming implementation of the following pollution control components:

  - Tunnels
  - Reservoirs
  - Treatment plant improvements
  - Instream aeration.

  The water quality impact of these various pollution control options is summarized in Table IV-1.

. Given current projections of Federal, state, and MSDGC financing capabilities and policies, the financing of the tunnels and instream aeration appears secure. The financing of the Calumet treatment

# Table IV-1
## Impact of Potential Pollution Control Options on Water Quality Along Main Channel and Calumet River Systems[1]

Notes (a) Tunnels plus instream aeration effects addressed in Section 8.1.1 of EIS.
(b) Phasing of options shown in order adopted by MSDGC in modeling studies.

| Water Quality Component \ Pollution Control Option | No Action | Phase I Tunnels | Phase I Tunnels Plus Instream Aeration | Tunnels Plus Treatment Plant Upgrading[2] Plus Instream Aeration | Tunnels Plus Reservoirs Plus Treatment Plant Upgrading Plus Instream Aeration |
|---|---|---|---|---|---|
| Combined-Sewer Overflows | Overflow to waterways 100 times per year. Illinois standards violated most of the time. | Overflows reduced from 100 to 10 per year. 75 percent of pollutant load captured and treated. | No significant change | No significant change | Overflows reduced to four occasions in 25 years. Standards met in waterways even during these rare overflow events. |
| Ammonia Levels | Ammonia standard violated by treatment plant discharges. | Ammonia standard violated due to treatment plant discharges. | No significant change | Ammonia standard met most of the time (not during overflow episodes). | Ammonia levels in waterways improved beyond standard. |
| Dissolved Oxygen (DO) Concentrations[3] | DO levels below Illinois standards along 80 percent of waterways. Anaerobic conditions exist over large stretches. | DO levels below Illinois standards along 70 percent of waterway. Anaerobic conditions greatly relieved. | Illinois standard met over entire 80-mile length of waterway. Anerobic conditions completely eliminated. | No significant change | No significant change |
| Allowable Water Uses | Illinois water use standards not met along area waterways. | No significant change | No significant change | No significant change | Illinois water use standards met. Fishing, boating, and shoreline activities permitted. |

1 Computer simulations of water quality along the Des Plaines River not yet available.

2 Upgrading to tertiary level assumed with nitrogen and phosphorus removal.

3 Evaluated for dry weather flow conditions.

4 Computer simulations of dry weather flow conditions.

plant expansion is probable; but financing the costly West-Southwest Treatment Plant is very doubtful. The financing of the reservoirs in the near future is very unlikely given the absence of any Federal commitment to provide assistance.

Additional details on water quality are provided in Sections 2.1 and 8.1 of the EIS text and details on financing in Section 3.3.1.

2. FUNDING UNCERTAINTY FOR TARP

THE CONVEYANCE TUNNELS CAN BE FINANCED BETWEEN 1976-1987 WITH MODEST INCREASES IN ANTICIPATED FEDERAL AND LOCAL FUNDING. HOWEVER, THE FUNDING OF THE RESERVOIR DURING THIS TIME PERIOD IS NOT A PART OF THE CURRENT FINANCING PLAN AND COULD NOT BE ACCOMPLISHED WITHOUT HAVING A MAJOR FINANCIAL IMPACT ON THE STATE, CITY, OR MSDGC.

Additional details on this finding may be found in Section 3.3.1 of the EIS.

3. EFFECTS OF ROCK SPOIL GENERATED DURING CONSTRUCTION

THE ROCK SPOIL MATERIAL GENERATED DURING TUNNEL CONSTRUCTION IS NOT EXPECTED TO BE MARKETABLE. THEREFORE, ENVIRONMENTAL IMPACTS ASSOCIATED WITH DISPOSAL OF THE ROCK SPOIL WILL DEPEND LARGELY ON THE AVAILABILITY OF LANDFILL DISPOSAL SITES.

Approximately 3,784,000 cubic yards (bulk measure) of spoil will be removed from the Des Plaines tunnel segments and branches. Although this amount can be adequately contained within area quarries, approximately 2,200,000 cubic yards of spoil will be stored on Forest Preserve lands for their use. Disposal of rock spoil from the reservoirs was addressed briefly in Section 6.2.4 of the EIS. A significant portion of rock spoil generated by reservoir construction is likely to be marketable and to be stockpiled on the quarry site for eventual sale by the quarry owners.

Major findings supporting the above conclusions are:

- Shale and other constituents present in the rock excavated from the Phase I tunnels will limit the rock's suitability for low-grade commercial uses.

- Landfill disposal sites capable of accepting the entire volume of tunnel spoil to be generated during TARP Phase I have not yet been identified by the MSDGC.

- McCook Quarry has enough volume to accept the entire quantity of spoil to be excavated from the Des Plaines tunnel segments and branches.

- Since conventional methods will be used to excavate rock from area quarries for reservoir construction, it is likely that a significant portion of the spoil will be marketable. Present plans envision stockpiling the saleable portion on the quarry sites for eventual sale by the quarry owners. Various stockpile configurations are being considered. Non saleable spoil can be stockpiled on-site, as is proposed for the McCook Quarry site.

A more detailed discussion is provided in Section 6.2.4 of the EIS.

4. EFFECTS OF CONSTRUCTION ON EMPLOYMENT

CONSTRUCTION OF THE DES PLAINES TUNNEL WILL PROVIDE ABOUT $87 MILLION IN CONSTRUCTION INCOME OVER A 7-YEAR PERIOD AND WILL CREATE A PEAK SUPPLY OF APPROXIMATELY 548 JOBS OVER A 3-YEAR PERIOD.

Further information may be found in Section 7.1.3.

5. GENERAL EFFECTS OF CONSTRUCTION

CONSTRUCTION OF THE TARP TUNNEL SYSTEMS WILL RESULT IN TEMPORARY PUBLIC ANNOYANCE AND INCONVENIENCE FROM THE CUMULATIVE EFFECTS OF NOISE, HANDLING OF CONSTRUCTION DEBRIS, VIBRATION FROM BLASTING, DISRUPTION OF VEHICULAR AND PEDESTRIAN TRAFFIC, AND GLARE FROM THE ILLUMINATION OF CONSTRUCTION AREAS AT NIGHT. ALTHOUGH THE CUMULATIVE EFFECTS MAY BE NOTICEABLE, TAKEN SINGLY, EACH EFFECT IS MINOR.

This conclusion is supported by the following findings:

- Surface construction sites are located in areas which are generally either vacant or near low-utilized industrial land.

- Noise at each construction site should be within levels mandated by Chicago ordinances and, at each surface construction site, noise will only occur for periods of 3 to 9 months.

- Because blasting will be used only to excavate shafts and not the tunnel, itself, blasts will be relatively infrequent and will continue at any one site for not more than 120 days.

Further information on this subject may be found in Sections 6.3.1, 6.3.2, 7.1.1, 7.2.1, 7.4, and 10.2.

## 6. EFFECTS OF INFILTRATION AND EXFILTRATION

IF THE GROUTING PROGRAM IS NOT EFFECTIVE,[1] GROUNDWATER INFILTRATION DURING CONSTRUCTION AND WASTEWATER EXFILTRATION DURING TUNNEL OPERATION CAN BE A SIGNIFICANT PROBLEM.

This conclusion is supported by the following findings:

- The inflow rate of groundwater for the TARP tunnel systems is estimated to be an average of approximately 0.5 MGD per mile of tunnel. In the absence of appropriate mitigative measures, this rate is sufficient to lower the piezometric or hydraulic pressure level of the upper aquifer. Tunnel grouting is the most effective method to reduce infiltration and a grouting program has been incorporated in TARP. Grouting integrity, however, must be maintained to keep inflows below the allowable limit of 500 gallons per day per inch of tunnel diameter per mile of tunnel. Observation wells will be required to monitor integrity throughout the operational phase of the tunnel.

- Exfiltration will most likely occur when tunnel pressures exceed inflow pressures during high storm runoff conditions. The TARP grouting program is expected to prevent extensive exfiltration of tunnel wastewaters into the upper aquifer.

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1 The objective of grouting is to achieve maximum penetration and a uniform grout spread. If grouting is ineffective, maximum infiltration/exfiltration flows will result.

However, if grouting integrity is not maintained during tunnel operation, exfiltration will be at a high enough rate to degrade groundwater quality of the upper aquifer. Observation wells will be necessary to determine whether exfiltration is occurring along the tunnel routes.

EIS Sections 2.1.2, 6.1.2, and 8.1.2 provide more information on the subject of groundwater infiltration and wastewater exfiltration. Specifications for observation well spacing and for the monitoring program are also presented in these sections.

## 7. WORKER SAFETY DURING CONSTRUCTION

TUNNEL OR UNDERGROUND CONSTRUCTION WORKERS WILL BE MORE SUSCEPTIBLE TO INJURY, DISABILITY, AND FATALITY THAN SURFACE CONSTRUCTION WORKERS. THE INCIDENCE OF INJURIES AND FATALITIES, HOWEVER, IS NOT EXPECTED TO BE GREATER THAN NORMAL FOR THIS TYPE OF CONSTRUCTION WORK.

This conclusion is supported by the following findings:

- Based on recent national statistics for all types of construction activities, the Des Plaines Tunnel system construction may result in 84 disabling injuries and in one permanent disability or fatality. For construction of the entire tunnel system, injuries and fatalities are expected to increase proportionately.

- Based on the safety statistics of the current construction of a rapid-transit system subway in Washington, D.C., construction of the entire TARP tunnel system could result in 1,525 injuries and in 9 fatalities.

- Analysis of the geologic and seismic characteristics of the project area indicates that most of the area is stable and suitable for the construction of underground tunnels. Precautionary measures will be required to protect workers in segments where rockfall and partings (loosened material) may occur frequently and shale deterioration conditions prevail.

Further information on this subject may be found in Sections 6.2.2 and 7.1.2.

8. EFFECTS OF OPERATION ON LAND USE

THE QUALITY OF LAND IN CERTAIN RIVERBANK SECTIONS ALONG THE DES PLAINES TUNNEL ROUTE MAY BE ENHANCED BY REDUCED FLOODING CONDITIONS.

Vacant land exists in the flood-prone areas associated with the Des Plaines Tunnel system. The reduction of flooding in these areas may enable development of this underutilized land into open space uses such as: parks, playgrounds, sport fields, and parking areas.

9. EFFECTS OF A SIGNIFICANT EARTHQUAKE ON TUNNEL SYSTEM

IF A SIGNIFICANT EARTHQUAKE OCCURS IN THE CHICAGO AREA, THE EVENT MAY OFFSET TUNNEL ALIGNMENT AND CAUSE SIGNIFICANT DAMAGE TO PORTIONS OF THE TUNNEL SYSTEM.

This conclusion is based on the following findings:

- The 175-year historical earthquake records indicate that a seismic event with a Modified Mercalli Intensity (MMI) of VIII can recur in the Chicago area at a rate of about once per 100 years. Assuming the tunnel system is in operation for 100 years, the probability of this event occurring at some time during this period is 100 to 1 or 10,000 to 1 for any given year. If an MMI VIII event occurs, severe alterations to tunnel alignment or tunnel surface may result.

- The conveyance tunnels will pass through several active faults prevalent in the TARP project area and will be sensitive to earth movement at these locations. Information on the distribution and nature of the active faults is insufficient to assess accurately the extent of damage which could result from an MMI VIII earthquake.

Further information on this subject may be found in Sections 2.2.3, 2.2.4, and 8.2.2 of the EIS.

10. EFFECTS OF FLOODING ON LAKE MICHIGAN

THE FLOODING PROBLEM EXISTING IN THE CHICAGO AREA WILL NOT BE RESOLVED BY THE PHASE I TUNNELS. OVERFLOW TO LAKE MICHIGAN WILL STILL PERSIST IF THE PROPOSED RESERVOIRS ARE NOT IMPLEMENTED.

# V. CONCLUSIONS AND RECOMMENDATIONS

The following is a summary of the principle conclusions of the Draft EIS, as well as recommended and suggested mitigative measures.

1. Implementation of the Lower Des Plaines System will significantly reduce the pollutant load in the Chicago waterways. These loadings will be reduced further with the implementation of the Mainstream and Calumet Tunnel systems. Water quality will be enhanced further with the upgrading of MSDGC's treatment facilities and the construction of the flood control aspects of the Tunnel and Reservoir Plan.

2. The rock spoil excavated from the Phase I tunnels is not expected to be marketable. Evaluation of various disposal alternatives leads to the conclusion that adequate environmentally acceptable landfill sites are available to handle the volume of rock which will be generated by the Phase I tunnels under consideration. We will rely on existing local, state, and Federal regulations to insure that disposal takes place in an acceptable manner. Additionally the MSDGC will be required to inform USEPA of their spoil disposal program as it is developed through discussion with the Contractor. This will be a condition of any grant awarded to the MSDGC for the Lower Des Plaines Tunnel System.

3. Although an effective grouting program is proposed, it must be sufficiently flexible to respond to the actual conditions encountered during construction. Should the grouting not be sufficient, additional infiltration could adversely affect the hydraulic pressure of the upper aquifer. Additionally, under surcharged conditions, exfiltration will occur, resulting in adverse impacts on the groundwater quality of the upper aquifer. Observation wells to monitor grouting integrity during operation are necessary along the entire tunnel alignment. If pollutants are detected in the observation wells, additional mitigative measures must be implemented to protect the upper aquifer, including a groundwater recharge system. Chapter X discusses particular aspects of the monitoring program, which will be developed in conjunction with the MSDGC, IEPA and USEPA. This monitoring program will also be a grant condition.

4. Since the majority of the construction shafts and drop shafts are in close proximity to area waterways, runoff from these sites could adversely affect water quality. Berms will be constructed around stockpiles of construction materials and spoil materials to preclude runoff into the waterways.

5. It is presently proposed that water pumped from the tunnels during construction be discharged directly to the waterways after a period of settling. Since the possibility of silt and other pollutants still exists after settling, it is recommended that these dewatering flows be discharged to MSDGC's intercepting system for treatment, except during periods of combined sewer overflows. This will be a condition of any grant awarded for the Lower Des Plaines Tunnel System.

6. Although no known historic, architectural, or archaeological resources will be affected by the proposed project, the possibility of finding archaeological resources must be investigated by the MSDGC. This must be accomplished by contacting the State Historic Preservation Officer.

7. Conformance with applicable regulation of the Occupational Health and Safety Administration, U.S. Department of Labor, and the Bureau of Mines, U.S. Department of the Interior is essential for safety of construction workers.

8. Significant earthquake events could adversely affect tunnel alignment and tunnel lining. Smaller earth movements could also affect the lining and grouting of the tunnels. It is, therefore, essential that MSDGC's inspection and maintenance program be extensive enough to insure efficient operation of the system.

9. There exists a wide range of potential adverse impacts which could develop during construction. This includes blasting, waste spillage, traffic congestion, light glare, and fugitive dust at construction and disposal sites. While these effects could be considered insignificant any measures taken to reduce their impact would aid in public acceptability of the project. These suggested mitigative measures are discussed in Chapter X.