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DRAFT ENVIRONMENTAL IMPACT STATEMENT

FREEWAY SANITARY LANDFILL EXPANSION

BURNSVILLE, MINNESOTA

June 4, 1980

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DRAFT ENVIRONMENT IMPACT STATEMENT
FREEWAY SANITARY LANDFILL EXPANSION

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FREEWAY SANITARY LANDFILL EXPANSION

SECTION I

SUMMARY

IDENTIFICATION OF DOCUMENT

Preface

In 1979, Richard B. McGowan Co., owner and operator of the Freeway Sanitary Landfill in Burnsville, filed an application with the Minnesota Pollution Control Agency (MPCA) for a permit to expand the disposal area of the landfill. The MPCA received an environmental assessment worksheet (EAW) on the proposal and, based on information contained in the worksheet, determined that an Environmental Impact Statement (EIS) should be prepared. On January 29, 1980, the MPCA board recommended to the Environmental Quality Board (EQB) that an environmental impact statement be prepared and that the Metropolitan Council prepare the EIS. The EQB concurred with the MPCA recommendations on February 21.

Organization of EIS

The Environmental Impact Statement has ten sections. Section Two briefly describes the existing landfill operations and the proposed action. Section Three describes the existing environment of the Freeway Landfill and the surrounding area. It covers air quality, water quality, ecology, and socio-economic aspects. Section Four covers the environmental impacts of the proposed expansion. This section of the EIS describes the primary impacts of the proposed action, direct effects that cannot be avoided, irreversible and irretrievable resource commitments, the relationship between local short-term uses of the environment and long-term productivity and any cumulative impacts. Section Five describes mitigating measures that might be undertaken to alleviate any significant environmental impacts. Section Six discusses alternatives to the proposal including a "no action" alternative, site design alternatives, waste reduction, and materials and energy recovery. Section Seven describes the impacts of any federal controls associated with the proposed action on state government. Section Eight describes multi-state responsibilities associated with the proposed action. Sections Nine and Ten discuss, respectively, impacts on county solid waste planning efforts and impacts on the Metropolitan Council's regional solid waste plan.

This EIS was prepared concurrently with EISs for the Burnsville and Pine Bend Landfills also in Dakota County, Minnesota. Sections Six through Ten of the EIS cover a number of issues that interrelate with the expansion of all three landfills. These sections of the EIS are contained in the Pine Bend Landfill EIS. Sections Six-Ten of the Pine Bend EIS are therefore an appendix to this document and the Burnsville EIS. The collection and management system cost section of Section III also references the Pine Bend EIS as an appendix.

PROPOSED ACTION

The Freeway application is for a permit to the existing landfill which is in Section 28, T.27 N., R. 24.W in Burnsville, Dakota County, Minnesota. The Freeway Landfill is a 126-acre site which has been in continual operation since 1968. The proposed project is for a vertical expansion of the existing landfill increasing the maximum permitted elevation of the landfill from 738 to 760 feet. This area will be filled with general residential and commercial refuse. The existing landfill has a remaining permitted capacity of 951 acre-feet (as of 1/80). At this capacity, the landfill has another 2 to 3-year "life" given normal receiving rates.

The proposed vertical expansion would provide for an additional 1860 acre-feet of space (3.0 million cubic yards), and will increase the estimated life of the landfill by three to six years given a fill rate of about 160 acre-feet per year. If allowed to expand, the landfill could operate for another six to nine years given normal receiving rates.

MAJOR ENVIRONMENTAL IMPACTS

Air Quality and Noise

The construction, operation and closing of the proposed expansion area will result in a minimum amount of fugitive dust, odors and methane gas. Current operational procedures at the landfill should be sufficient to handle most of the air emission problems associated with the proposed expansion area. In addition, the surrounding topographic and land use features of the area should provide adequate protection from adverse impacts on local people and property.

The potential for adverse methane gas impacts will be increased by the proposed expansion area. If buildings are constructed on the former fill area or near the perimeter of the landfill, there is potential for gas accumulation in these structures in explosive concentrations. It may be necessary prior to closure of the facility to install a gas monitoring system to evaluate any future requirements for on-site and perimeter gas control measures.

Water Quality

The primary impact on surface and groundwater from the proposed expansion will be the increased length of time in which leachate will be produced from the landfill. Since the proposed action is a vertical expansion only, there will be no increase in surface area. The leachate production rate should not increase. The area where leachate may potentially influence shallow levels of groundwater should not increase. It is uncertain whether or not leachate concentration will increase due to the proposed expansion.

Results of the analysis to determine the impact of the proposed expansion on Minnesota River quality indicate that there is no significant impact from the expanded landfill. Most measures show no appreciable change due to the landfill. The same is true for nearby wetland areas.

The application and grading of daily and final cover material at the landfill will serve to direct on-site drainage to the drainageway. Surface leachate should rarely occur with continued cover soil placement, grading and seeding practices. Continued seeding will promote natural vegetative growth which will subsequently stabilize fill surface areas, prevent erosion and enhance the appearance of the site.

There is no potential for leachate contamination of the water supply wells. The two wells within the area of potential leachate influence at U.S. Salt Company and Freeway landfill truck shed have not shown any signs of leachate contamination. The proposed expansion should not effect these wells if pumping rates remain the same. Future development of this area is restricted by the floodway ordinance. Continued monitoring of these two wells is recommended along with the existing landfill monitoring system.

Terrestrial and Aquatic Ecology

Construction activities in the proposed expansion area, particularly the excavation and fill procedure, will unavoidably delay the onset of new vegetative growth. While considerable time will lapse between replanting and full restoration of a vegetative cover and subsequent reintroduction of associated wildlife species, impacts are generally not substantive.

Operating activities in the proposed expansion area should have only negligible impacts on off-site ponds and wetlands. With daily cover and surface runoff controls (such as slope structure and seeding), potential impacts should be negligible.

Socio-Economics

The expansion of the landfill will delay use of the property for other purposes for about three to six years. Transportation-related impacts will not be new; rather, they will reflect existing impacts. Existing impacts have been identified as traffic congestion in the vicinity of the landfill, traffic operating deficiencies at the Interstate Highway 35W-113 Street South interchange, and litter on local streets in the vicinity of the landfill.

Nearby homes that look directly on the landfill will be exposed to the operation of the facility during the expansion period. Visual impacts will be greater than at present, since the final elevation of the expansion areas will create an isolated mound.

The expansion area will add about nine months of life to the metropolitan land disposal system. This will, in turn, lessen the need

and expense for new landfills and the need for routing and/or additional fuel costs for area haulers. Filling of the expansion area will, therefore, lessen the need to develop new landfills sooner, and help maintain present land disposal charges and collection rates.

REASONABLE ALTERNATIVES

The Freeway Sanitary Landfill, without expansion, will close in 1983. No resource recovery or new landfill facilities would likely be operating in time to represent reasonable alternatives to the proposed expansion.

Existing alternatives to the proposed expansion include waste reduction and material recovery. Neither of these waste management methods could provide a reasonable alternative to the entire capacity proposed for expansion. Source separation and materials reuse and recovery methods do, however, provide cost-effective alternatives for a portion of the waste materials presently landfilled. Additional support for existing programs and stepped-up efforts to implement new programs could be deemed as reasonable and prudent alternatives to a portion of the proposed expansion.

Federal, State and Local Permits Outstanding

The applicant is required to obtain a modification of its existing solid waste disposal permit with the Minnesota Pollution Control Agency. The Metropolitan Council must approve the modification. The applicant is also required to obtain modification of its license with Dakota County and its conditional use permit with the City of Burnsville.

AGENCIES, ORGANIZATIONS AND INDIVIDUALS CONSULTED

The Metropolitan Council staff prepared this Environmental Impact Statement. The Minnesota Pollution Control Agency's staff prepared Sections Seven and Eight and a portion of Section Six.

The following agencies, organizations and individuals were consulted during preparation of this EIS.

University of Minnesota

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Minnesota State Planning Agency

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Dakota County	D. Gurney
Barr Engineering	D. Farb, L. Dalen, A. Gebhard
Dakota County Soil and Water Conservation District	B. Christenson
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Minnesota Historical Society	R. Fridley
Dakota County Historical Society	F. Miller
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City of St. Paul	F. Forsberg, R. Person
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Minnesota Department of Natural Resources	T. Kucera, C. Henderson, J. Davidson, K. Gill, C. Cohen, R. Norrgard, J. Dustrude
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City of Bloomington	J. Truax, G. Shirley
Northern States Power Company	T. Williams, G. Kelly J. Bechtoldt, L. Eberly
Minnesota Pollution Control Agency	D. Korpela, G. Blaha
R. B. McGowan Company	R. Mc Gowan, M. McGowan

FREEWAY SANITARY LANDFILL EXPANSION

SECTION II

DESCRIPTION OF EXISTING LANDFILL AND PROPOSED ACTION

DESCRIPTION OF EXISTING LANDFILL

SITE LOCATION

Legal Description

The Freeway permit application is for a vertical expansion of the existing landfill located in the southeast quarter of Section 28, T27N, R24W in the City of Burnsville, Dakota County, Minnesota. The location and limits of the landfill are shown in Figures II-1 and II-2. The legal description of the existing landfill property is included in Appendix I.

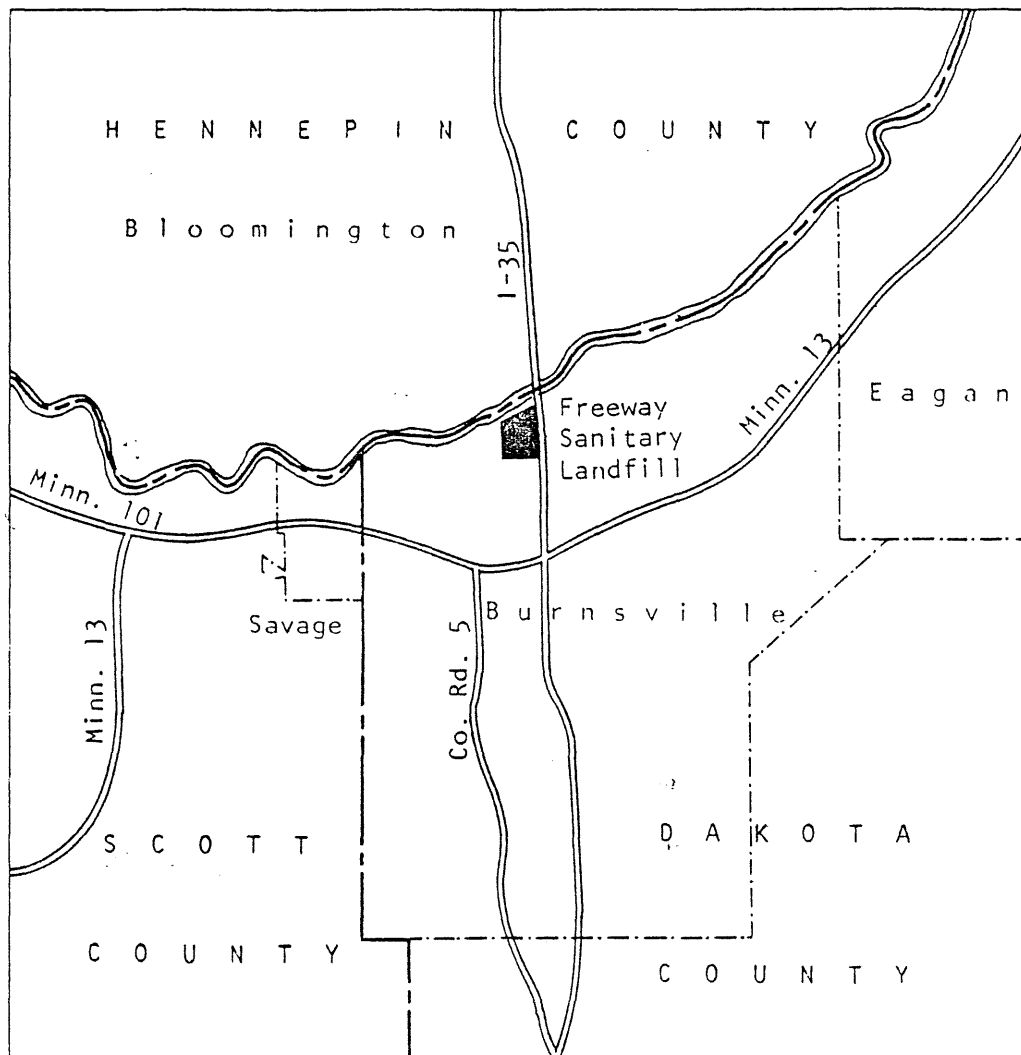
The Burnsville zoning map, dated November 1977, identifies the site and surrounding lands within one-quarter mile as I-2, general industrial district. The 1965 Burnsville Comprehensive Plan identifies the site as general industry.

As Figures II-2 and II-3 indicate, the area to the west, north, and east of the landfill is open land; Interstate 35W is adjacent to the landfill's eastern boundary. A quarry operated by Edward Kraemer and Sons is immediately south of the landfill. The Minnesota River is approximately 400 feet north of the landfill.

The Freeway Sanitary Landfill is an existing permitted landfill (MPCA Permit No. SW-57) which has been in continual operation since July 1968. The landfill is operated under a conditional use permit with the City of Burnsville and a license with Dakota County. The landfill occupies 126 acres and is owned and operated by the Richard B. McGowan Company.

Major Access Roads

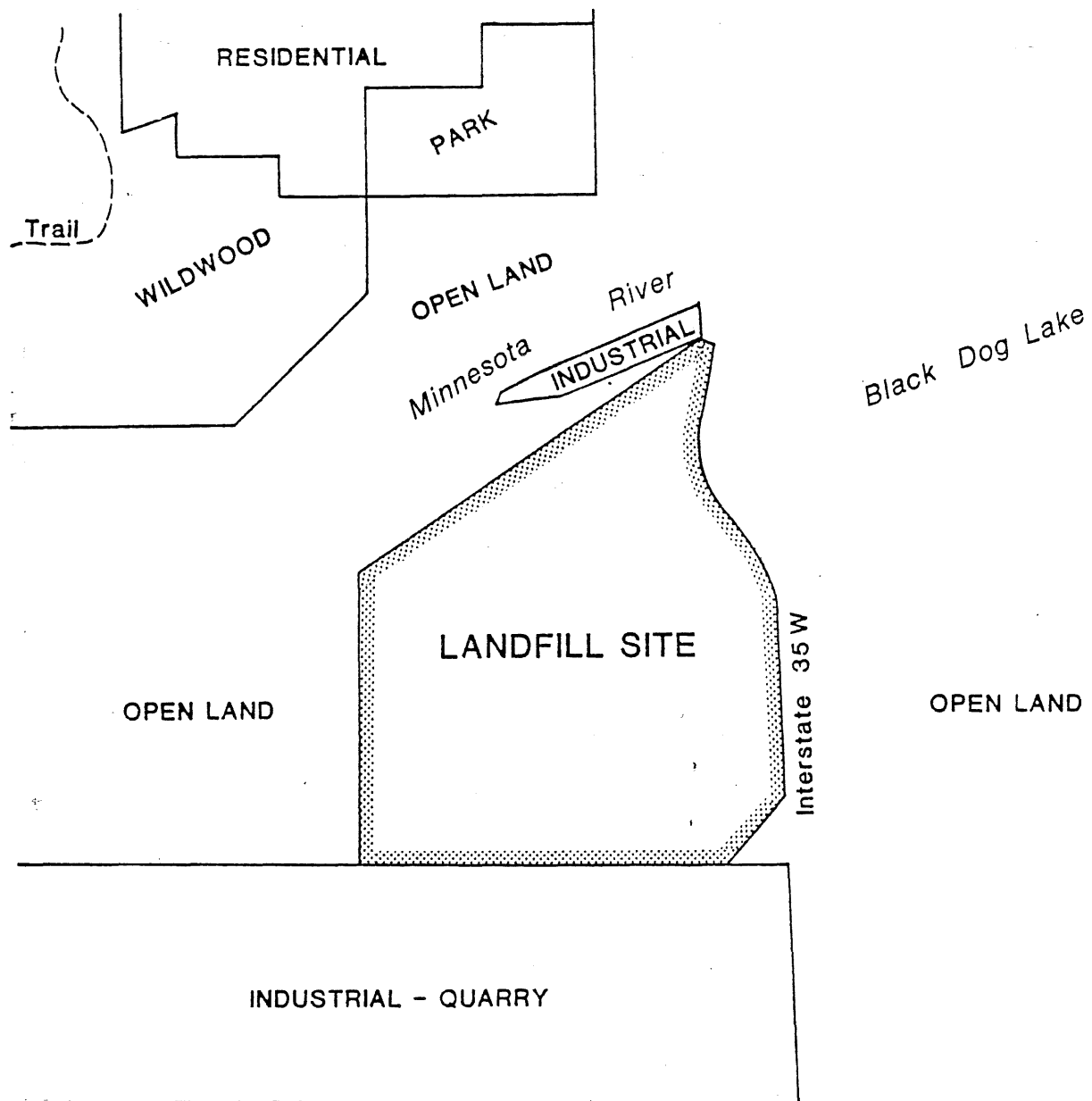
Solid waste is brought to the disposal site by commercial haulers or private individuals along the haul roads shown in Figure II-1. The primary haul road is Interstate 35W with access to the landfill from 113th Street South. Access to the landfill site is provided by an all weather, blacktopped entrance road.



N
▲
1" = 2 Miles

FIGURE II-1

REGIONAL LOCATION
and
EXISTING HAUL ROADS



N



1" = 1000'

FIGURE II-2
EXISTING LAND USE

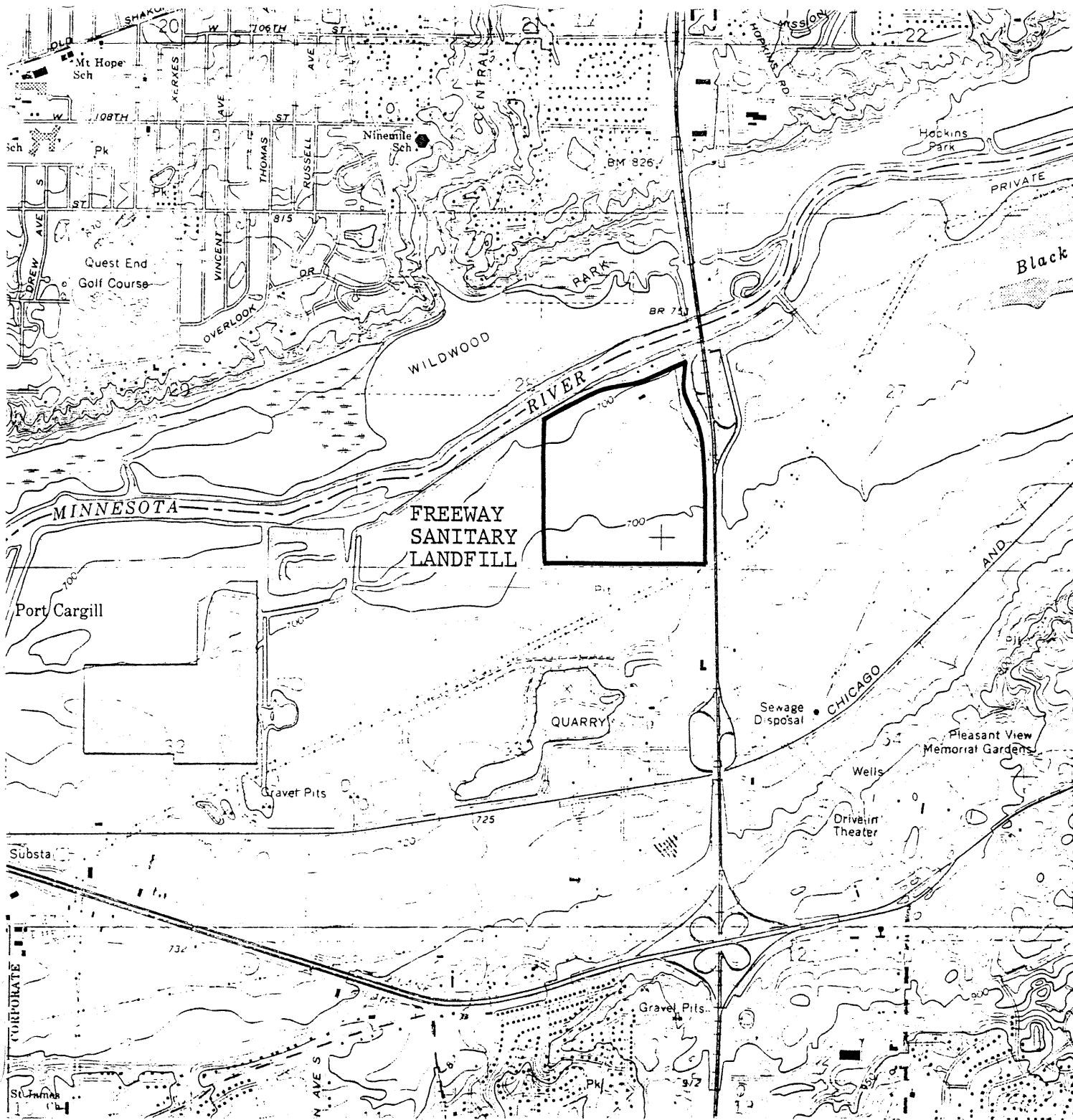


Figure II-3 Quad Map Excerpt

Scale 1" = 2000'

From: USGS Bloomington Quadrangle

SOLID WASTE SERVICE CONDITIONS

Areawide

For a description of areawide solid waste collection and disposal conditions see "Environmental Impact Statement for Woodlake Sanitary Landfill Expansion," Technical Work Paper No. 1, Minnesota Pollution Control Agency, 1980.

Solid Waste Quantities and Composition

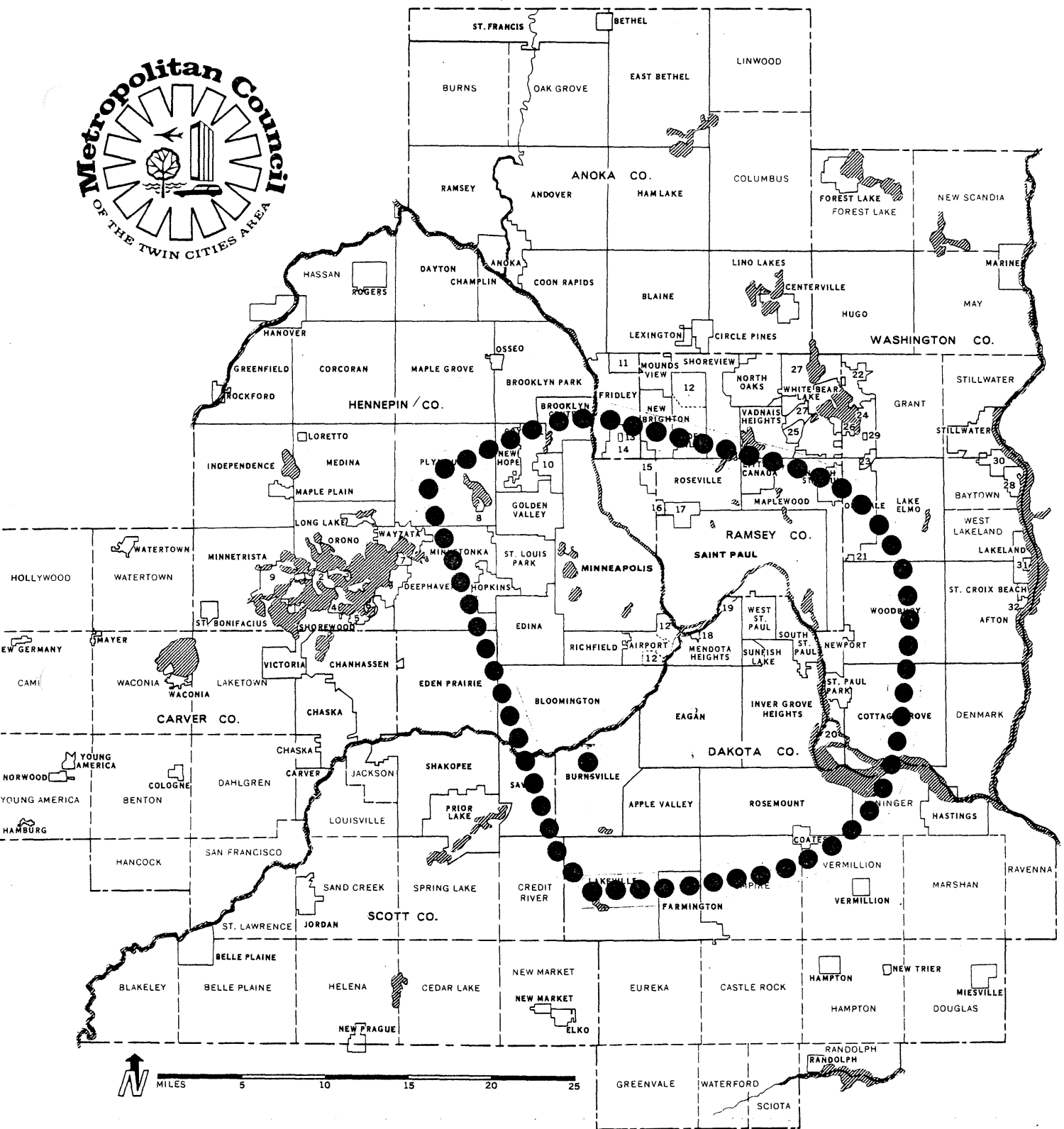
The Freeway Sanitary Landfill was originally permitted at a capacity of 1,962 acre-feet. There is approximately 470 acre-feet of capacity remaining, representing about two to three years of landfill life. Solid wastes are normally disposed at the landfill at a rate of approximately 15,000 to 40,000 tons per month. However, because of recent tipping fee increases, receiving rates at the gate have dropped approximately 50 percent.

The Freeway Sanitary Landfill disposes of any solid waste material other than hazardous waste. Although the landfill will accept tree, demolition and construction waste material (i.e. "clean fill"), the disposal charges for these materials make this disposal option prohibitively expensive. Since the amount of tree waste, clean fill, and industrial waste materials has been insignificant in the past years, it can be assumed that the solid waste presently in the landfill is predominately municipal solid waste generated from residential and commercial sources. Municipal solid waste contains generally the following components: food waste, paper, cardboard, plastics, textiles, rubber, leather, garden trimmings, wood, glass, tin cans, non-ferrous metals, ferrous metals, dirt, ashes, brick, and other miscellaneous materials.

Collection and Disposal Systems

The Freeway Sanitary Landfill serves a collection area bounded approximately by southern Hennepin County including most of Minneapolis; southern Ramsey County including most of St. Paul and parts of Roseville and Falcon Heights; portions of western Washington County including New Port, St. Paul Park, Grey Cloud, and Cottage Grove; portions of northern Dakota County as far south as the townships of Farmington and Empire; and portions of Scott County including Savage. A recent waste shed analysis by a consultant for the Metropolitan Inter-County Council shows the general service area boundaries for the Freeway Sanitary Landfill (see Figure II-4).

Waste is brought to the disposal site by commercial haulers or private individuals. The majority of the trucks dumping at the Freeway Landfill are rear-loading compactor trucks with capacities of 10 to 30 cubic yards. Since most of the waste comes directly to the landfill without prior processing at a



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transfer station, the compaction within the packer trucks themselves represents the only compaction before disposal at the landfill.

SITE OPERATION

General Methods of Landfilling

The Freeway Sanitary Landfill contains three buildings on-site including an office, maintenance garage, and a portable building near the working area of the fill. The landfill is operated 9 hours a day (8:00 a.m. to 5:00 p.m.), seven days a week. A sign is posted near the site's entrance indicating where vehicles are to unload. An attendant is on duty during operating hours, limiting access to the site and providing directions for unloading. The attendant also assures that the unloading area is confined to as small an area as possible. Tables II-1 and II-2 show the equipment used at the landfill and the personnel needed to operate the facility.

The following discussion describes the disposal procedures presently used at the landfill.

Filling Sequence -- The staging of the development of the landfill consists of three phases as shown in Figure II-5. Phase 1 has already been completed as planned. Phase 2 is near completion and Phase 3 is just beginning to be developed. The landfill manager is presently constructing berms along the eastern edge of the fill area for visual screening purposes. The berms are being constructed of demolition and construction debris as such material becomes available.

Compaction Procedure -- Refuse is compacted on the working face by one or two compactors seven days a week. The working face is kept as small as possible to minimize the amount of wind-blown debris. Refuse is worked from the unloading area either below or above the working face through the use of the blades on the compactor. The working face, is maintained at slopes of 5 to 15 percent and is compacted in approximately 8 foot lifts. This procedure insures more complete compaction of the refuse.

Cover Procedure -- Six inches of cover material is applied daily to the top and side slopes of the working face by a scraper. In addition, areas over which another lift will not be placed for more than 120 days is covered with one foot of cover material. Cover material is taken from a 40-acre site adjacent to the western edge of the landfill. Cover material for winter operations is available from this site or from stockpiles on the finish grade of the landfill.

The landfill has been cited a number of times recently by the MPCA for daily cover violations (see Appendix II).

TABLE II-1
EQUIPMENT INVENTORY

<u>Machine</u>	<u>FUNCTION</u>				<u>Number of Units</u>
	<u>Excavation</u>	<u>Earth Moving</u>	<u>Spreading & Compacting</u>	<u>Other</u>	
Compactor			x		2
Tractor/Dozer	x	x	x		1
Scraper		x			1
Pickup Truck				x	1
Water Tank Truck (45,000 gal. capacity)				x	1

TABLE II-2
LANDFILL SITE PERSONNEL

<u>Classification</u>	<u>Number</u>
Foreman	1
Equipment Operators	2
Clerk	1
Night Watchman	1
Part-time Personnel	2

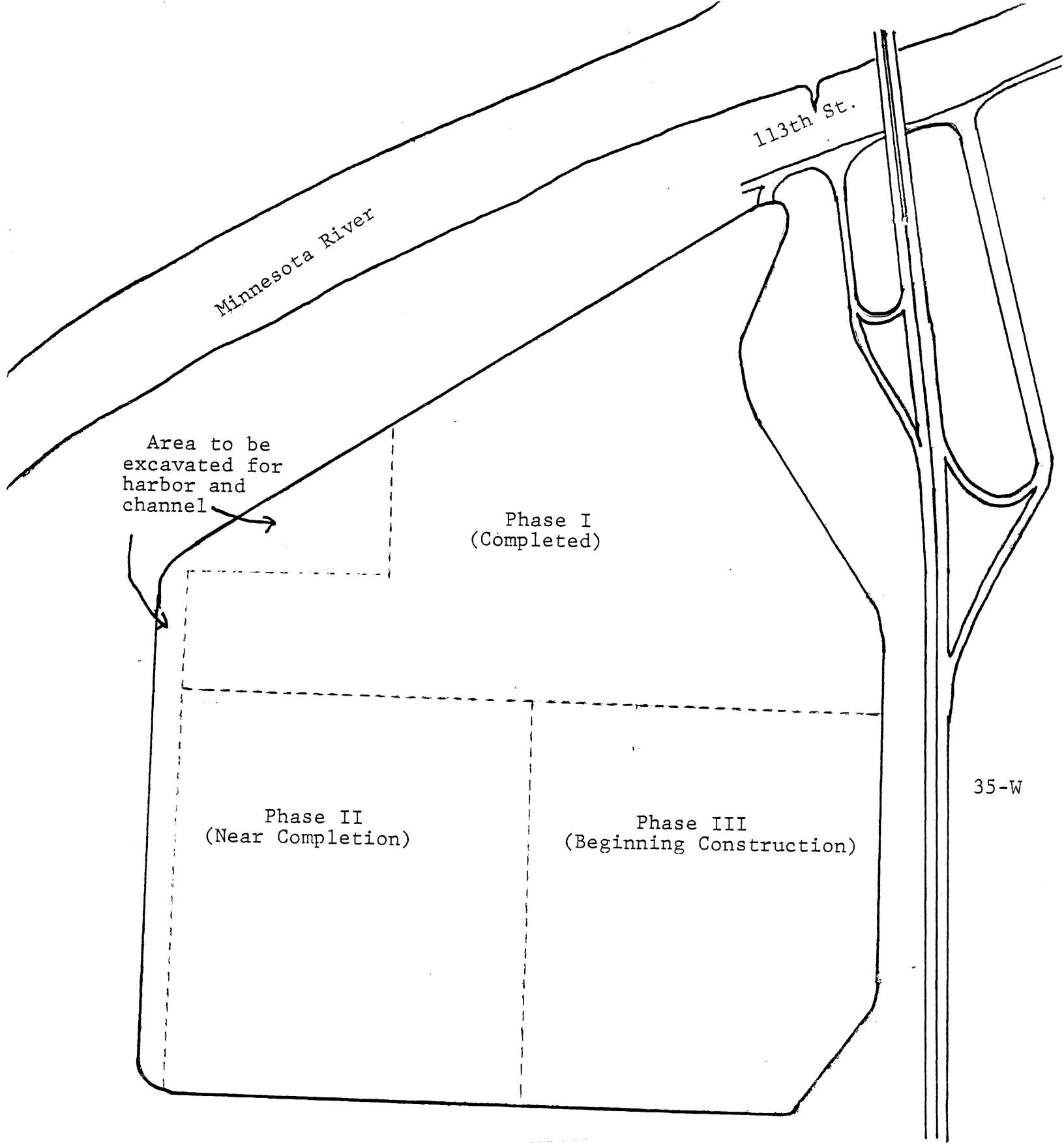


Figure II-5
Phase Development Plan
Freeway Sanitary Landfill

Within one month after the final contours of the landfill are achieved or any continuous, unbroken area of approximately two acres is brought to the final contours, the area is covered with two feet of compacted cover material and properly sloped to provide surface water runoff control. The finished surface of the landfill is covered with topsoil and seeded with native grasses. Side slopes are covered with mulch as required to prevent erosion.

Appendix II contains a chronology of significant events that have occurred at the Freeway Sanitary Landfill including MPCA site inspections.

Environmental Controls

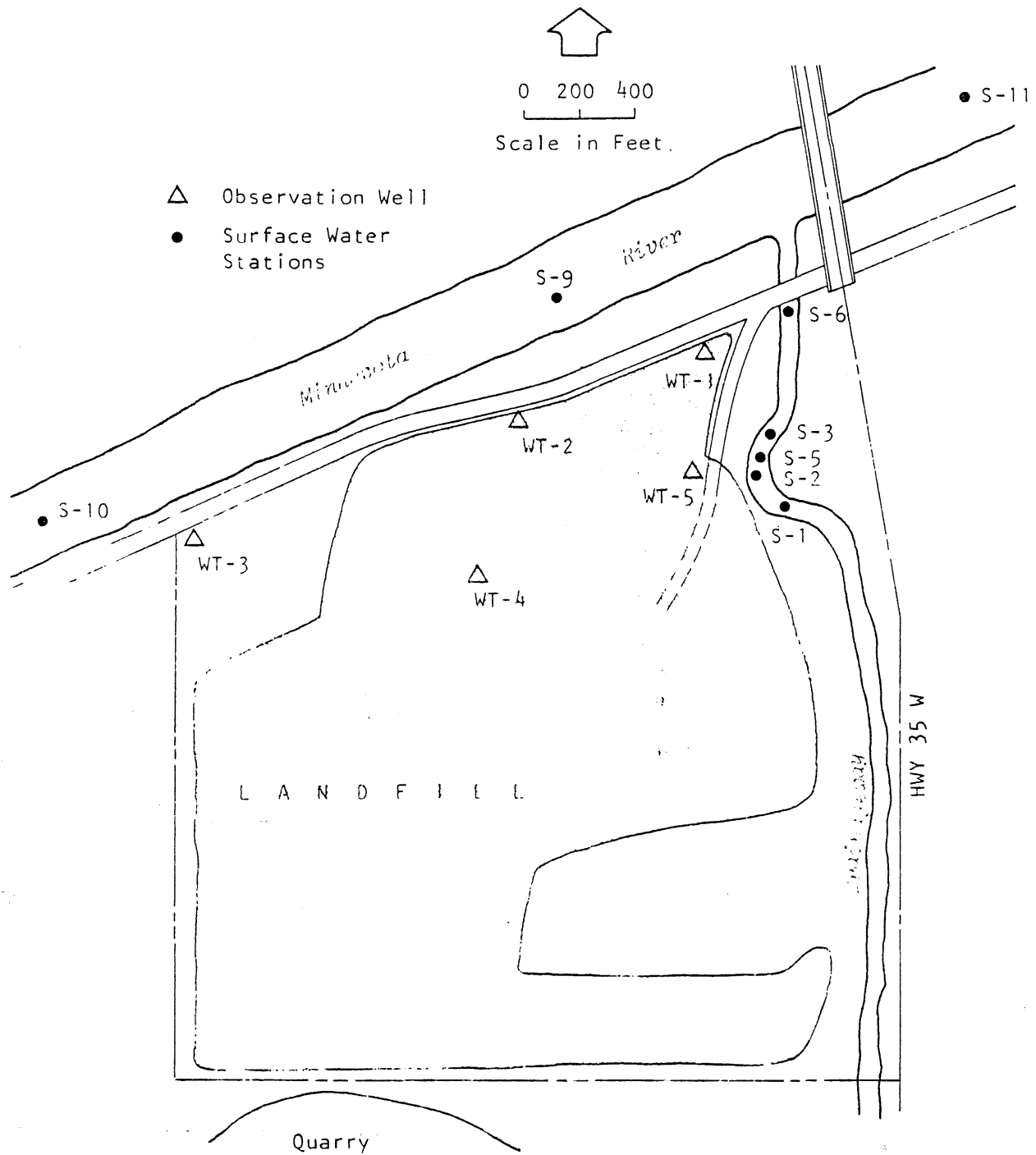
Leachate Control -- There is no leachate collection system under the landfill.

Ground Water Monitoring System -- Five piezometers have been installed to monitor possible impacts by the landfill including subsequent surface water impacts (see Figure II-6 for locations). The monitoring plan includes quarterly sampling of four surface stations and the five ground water wells for the following parameters: COD (filtered and total), BOD (filtered and total), chloride, specific conductance, pH, copper and total chromium. This monitoring system will remain in operation during and subsequent to the filling of the landfill including the proposed expansion,

Surface Water Drainage -- The entire landfill, including the fill surface, is graded and/or provided with drainage facilities to minimize run-off onto and into the fill, to thus prevent erosion or washing of the landfill and to prevent collection of standing water. The final contours and runoff water flow direction, after completion of the landfill including the proposed expansion, are shown in Figure II-7. The general plan is to construct hills of refuse with fairly steep slopes. Surface runoff is directed to adjacent drainage ditches which then flow into the Minnesota River north of the site.

Freeway Sanitary Landfill is bordered by a drainageway between the landfill's eastern boundary and I 35-W. This drainageway receives surface runoff water from the Freeway Landfill, I 35-W and other parts of the watershed further south. The runoff flows in the drainageway until it reaches the Minnesota River. A flood gate operated by the Department of Transportation (MnDOT) prevents back flow from the river during high water conditions. According to the operator of the landfill, on one occasion during flood conditions the gate was not properly closed, which caused river water to back up beyond 113th Street and onto the landfill.

Vector Control -- Periodically, or at the County Engineer's request, the operator has the landfill inspected by a licensed exterminator company, who sends a report of the inspection to the operator. This report is available to the MPCA and the County Engineer's Office. To minimize scavenging by rodents



FREWAY LANDFILL
WATER SAMPLING STATIONS

FIGURE II-6

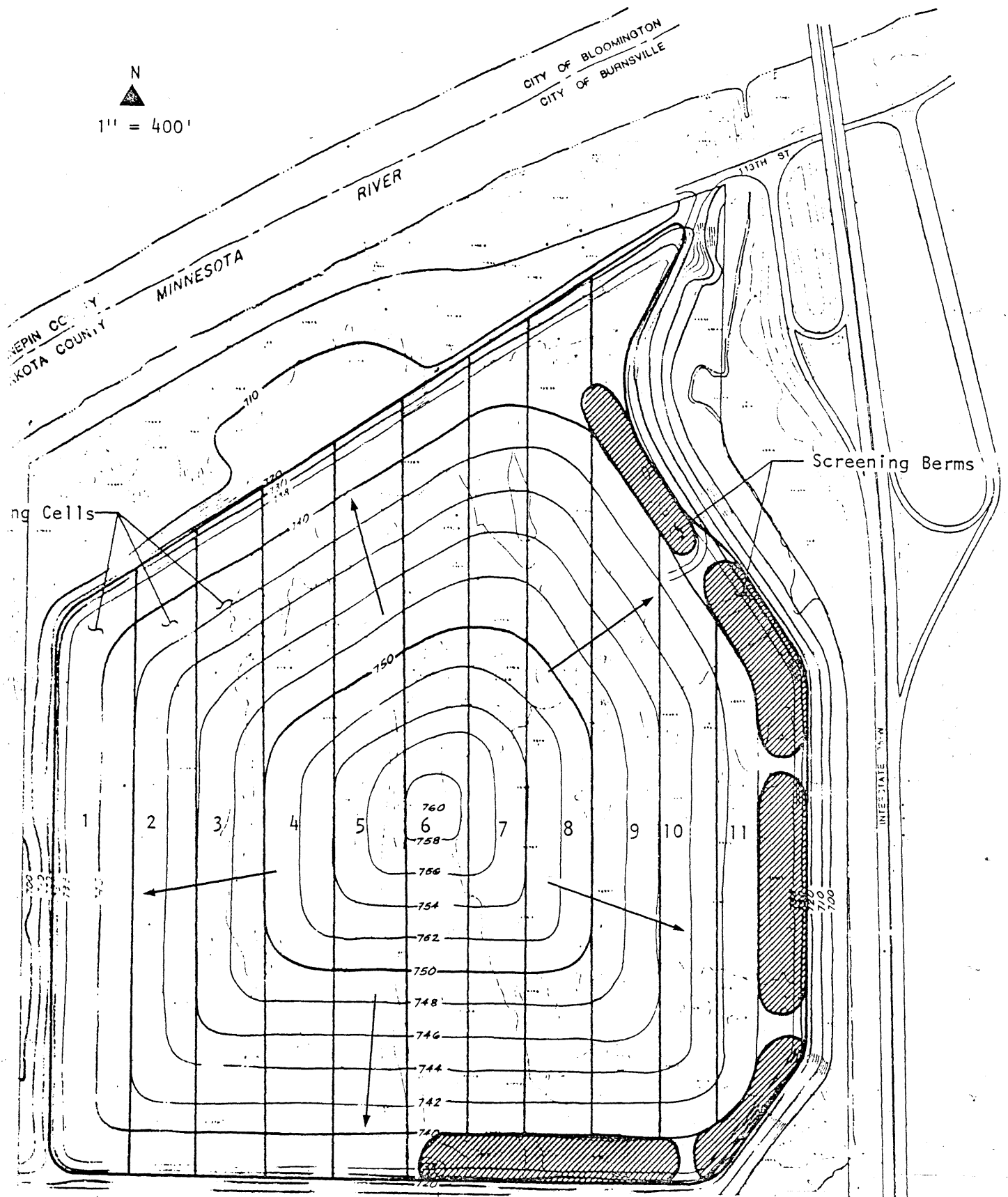


FIGURE II-7

FILLING SEQUENCE of PROPOSED EXPANSION,
FINAL GRADING and DRAINAGE PLAN

and other animals, daily cover is applied at the end of the day's operation. Vectors are apparently not a problem at the site.

Air Quality -- The landfill's operational procedures provide protection against fugitive dust emissions. The approach to the landfill and the main site road for routing trucks to the active fill area are paved. In addition, water from a fire truck is available to sprinkle on the dirt portions of the road if further dust control is necessary.

Noise Control -- The land use features surrounding the landfill site and the topographic features of the working area of the landfill provide physical barriers and buffer areas from noise generated by the landfill operation.

Litter Control -- An attendant picks up paper and other debris which may be scattered on the site. Litter control fences also are used to prevent wind blown material from leaving the site.

The landfill has been cited a number of times by the MPCA for litter violations (see Appendix II).

Security and Safety Practices

Fire Protection -- Fire protection is provided by a 4,500-gallon water truck equipped with a pressure water pump. An additional pump is available to take water out of the drainageway along the eastern edge of the landfill. In addition, a stockpile of earth is maintained reasonably close to the landfill to be used, if necessary, for extinguishing fires. Fire extinguishers are kept on all site vehicles and in all buildings at the landfill. The Burnsville Fire Department has also been notified of the existing operation, is aware of the access points to the site, and has a fire station within five miles of the site.

Security -- Security at the site is provided by an attendant who is on duty during the operating hours of the landfill. The attendant, limits access to the site and provides directions for unloading vehicles. In addition, an employee of the landfill lives in a house-trailer located at the site's entrance. This employee provides security during the nonoperating hours of the landfill.

The landfill, however, is not fenced and off-road access is possible.

Sanitary -- The maintenance garage has a rest room for personnel. There is a well on the site to supply water.

Emergency Communications -- Telephones are available for emergency communications during all working hours in all three of the landfill buildings.

Closure

Once an area reaches final fill elevation, two feet of earth is spread, graded and compacted. Figure II-7 shows the final grading plan with the proposed vertical expansion. The area is then revegetated with grass species as the final step in the closure.

Prior to termination of the operation of the site, the Minnesota Pollution Control Agency and the Dakota County Engineer will be notified to conduct a site inspection to determine the final condition of the completed landfill. Within one month after approval of the final condition, a detailed description and plot of the completed site will be recorded with the Dakota County Recorder's Office. This description will give the general type and number of lifts, the original and final elevation of the completed site.

Post-Closure

The landfill site is located in a General Industrial Area as shown on the Burnsville Comprehensive Plan. The preliminary end use plans developed for the landfill, as approved by MPCA and the Metropolitan Council as part of the conditions under which a permit to operate (SW-57) was issued for the site, shows general and limited industrial uses for the site. Figure II-8 shows the proposed final uses of the site.

As Figure II-8 indicates, the general and limited industrial areas will possibly be accessed by two roads over the closed landfill area: County Road 5 extension and a I-35W frontage road. Building locations will depend on sufficient subgrade support capacity, methane hazard potential, and approval from appropriate governmental agencies.

The landfill owner has stated an intent to investigate the possibility of developing a marina harbor on the northern edge of the landfill with direct access to the Minnesota River and a 9-foot deep channel directly west of the landfill to provide interior marina access.

Energy

The majority of the energy demand from operations of the Freeway Sanitary Landfill comes from the following on-site equipment: a compactor, tractor-dozers, scraper, pickup truck, and water-tank truck. Annual diesel fuel requirements are approximately 70,000 gallons. An on-site storage tank holds approximately 30,000 gallons of diesel fuel.

For a description of areawide energy supply and demand forecasts see "Environmental Impact Statement for Woodlake Sanitary Landfill Expansion", Technical Work Paper No. 8, Minnesota Pollution Control Agency, 1980.

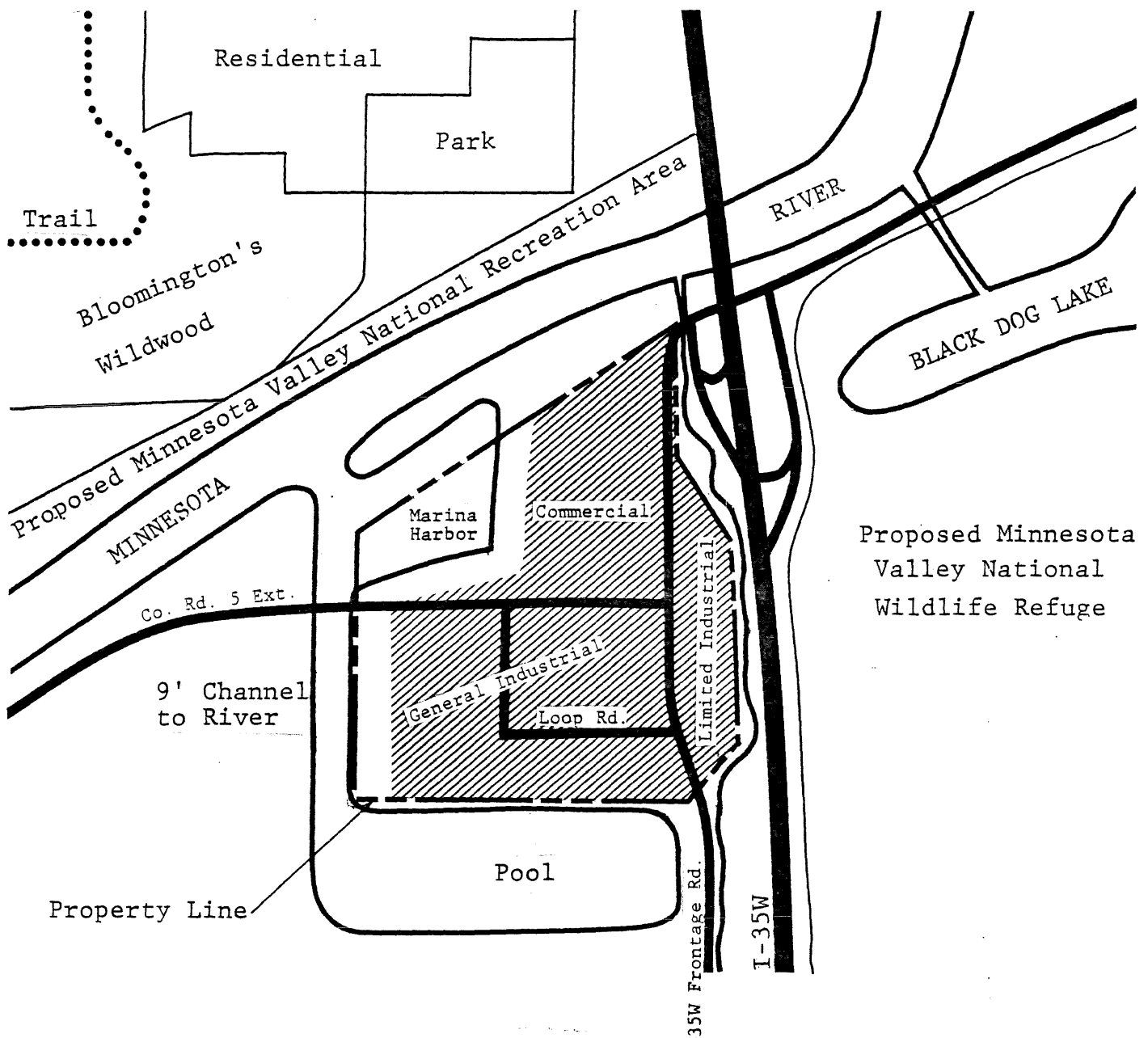
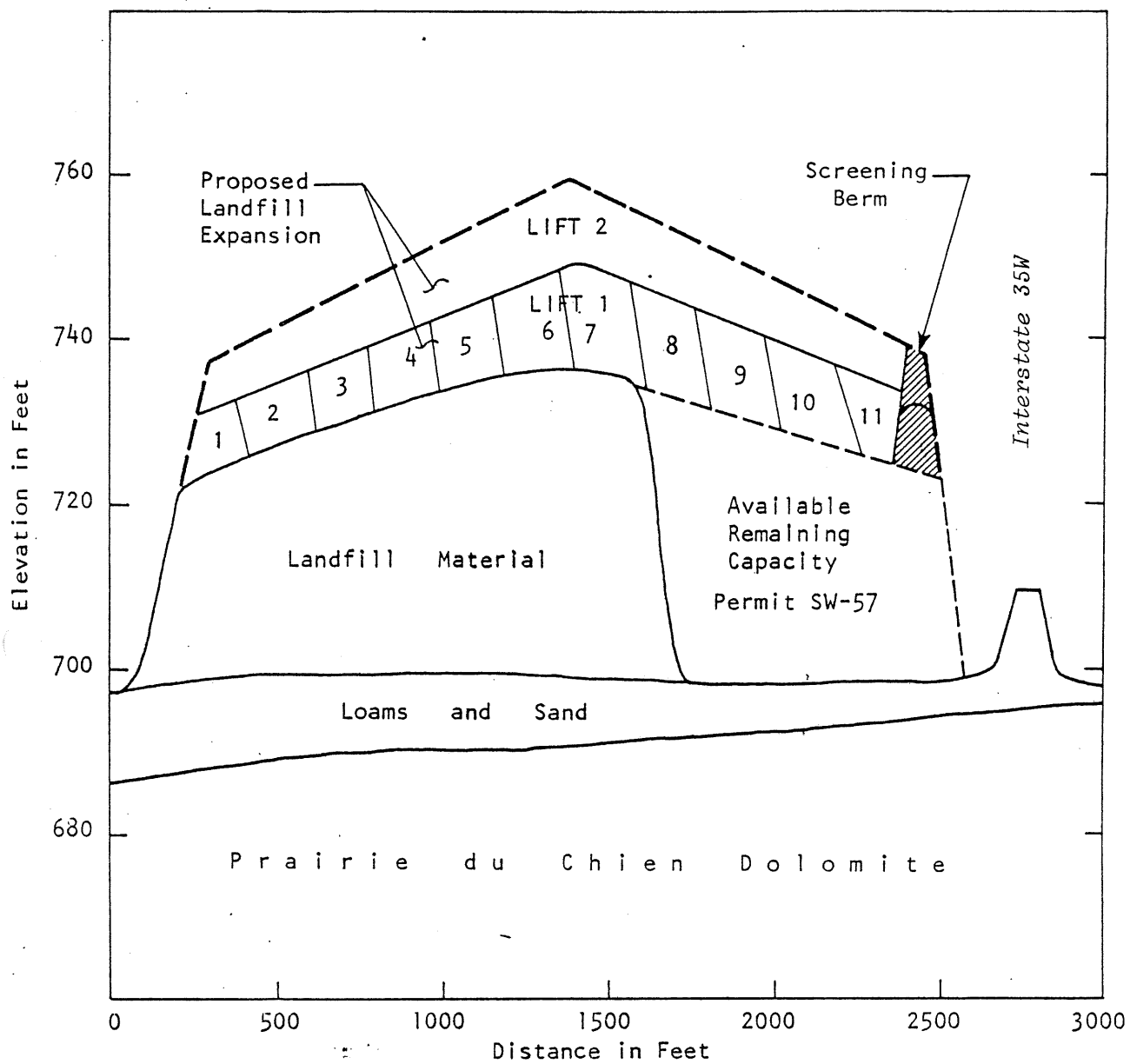


FIGURE II-8

END USE PLAN
 FREEWAY SANITARY LANDFILL

 Area with Buried Refuse Material



Note: Different horizontal and vertical scales

FIGURE II-9
WEST-EAST CROSS SECTION
FREEWAY SANITARY LANDFILL

DESCRIPTION OF PROPOSED ACTION

PRESENT APPLICATION

The requested permit modification would allow the vertical expansion of the existing 126-acre landfill by increasing the maximum permitted elevation of the landfill from 738 to 760 feet (see Figure II-9). The proposed project does not alter the existing exterior boundaries of the landfill.

The existing landfill has a permitted capacity of 1,962 acre feet. At this capacity the landfill could continue to operate for approximately another two to three years given normal waste receiving rates.

The proposed vertical expansion would provide for an additional 1,860 acre-feet of capacity which would give an additional four to six years of operating life to the landfill. Allowed the expansion, the landfill could dispose of solid waste for another six to nine years given normal waste receiving rates.

SITE LOCATION

The proposed action is located wholly within the existing, permitted boundaries of the Freeway Sanitary Landfill in Section 28, T27N, R24W in the City of Burnsville, Dakota County, Minnesota.

For a description of the surrounding land uses refer to Section III, Socio-Economics.

LEGAL DESCRIPTION

Since the proposed project is a vertical expansion of the existing landfill, the legal description of the proposed expansion remains unchanged from the legal description of the existing landfill property (see Appendix I).

ANTICIPATED LIFE, REFUSE SUPPLY, DESIGN CAPACITY

The 22 foot vertical addition to the 126-acre landfill will hold approximately 1,860 acre-feet of refuse. Given normal waste receiving rates of about 180,000 to 300,000 tons of refuse a year, this additional capacity will extend the life of the landfill by four to six years.

The type of refuse disposed and the collection area serviced for the proposed vertical expansion will remain the same as that of the present operation.

MAJOR ACCESS ROADS

The major access roads for the proposed vertical expansion are the same as that of the present operation (see Figure II-1).

PROPOSED OPERATION

GENERAL METHOD OF LANDFILLING

The proposed project does not change the current methods of operation at the Freeway Sanitary Landfill.

ENVIRONMENTAL CONTROLS

Environmental controls will remain the same as that of the present operation.

SECURITY AND SAFETY PRACTICES

Security and safety practices will remain the same as that of the present operation.

BUILDINGS

No change in the existing buildings on the landfill will be made. No new buildings will be constructed.

ENERGY

Current energy requirements to operate the landfill are expected to continue with the addition of the expansion capacity.

PROPOSED CONSTRUCTION

The staging of the development of the landfill with the proposed expansion will be as follows. Once all three phases of the originally permitted landfill are completed (see Figure II-5), two lifts will be constructed on top of the in-place landfill material. Construction will proceed from west to east after a screening berm is in place on the eastern edge of the landfill (see Figure II-9).

Figure II-7 shows the proposed final contours and surface water runoff patterns of the completed landfill with the vertical expansion. the 22-foot vertical expansion would not alter the proposed end use plan for the site.

FREEWAY SANITARY LANDFILL EXPANSION

SECTION III

DESCRIPTION OF EXISTING ENVIRONMENT

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

General

The most significant meteorological parameters associated with sanitary landfill design and operation are wind speed, wind direction, atmospheric stability, temperature and precipitation. Prevailing winds are important in consideration of problems relating to odor, dust, and blowing debris. The advection and diffusion of odorant gases and particulates from the landfill to receptors in the impact area is largely determined by the wind speed, wind direction and atmospheric stability.

Ambient temperature governs such factors as the types and quantities of odorant emissions and probable (indoor versus outdoor) activities of persons (sensitive receptors) in the area. Freezing temperatures may also cause problems. Cover material may be difficult to obtain when the frost line is more than six inches below the ground surface. The stockpiling, transport and placement of cover material may also be difficult during freezing conditions.

Precipitation (both rain and snow) is important in determining surface runoff, the design of an adequate drainage system for its control, the rate of waste decomposition, the generation and control of leachate, the feasibility of maintaining operations at all times at the site, the transport of equipment on the site, and access to and from the site. Loaded vehicles may experience difficulty on steep inclines and snow-covered roads. The combination of mild temperatures (thaw) and rainy conditions can make clayey soil conditions very muddy, thus limiting effective operations at the site. In certain areas, for example, it may be beneficial to construct a wet weather site where limited amounts of waste can be disposed of over short periods when weather conditions make access to the main site difficult.

The Freeway Sanitary Landfill, like the rest of the Metropolitan Area, is situated in the upper Mississippi River Valley on the borderline between the Humid Continental Warm Summer and Humid Continental Cool Summer Climates. The boundary between the

milder and more severe cool-summer phase of the Continental Climates (Da and Db) is the 71.5° F. Isotherm for the warmest month. The normal monthly temperature at the Minneapolis-St. Paul International Airport for the warmest month (July) is 71.9° F.

Due to the Metropolitan Area's closeness to the geographical center-line of North America, there exists a tendency forextremes in all climate features. For example, there are wide variations in temperature, plentiful summer rainfall and relatively little winter precipitation.

Temperature

Temperatures in the Metropolitan Area tend to range widely during the course of the year. The coldest month is January with mean daily maximum and minimum temperatures of 22.4 and 2.4° F., respectively. July is the warmest month with mean daily maximum and minimum temperatures of 83.9 and 60.7° F., respectively. The normal monthly temperature is 44.1° F. The lowest recorded temperature was -34° F. in January of 1970; the highest recorded temperature was 104° F. in July of 1941. The Annual Temperature Profile of the area is shown below:

TABLE III-1: ANNUAL TEMPERATURE PROFILE
TEMPERATURE DEGREES F

Maximum

Days annually 90° F and above	15 days
Days annually 32° F and above	83 days

Minimum

Days annually 32° F and above	153 days
Days annually 0° F and above	34 days

Source: Local Climatological Data, Annual Survey, 1974, Minneapolis, St. Paul, Minnesota, United States Department of Commerce.

The maximum temperature for almost one-quarter of the year does not exceed freezing (32° F.) and the minimum temperature for more than one-half of the year (193 days) is below 32° F. These temperatures translate into 8,159 heating degree-days and 585 cooling degree-days annually. Extremely low temperatures during the long winter frequently combine with moderate to high winds to create "wind chill factors" which make outside activity extremely uncomfortable. Winds during the winter months (November to March) consistently average above 10 miles per hour.

Humidity and Precipitation

The Metropolitan Area experiences only a relative brief (May to September) growing season, but precipitation is ample and well distributed during the five month growing cycle (average for the five month growing cycle is 16.78 inches). The average annual precipitation is 25.94 inches, including an average annual snowfall of 40.3 inches. Thunderstorms are the primary source of rainfall during the growing season. Rainfall can be heavy, but is usually brief in duration. Severe thunderstorms occur occasionally and may produce excessive rains, high winds, lightning and hail.

Table III-2 shows mean humidity (recordings over a fifteen year period) and mean precipitation (recordings over a thirty six year period) for the Minneapolis-St. Paul area.

TABLE III-2: MINNEAPOLIS-ST. PAUL MEAN
HUMIDITY AND PRECIPITATION

<u>Month</u>	<u>Humidity (%)</u>				<u>Precip. in.</u>
	<u>Midnight</u>	<u>6 am</u>	<u>Noon</u>	<u>6 pm</u>	
January	72	73	67	68	0.73
February	73	74	65	65	0.84
March	73	77	64	63	1.68
April	70	76	55	54	2.04
May	70	77	54	52	3.37
June	74	80	55	53	3.94
July	77	82	55	54	3.69
August	78	85	56	56	3.05
September	81	87	60	62	2.73
October	76	83	60	63	1.78
November	79	82	67	71	1.20
December	<u>77</u>	<u>79</u>	<u>72</u>	<u>74</u>	<u>0.89</u>
Year	75	80	61	61	25.94

Source: Local Climatological Data, Annual Survey, 1974,
Minneapolis, St. Paul, Minnesota, U.S. Department of
Commerce.

The annual precipitation at the Minneapolis/St. Paul Airport (7 miles from the Freeway Landfill) averages 29.3 inches per year. Table III-3 summarizes the estimated average monthly precipitation at the Freeway Sanitary Landfill site. These averages were calculated from precipitation records (1949-1974) at the Chaska, Farmington, Jordan, Minneapolis and Montgomery weather stations.

Table III-3: AVERAGE MONTHLY PRECIPITATION
NEAR FREEWAY SANITARY LANDFILL

	<u>Inches</u>
January	0.7
February	0.8
March	1.6
April	2.2
May	4.3
June	5.2
July	4.2
August	3.4
September	3.0
October	1.9
November	1.2
December	<u>0.8</u>

Average Total Annual Precipitation 29.3 Inches

As can be seen from Tables III-2 and III-3, precipitation amounts in the Metropolitan Area are small during winter and relatively high during the summer. The vast majority of precipitation during winter falls as snow. Annual precipitation near the Freeway Sanitary Landfill averages about 29 inches.

The Metropolitan Area is subject to periods of severe weather during both the summer and winter months. The vast majority of the severe weather during the summer months derives from either convective or frontal thunderstorm activity. During the winter months, passage of cold fronts can produce very high winds associated with blizzard conditions. The highest recorded wind for the Twin Cities area in the 36 years ending in 1974 was 92 miles per hour.

The State of Minnesota is on the northern edge of the national region of maximum tornado frequency. The state ranks sixteenth among the fifty states and District of Columbia in frequency of tornadoes based on the forty-nine years ending in 1964.

Wind

Wind data at the Minneapolis-St. Paul Airport indicate that wind velocities are moderate with the annual wind speed averaging 10.5 mph (Table III-4). Prevailing winds are from the northwest during the winter, early spring and late fall. During the remainder of the year south or southeasterly winds predominate. Average wind speeds are highest during the cold portion of the year (12.3 mph in April), while the lowest values occur during the summer (9.1 mph in August). The advance of cold air after the passage of a strong storm system is responsible for most of the high winds which occur in winter. High winds experienced in summer often result from the gustiness produced by strong thunderstorms.

Dispersion Characteristics

The overall dispersion ability of the atmosphere in this area of the country is quite good. The frequent passage of weather systems minimizes periods of air stagnation. Consequently, atmospheric conditions are usually favorable for the dispersion of pollutants and the area seldom encounters "extended" periods of fog or high pollutant levels. The frequency of light winds (0-3 mph) at Minneapolis, which is indicative of the frequency of stagnation periods, is low ranging from 11 to 14 percent of the time (MPCA 1979). Pollutants are distributed through the atmosphere by the action of horizontal wind and vertical air currents. At times, atmospheric inversions tend to "clamp a lid" over an area, reducing the volume of air into which the pollutants can diffuse. Inversions are commonly associated with stagnating, high pressure systems and are characterized by fog, light winds and very stable conditions. When inversions exist for a long period of time, pollutants are trapped near the ground and can build up to potentially harmful levels. The frequent weather changes common to this section of the country inhibit prolonged inversion conditions so that adequate dispersion conditions generally prevail.

AIR QUALITY

Federal and State Regulations

Since the passage of the federal Clean Air Act of 1970, and the 1977 amendments, each state must revise its clean air strategy to attain the ambient air standards by December 31, 1982. Portions of the Minnesota State Implementation Plan (SIP) were approved by EPA in 1979. The plan defines how the state will reduce air pollution in areas where health standards are violated, and prevent deterioration of air quality elsewhere.

The Clean Air Act amendments require each state to identify all areas that meet healthy air standards and those that do not for five major pollutants: carbon monoxide (CO), ozone (O₃),

TABLE III-4: WIND SPEED AND DIRECTION SUMMARY FOR
MINNEAPOLIS-ST. PAUL, MINNESOTA
(1941-1970)

<u>Month</u>	<u>Mean Wind Speed-(mph)</u>	<u>Prevailing Direction</u>	<u>Fastest Mile*</u>		<u>Year</u>
			<u>Speed (mph)</u>	<u>Direction</u>	
Jan	10.4	NW	40	SE	1956
Feb	10.5	NW	52	NW	1952
Mar	11.2	NW	47	E	1951
Apr	12.3	NW	52	WSW	1964
May	11.3	SE	61	NW	1964
June	10.5	SE	63	NW	1939
July	9.3	S	92	W	1951
Aug	9.1	SE	63	N	1967
Sep	9.8	S	47	N	1951
Oct	10.4	SE	73	S	1949
Nov	11.0	NW	60	SW	1958
Dec	<u>10.4</u>	<u>NW</u>	<u>52</u>	<u>W</u>	<u>1946</u>
Annual	10.5	NW	92	W July	1951

*Fastest Mile Wind - Speed is fastest observed 1-minute value when the direction is in tens of degrees.

Source: J.T. McLaughlin, T.D. Van Epp and W.K. Tusa,
Environmental Impact Statement For Woodlake Sanitary
Landfill Expansion, Technical Work Paper No. 3,
Prepared for MPCA, Roseville, MN , 1980.

particulates (dust and soot), sulfur dioxide (SO_2), and nitrogen oxides (NO_x). The Environmental Protection Agency promulgated two levels of standards for each pollutant (National Ambient Air Quality Standards). Primary air quality standards were developed to protect public health while secondary standards were developed to prevent other deleterious effects of air pollution, i.e. injury to crops, livestock, transportation and nuisance problems. The primary standards for particulates and sulfur dioxide are more stringent than the secondary standards for these pollutants.

Since the establishment of the national ambient air quality standards each state has been faced with the responsibility of meeting the standards. The national standards are minimum requirements that must be met within a specified time table, but the states may establish more stringent standards as Minnesota has done in the case of sulfur oxides, peak-hour carbon monoxide, and photo-chemical oxidants.

Table III-5 presents a comparison between federal and Minnesota state standards. Two units describe the standards: (1) ug/m^3 , micrograms/cubic meter, which refers to particulate matter; and (2) ppm, parts per million which quantifies gaseous pollutants. The standards specify exposure periods for each pollutant based on scientific studies concerning possible adverse health effects. With the exception of nonmethane hydrocarbons, all of the pollutants listed in Table III-5 affect the human physiological system. Nonmethane hydrocarbons, along with nitrogen oxides, are of primary concern due to their role in the formation of photochemical smog.

As can be seen from Table III-5, there are significant differences between the federal and Minnesota air quality standards for certain pollutants. For example, the Minnesota annual and 24-hour primary standards for sulfur oxides are approximately one-third less than the federal standard and the state's 3-hour secondary standard is only half of the national standard. It should also be noted that Minnesota has established standards for sulfur oxides where none currently exist at the federal level. Specifically, the state has established a 3-hour primary standard for sulfur oxides, along with annual and 24-hour secondary standards. In addition, Minnesota's 1-hour carbon monoxide standard (both primary and secondary) of 30 parts per million (ppm) is 5 ppm lower than the corresponding federal standards.

The National Ambient Air Quality Standards were to be met by June 1, 1975; although substantial improvements have been made in ambient air quality, the standards are not being met in all areas of Minnesota or the United States. Ambient air quality continues to be assessed by the primary and secondary standards.

With regard to the SIP for Minnesota, areas that violate standards are classified non-attainment for each pollutant

TABLE III-5: COMPARISON BETWEEN NATIONAL AND MINNESOTA
AMBIENT AIR QUALITY STANDARDS

POLLUTANT	WORDING OF STANDARD	PRIMARY ^a STANDARD		SECONDARY ^b STANDARD	
		National	State	National	State
SUSPENDED PARTICULATE MATTER	Annual geometric mean conc. Maximum 24-hour concentration Not to be exceeded more than once per year	75 $\mu\text{g}/\text{m}^3$ 260 $\mu\text{g}/\text{m}^3$	75 $\mu\text{g}/\text{m}^3$ 260 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ 150 $\mu\text{g}/\text{m}^3$	60 $\mu\text{g}/\text{m}^3$ 150 $\mu\text{g}/\text{m}^3$
SULFUR OXIDES	Annual arithmetic avg. conc. *Maximum 24-hour concentration Not to be exceeded more than once per year *Maximum 3-hour concentration Not to be exceeded more than once per year	.03 ppm .14 ppm	.02 ppm .10 ppm .25 ppm	 .50 ppm	.02 ppm .10 ppm .25 ppm
CARBON MONOXIDE	*Maximum 8-hour concentration Not to be exceeded more than once per year *Maximum 1-hour concentration Not to be exceeded more than once per year	9 ppm 35 ppm	9 ppm 30 ppm	9 ppm 35 ppm	9 ppm 30 ppm
PHOTOCHEMICAL OXIDANTS	*Maximum 1-hour concentration Not to be exceeded more than once per year	.08 ppm	.07 ppm	.08 ppm	.07 ppm
HYDROCARBONS	*Maximum 3-hour concentration (6-9 a.m.) Not to be exceeded more than once per year	.24 ppm	.24 ppm	.24 ppm	.24 ppm
NITROGEN OXIDES	Annual arithmetic average concentration	.05 ppm	.05 ppm	.05 ppm	.05 ppm

FOOTNOTES: (a) Primary Standard: Protect Public Health
(b) Secondary Standard: Prevent all other adverse affects of air
pollutants

*Not to be exceeded more than once per year.

exceeding the standard. Areas that do meet health standards are classified attainment. The MPCA is presently identifying the exact sources of pollutants in each area.

In nonattainment areas, industrial growth could occur until July 1, 1979, if: the firm's potential pollutant emissions are less than 100 tons per year or the amount of pollution added by the new facility is offset somewhere else in the area and the firm attains the lowest achievable emission rate for its type of operation. After July 1, 1979, new sources must be permitted in accordance with the revised SIP.

In addition to regulations for primary and secondary emissions, Minnesota has established a number of regulations and rules pertaining to the emission of odorous substances. Specifically, Minnesota Air Pollution Control (APC) Rule 9 regulates odorous air pollution from various sources including sanitary landfills. APC 9 sets odor emission limits based on the specific type of source and the nature of the potential odor impact area (residential, industrial, etc.).

Areawide Compliance

The Twin Cities Metropolitan Area has been designated as a nonattainment area for particulates, sulfur dioxide, carbon monoxide and oxidants. It is important to note that nonattainment designations are on an areawide basis. Attainment areas (or pockets of clean air) can exist within a nonattainment area. It is probable that air quality, particularly in the rural portions of the Region, are in compliance with ambient air quality standards. For a further description of areawide compliance with federal and state air quality standards see Environmental Impact Statement For Woodlake Sanitary Landfill Expansion, Technical Work Paper No. 3, Minnesota Pollution Control Agency, 1980.

Freeway Landfill Area

Existing land use in the vicinity of the Landfill is industrial or open land. Directly north of the landfill is U. S. Salt, a salt manufacturer. A dolomite quarry operated by Edward Kraemer and Sons is immediately south of the landfill.

The MPCA has established three air monitoring stations (MPCA No.'s 0375, 0376, 0377) in the southern portion of Bloomington located approximately 2-4 miles from the Freeway Landfill. Table III-6 shows the results of monitoring at these stations for particulates and sulfur dioxides.

Suspended Particulate Matter -- For total suspended particulate concentrations, air monitoring stations 0375, 0376, and 0377 recorded (out of 26, 26, and 33 observations respectively) in 1978 no violations of federal or state primary and secondary standards for maximum 24-hour concentrations. In 1979, air monitoring station number 0375 recorded (out of 39 observations)

TABLE III-6

1978 Particulate Summary (Micrograms/Cubic Meter)

Location MPCA No.	State Rank	No. Obs	Geom Mean	Std Dev	Max Obs	2nd High	No. 260u/m ³	No. 150u/m ³
0375	50	26	56.5	1.6	128	120	0	0
0376	27	26	40.9	1.5	101	83	0	0
0377	20	33	39.4	1.7	98	71	0	0,

1979 Particulate Summary (Micrograms/Cubic Meter)

Location MPCA No.	State Rank	No. Obs	Geom Mean	Std Dev	Max Obs	2nd High	No. 260u/m ³	No. 150u/m ³
0375		39	55.6	1.6	153	105	0	1
0376		22	33.8	1.5	60	59	0	0
0377		47	38.3	1.8	124	92	0	0

1978 Sulfur Dioxide Summary (ppm)

Location MPCA No.	No. Obs.	Ari Mean	Std Dev	3-Hour Average			24-Hour Average		
				Max Obs	2nd High	No. Vio	Max Obs	2nd High	No. Vio
0375	8016	.009	.008	.102	.100	0	.030	.029	0

1979 Sulfur Dioxide Summary (ppm)

Location MPCA No.	No. Obs.	Ari Mean	Std Dev	3-Hour Average			24-Hour Average		
				Max Obs	2nd High	No. Vio	Max Obs	2nd High	No. Vio
0375	6134	.007	.009	.113	.061	0	.047	.038	0

Source: Minnesota Pollution Control Agency, 1979.

one violation of secondary standards and no violations of primary standards. Air monitoring station numbers 0376 and 0377 recorded (out of 22 and 47 observations respectively) no violations of federal or state primary and secondary standards for maximum 24-hour concentrations.

A list of the major point sources of particulates in the Metropolitan Area are shown in Table III-7 with the location of these sources shown in Figure III-1. Figure III-2 shows the areas in the Region impacted by particulate concentrations from these sources. As can be seen, NSP's Black Dog Electrical Generating Plant, Cargill's and Bunge's grain elevators are the main contributors of particulate concentrations near the Freeway Landfill. The air quality at the landfill site may also be influenced by the adjacent quarry operation, an adjacent asphalt plant and by transportation-related emissions from Interstate 35W and Minnesota Highway 13.

Sulfur Oxides -- In 1978 and 1979, air monitoring station number 0375 recorded no sulfur dioxide concentrations (out of 8016 and 6134 observations respectively) in violation of federal and state primary and secondary standards for maximum 3-hour and 24-hour concentrations. In 1978 and 1979 the annual arithmetic average concentrations for sulfur dioxide recorded at station number 0375 did not exceed state primary and secondary standards. Also the federal primary standard was not exceeded.

Regulatory Compliance

The Freeway Landfill area is not in violation of standards for suspended particulates and sulfur oxides.

Existing Landfill Site

The Freeway Sanitary Landfill is located in the northwest portion of the Burnsville Township. Given the geographic relationship to other industries in the area and the prevailing wind (from the southeast in the summer and the northwest in the winter), the air quality at the landfill site does change considerably from winter to summer.

Suspended Particulate Matter -- The particulate problem at the landfill site is caused, for the most part, by fugitive dust emissions. The engineering method of sanitary landfilling is by nature a construction activity, and as such, it produces fugitive emissions. Fugitive dust emissions are caused by activities such as the movement of refuse trucks to and from the working area of the landfill, the excavation, stockpiling and grading of cover material, the movement of heavy equipment and vehicles over unpaved areas, and the land clearing of future disposal areas on the site.

Fugitive dust has not been a significant problem with the existing operation. Fugitive dust has been minimized by the paving of access roads with asphalt or crushed rock, by the type of landfill cover being used, by vegetation of landfill slopes,

Table III-7

TWIN CITIES METRO AREA

MAJOR POINT SOURCE EMISSIONS INVENTORY, 1977

Site	PARTICULATES		HYDROCARBONS	
	Tons/Year	Effective Stack Hgt.	Tons/Year	Effective Stack Hgt.
1. H&S Asphalt	n/a	n/a	-	-
2. NSP-Blackdog	5,866	289'	-	-
3. Koch Refining Co.	234	50'	11,593	60'
4. St. Paul Ammonia	105	45'	-	-
5. Williams Pipe Line Co.	-	-	105	48'
6. Minnesota Valley Surfacing	7,040	n/a	11,826	n/a
7. Agg Sinter, Coke	1,260	30'	-	-
8. Champion Packages Co.	-	-	358	40'
9. NSP-Riverside	503	335'	-	-
10. Fleischmann Malting	252	30'	-	-
11. Tonka Toys	-	-	181	25'
12. University of Minnesota	299	n/a	-	-
13. A D M Nokomis Mill	178	60'	-	-
14. General Electric Service	-	-	175	25'
15. Honeymead Products	157	150'	-	-
16. Commutator Foundry	292	40'	-	-
17. Honeywell Inc.	-	-	119	n/a
18. Onan Div. of Onan Corp.	-	-	112	36'
19. Howe Incorporated	103	25'	-	-
20. 3M Company	-	-	42,919	n/a
21. Webb Publishing	-	-	17,273	43'
22. Mobil Oil Corporation	-	-	1,772	n/a
23. Ford Motor Company	-	-	1,008	50'
24. William Pipe Line	-	-	1,100	72'
25. American Can Co.	-	-	611	200'
26. Union Oil Co. of California	-	-	1,052	10'
27. Metro. Waste Control Commission	2,050	n/a	-	-
28. Hoerner Waldorf Corp.	-	-	463	58'
29. Koppers Co.	180	20'	300	20'
30. Whirlpool Corp.	-	-	266	68'
31. Total-Asphalt	257	36'	-	-
32. Fugta	355	n/a	-	-
33. Standard Oil	-	-	392	24'
34. Shell Oil Co.	-	-	604	48'
35. Texaco Inc.	-	-	194	n/a
36. Olympia Brewing Co.	184	n/a	-	-
37. NSP-Highbridge	290	570'	-	-
38. NSP-3rd Street Stream	136	258'	-	-
39. National Can	-	-	132	41'
40. Bryan Rock Products	1,439	20'	-	-
41. Bunge Corporation	1,292	n/a	-	-
42. Rahr Malting Co.	554	n/a	-	-

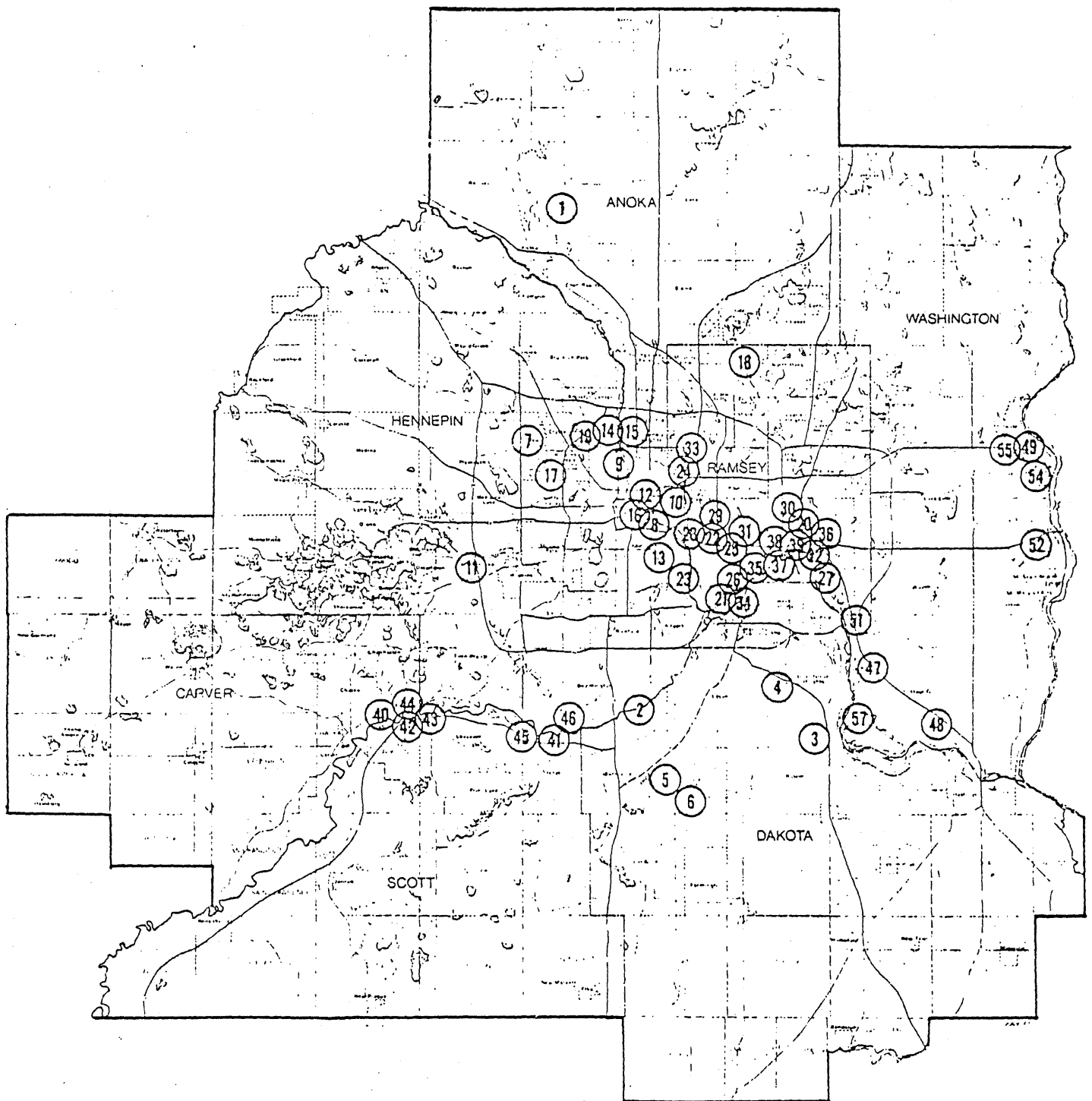
Table III-7 cont'd.

43.	J.L. Shiely Compan -Shakopee	500	n/a	-	-
44.	Continental Grain Co.	448	20'	-	-
46.	Cargill, Elev. C	147	n/a	-	-
47.	Northwestern Refining Co.	-	-	7,720	53'
48.	3M Company-Cottage Grove	-	-	2,999	31'
49.	NSP-King	659	785'	-	-
51.	Erickson Petroleum Corp.	-	-	1,329	48'
52.	Tower Asphalt Inc.	465	n/a	-	-
54.	Anderson Corp.	-	-	511	25'
55.	Minn. State Prison	397	110'	-	-
57.	J.L. Shiely-Grey Cloud	325	10'	-	-

Source: Metropolitan Waste Control Commission, 1977.

Figure III-1

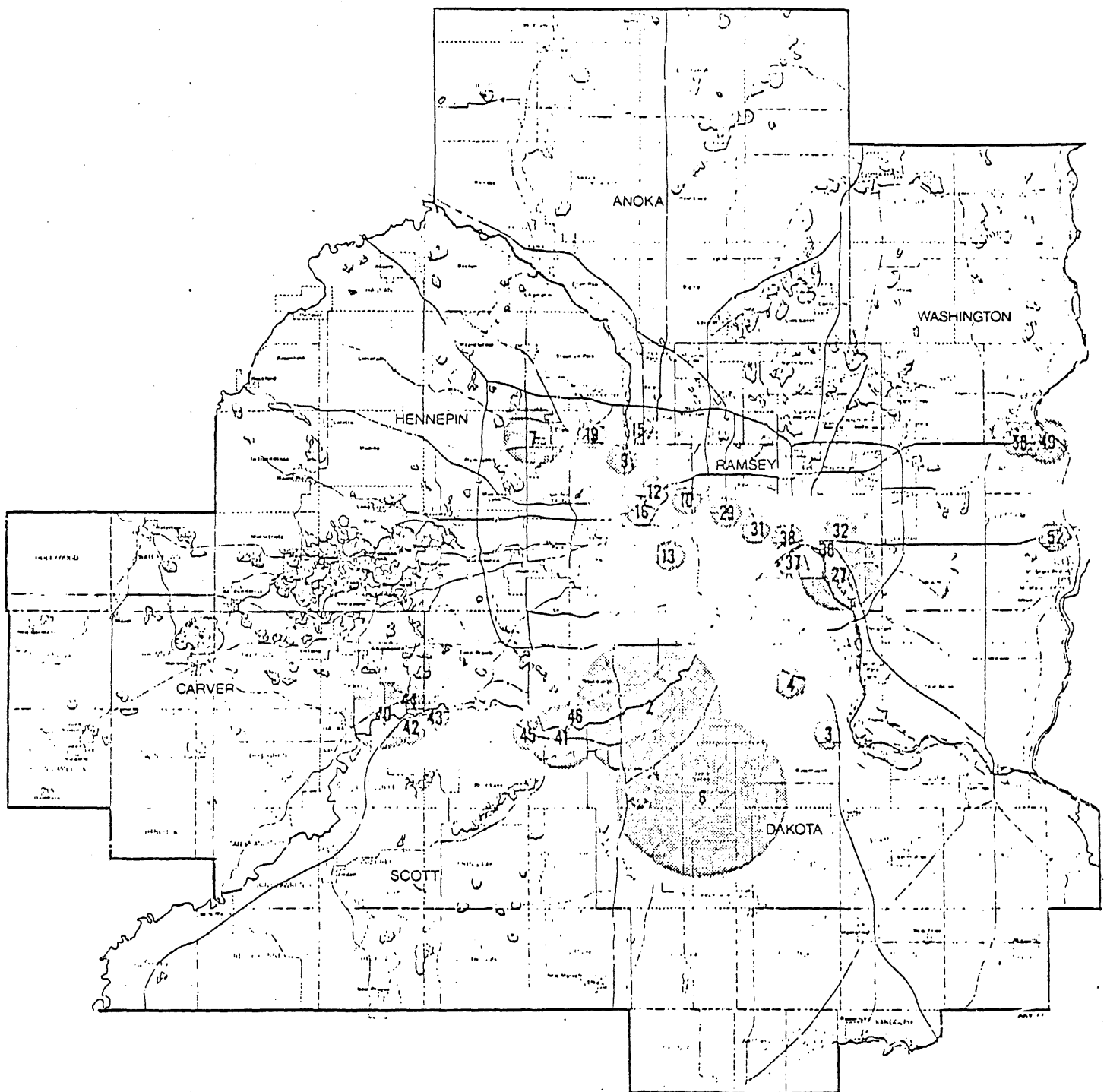
LOCATION OF MAJOR EMISSION SOURCES



SOURCE: Metropolitan Waste Control Commission, 1977

Figure III-2

METROPOLITAN AREAS IMPACTED BY PARTICULATES



SOURCE: Metropolitan Waste Control Commission, 1977

and by the lack of sensitive receptors in the vicinity of the landfill. In addition, water from a fire truck is available for further dust control when conditions warrant its use.

The primary carrier of refuse traffic to the Freeway Sanitary Landfill is Interstate 35W and State Highway 13. Transportation-related emissions from the landfill are small in comparison to those generated by the general traffic flow in the area.

Sulfur Oxides -- Sulfur oxide emissions from the operation of the landfill itself are negligible.

Methane Gas -- Methane gas (CH_4) is a colorless, odorless gas produced by the anaerobic decomposition of refuse. Methane generation in a sanitary landfill depends on the waste composition, internal moisture content, temperature, and other environmental factors. In general, a mature landfill that has reached its maximum generation rate, estimated to occur between one to five years after completion, will produce gas at a high rate for about six to ten years and will continue to produce gas at lesser rates for up to 100 years.

The composition of landfill gas based on field samples ranges from 45 to 65 percent methane with the most common values lying between 45 and 55 percent. The balance of the gas is carbon dioxide with smaller amounts of hydrogen, oxygen, nitrogen, and traces of other gases.

From a safety aspect, methane is only considered a problem when it is mixed with oxygen at concentrations greater than 15 percent. At such concentrations methane is explosive.

Generally, there is no danger of a methane explosion. Methane, being lighter than air, will naturally vent upwards through the cover material into the atmosphere, where the methane will be at concentrations much lower than 15 percent. If methane is prevented from venting upwards into the atmosphere, possibly by an impermeable cover over the refuse, the gas will migrate laterally beneath the surface until it reaches a permeable surface where it can escape into the atmosphere. If there are buildings with basements near the landfill and if the methane is prevented from venting upward through the cover material and therefore is forced to migrate laterally below the surface, there is a possibility that some methane may concentrate in a basement and be an explosion hazard.

The operational procedures at the Freeway Sanitary Landfill should provide adequate protection against any methane hazard. The rate of methane production in a landfill is increased according to the amount of moisture coming in contact with the refuse. Covering and grading practices by the landfill operator and subsequent surface water drainage pattern development should keep water in contact with the buried refuse at a minimum. The rate of refuse decomposition will, therefore, be slow, and as a result methane gas will be produced in small amounts over a long period of time. This low rate of methane production reduces the

possibility of explosive concentrations being reached. In addition, the small amount of methane gas that is produced within the landfill should vent through the cover material and at the landfill perimeter, ultimately dissipating at harmless concentrations into the atmosphere.

Odor -- Odorous emissions may result from the operation of sanitary landfills. In general, there are a number of primary sources of odor at sanitary landfills. The most common is that which emanates directly from the incoming refuse. Odorous compounds can also result from the degradation of previously buried refuse. As previously discussed, gas is produced naturally when solid wastes decompose. The quantity generated in a landfill and its composition depend on the types of solid waste and on environmental factors such as temperature, and moisture content.

Some of the chemical compounds that are released during the decomposition process may include odorant gases. While methane and carbon dioxide are the major constituents of landfill decomposition gas, other gases produced may cause a repugnant odor. For example, hydrogen sulfide may be generated at a landfill, particularly if it contains a large amount of sulfate containing wastes or if brackish water infiltrates the solid waste. Other odorant gases which may be produced by the decomposition process include ammonia and trace mercaptans.

Another potential source of odor is leachate which reaches the surface from either seeps or from a collection system. Groundwater and infiltrating percolation in conjunction with landfill liquid wastes can result in leachate, a term denoting a solution consisting of dissolved and suspended solid matter and microbial waste products which results when water comes in contact with landfilled solid waste.

The specific nature and concentration of substances contained in the leachate depend on the composition of the refuse as well as its degradation stage. Odorants may be released into the air as a result of leachate formation, collection or treatment.

Special wastes being received at the landfill may also generate strong odors. Typical examples include manures, fermented grains, and food processing wastes. In general however, properly operated sanitary landfills do not have substantive odor problems. Prompt waste processing, application of daily cover, leachate and gas control measures and exclusion of special wastes, as necessary, generally result in a relatively odor free operation.

On May 14, 1980, Metropolitan Council staff conducted a walking survey of homes and businesses surrounding the Burnsville and Freeway landfills. The purpose of the survey was to determine attitudes toward the landfills. A number of residents directly across the Minnesota River in Bloomington (homes overlooking the river valley) stated that they noticed odors emanating occasionally from the landfills, particularly in the summer

months when there was a south breeze. They could not, however, determine if both or one of the two landfills is the cause of the problem. It should be pointed out that the Freeway Landfill has violated daily cover requirements several times over the past years. This probably accounts for most of the odor problems that can be attributed to the landfill operations.

Regulatory Compliance -- Based on available information, the existing Freeway Sanitary Landfill appears to be in compliance with regulations concerning potential air emissions from the landfill. However, there could be some odor problems at the landfill because of failure to meet daily cover requirements. No significant adverse impacts from fugitive dust emissions and methane gas emissions have been reported.

NOISE

Federal and State Regulations

MPCA regulations NPC-1 and NPC-2 govern acceptable noise levels throughout the state. NPC-1 contains relevant definitions and specifies provisions for obtaining a variance from MPCA noise pollution control regulations. Variances may be granted in certain cases involving practicality and feasibility of compliance with the standards. MPCA regulation NPC-2 instituted a three-tier noise area classification (NAC) scheme which limits L_{50} and L_{10} (hourly) exterior noise levels during both the daytime and nighttime periods. The L_{50} parameter is defined as the noise level that is exceeded 50 percent of the time and the L_{10} parameter is the noise level that is exceeded 10 percent of the time. Noise area classification 1, which contains the most restrictive noise standards, pertains to various types of human habitations ranging from single dwellings to camping areas and hotels. Nonresidential public area activity spaces (e.g., commercial establishments) are represented by NAC-2. Manufacturing, industrial, and agricultural land uses are represented by NAC-3. Underdeveloped land is represented by NAC-4; however, no standards have been promulgated for this category. The MPCA noise standards are shown in Table III-8.

The Occupational Safety and Health Act (OSHA) of 1970 established maximum permissible noise exposures for persons working in noise environments. These noise standards are shown in Table III-9 and are intended to protect the hearing of people exposed on a daily basis to elevated noise levels over a lifetime of employment. Violations of the OSHA standards are not common in most work environments.

Existing Landfill Site

Noise monitoring has not been conducted at or near the vicinity of the Freeway Sanitary Landfill. It is, therefore, difficult to assess compliance with the above regulations. An important

Table III-8

MINNESOTA POLLUTION CONTROL AGENCY NOISE STANDARDS (dBA)

NA C	Day (7:00 A.M. to 10:00 P.M.)		Night (10:00 P.M. to 7:00 A.M.)	
	<u>L</u> <u>50</u>	<u>L</u> <u>10</u>	<u>L</u> <u>50</u>	<u>L</u> <u>10</u>
1	60	65	50	55
2	65	70	65	70
3	75	80	75	80

Table III-9

OCCUPATIONAL SAFETY AND HEALTH ACT
MAXIMUM PERMISSABLE NOISE EXPOSURE
IN NOISE ENVIRONMENTS

<u>Duration per day, hours</u>	<u>Sound level (dBA)</u>
8	90
6	92
4	95
3	97
2	100
1.5	102
1	105
0.5	110
0.25 or less	115

point to consider is that Interstate 35W is located along the eastern boundary of the landfill and substantial noise impacts presently exist due to the highway.

During the operation of the landfill, the primary generators of noise are equipment for earth moving and compaction and vehicular traffic entering and leaving the facility. Table III-10 shows a range of dBA levels for typical equipment used at the landfill site.

Table III-10

<u>Machine</u>	<u>dBA Range</u> (measured at 50 ft.)
Scraper	89-95
Dozer	87-89
Motor Grader	77-87
Refuse Trucks	85-95

It has been determined that in a typical hour the approximate cumulative ambient noise produced by equipment at the landfill is 99 dBA. The noise received by the nearest private dwelling (2900 feet from the working area of the fill) is 64 dBA. This is a substantial reduction of noise; and is slightly below the MPCA NAC-1 daytime L10 standard of 65 dBA. This analysis does not assume topographical variations at the landfill which could dramatically change sound levels.

Noise generated by the above equipment and vehicles is mitigated at the existing landfill by the following considerations. Extensive buffer zones of industrial and commercial-industrial property lie between the landfill and residential areas. The closest commercial receptor to the landfill is U. S. Salt which is adjacent to the northern boundary of the landfill. The next closest commercial receptor is approximately 1000 feet from the landfill. The proposed expansion area is about 2900 feet from the nearest private dwelling.

Operating hours at the site are from 8 a.m. to 5 p.m., seven days a week. After those hours, no heavy equipment is in operation.

SO001D

WATER QUALITY

CONTAMINATION FROM LANDFILLS

Leachate

The principal source of surface water and groundwater contamination from landfills is leachate. Leachate may be defined as liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it. In most landfills the liquid portion of the leachate is composed of the liquid produced from the decomposition of the wastes and liquid that have entered the landfill from external sources, such as surface drainage, rainfall, groundwater, and water from underground springs.

When leachate percolates through solid wastes that are undergoing decomposition, both biological materials and chemical constituents are picked up. Representative data on the chemical characteristics of leachate, indicates that the range of concentration values for the various constituents is rather extreme. For this reason, no average value can be given for leachate.

In general, it has been found that the quantity of leachate is a direct function of the amount of external water entering the landfill. In fact, if a landfill is constructed properly, the production of measurable quantities of leachate can be eliminated. In some cases leachate treatment may be required.

Leachate Movement

Under ideal conditions, leachate should either be contained within the landfill or removed for treatment. Unfortunately, these conditions are found only in a few modern landfills, and so the movement of leachate from landfills is an important aspect of solid waste disposal.

Under normal conditions leachate is found in the bottom of landfills. From there its movement is through the underlying strata, although some lateral movement may also occur, depending on the characteristics of the surrounding material. As leachate percolates through the underlying strata, many of the chemical and biological constituents originally contained in it will be removed by the filtering and adsorptive action of the material composing the strata.

Control of Leachate Movement

Because of the potential risk involved in allowing leachate to percolate to the groundwater, best practice calls for its elimination or

containment. To date, the use of clay has been the favored method of reducing or eliminating the percolation of leachate. Membrane liners have also been used, but they are expensive and require care so that they will not be damaged during the filling operation.

Surface Water Runoff

Equally important in controlling the movement of leachate is the elimination of surface water infiltration, which is the major contributor to the total volume of leachate. With the use of a relatively impermeable cover material, an appropriate surface slope, and adequate drainage, surface infiltration can be controlled effectively.

Improper surface runoff from a landfill can also result in erosion of the cover material. Erosion may lead to the discharge of suspended solids to streams and possible siltation of adjacent water bodies. Surface runoff diversion may be necessary including channeling and the construction of berms and dikes.

GEOLOGY AND HYDROLOGY OF THE FREEWAY LANDFILL AND SURROUNDING AREA

Geologic and hydrologic conditions are major considerations in determining the environmental acceptability and impacts on an area from a landfill operation. Data on these factors are necessary to assess the pollution potential of a landfill and to establish what must be done to ensure that the movement of leachate and surface water runoff from a landfill will not impair the quality of local groundwaters and surface waters.

The following discussion is presented for background purposes for the later assessment of water quality impacts from the existing operation and proposed expansion of the Freeway Sanitary Landfill.

Regional Setting

The Metropolitan Area has been glaciated several times. On each occasion, as the glaciers advanced and retreated, they deposited a highly complex mantle of glacial drift, ranging from highly permeable sands and gravels of outwash to highly impermeable clays of glacial lakes and tills. In addition, each period of glaciation altered the course of the rivers in the Region. The various rivers cut through the glacial drifts down into the bedrock in several areas and subsequently filled in by drift from a later period of glaciation.

The Freeway Sanitary Landfill is located in the Minnesota River Valley in the southern portion of the Twin Cities Structural Basin. This river valley was eroded by the Glacial River Warren through the St. Croix Moraine down to and into the subcropping Prairie du Chien Dolomite. The majority of the valley bottom is covered by a thin veneer of alluvial deposits with a maximum thickness of less than 80 feet.

One to two miles north of and paralleling the Minnesota River lies another buried valley eroded into bedrock. This valley is eroded

into the Jordan Sandstone which underlies the Prairie du Chien Dolomite. The land surface overlying this valley is covered with ground moraine deposits of the Des Moines Lobe and alluvial terrace deposits of the early phase of the Glacial River Warren. The bluff lands south of the Minnesota River Valley are covered by morainal deposits of both the Des Moines and Superior Lobes.

Area Topography

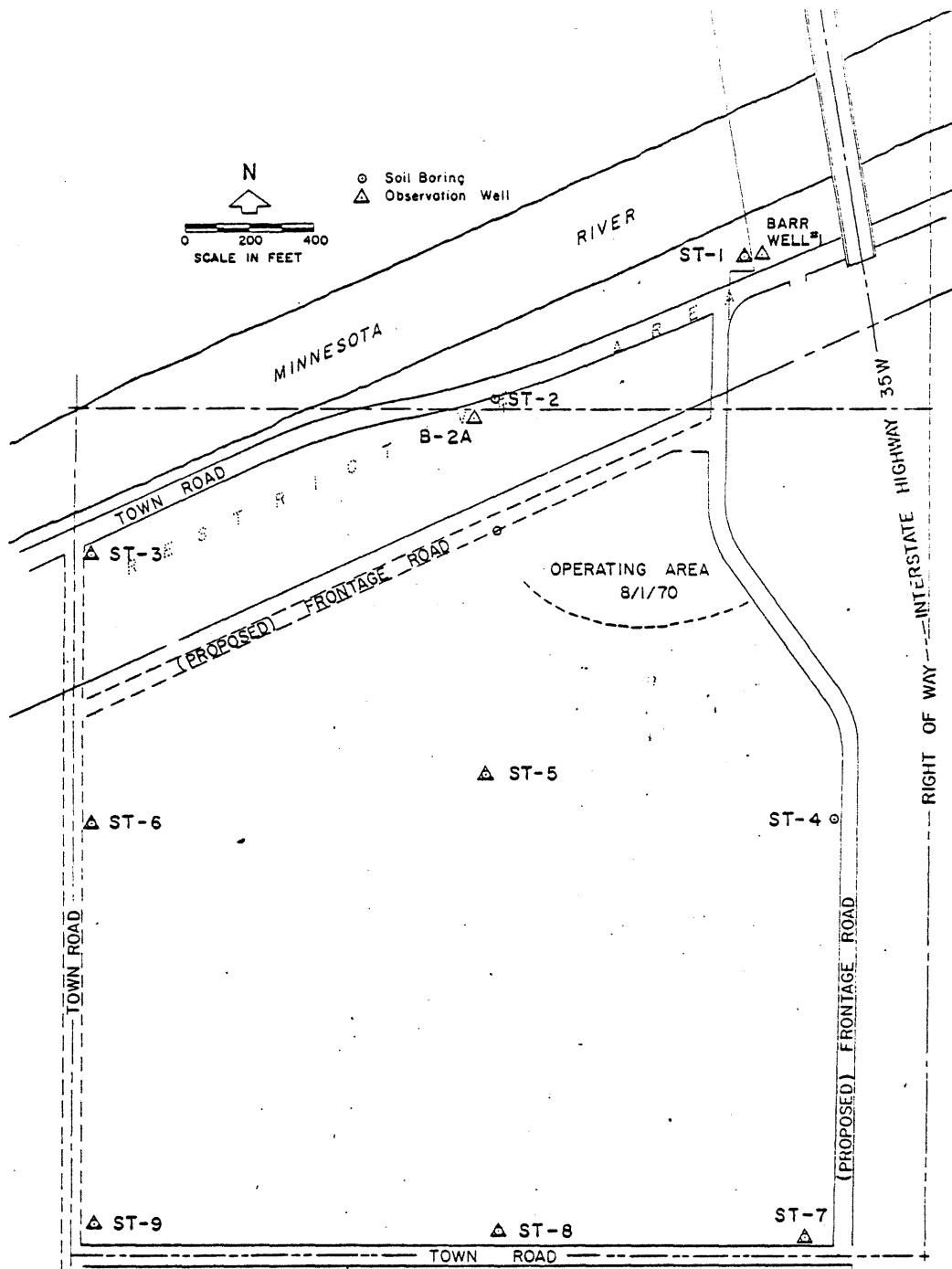
Topographic relief within this area of the Minnesota River valley varies from the river water surface level of approximately 685 feet to the height of the bluffs in Bloomington of about 810 feet. The presently existing surface elevations of the landfill site vary from Elevation 695 to Elevation 738. The topography of the site prior to any landfiling activity likely varied from about Elevation 696 to Elevation 705.

Site Geology

Bedrock -- The Freeway Sanitary Landfill is shallowly underlain by the Prairie du Chien Dolomite. Borings put down in the vicinity of the landfill indicate that the depth to bedrock varies from three feet to approximately 45 feet. The location of these borings are shown in Figure III-3. The bedrock surface beneath the landfill varies from elevation 656 to elevation 698. Data from the borings show that the bedrock surface contours in the area of the landfill are generally as shown in Figure III-4. (The boring logs are available upon request from the Metropolitan Council.) The bedrock surface is irregular and drops off sharply to the north along the northern boundary of the landfill. This is an eroded valley underlying the river.

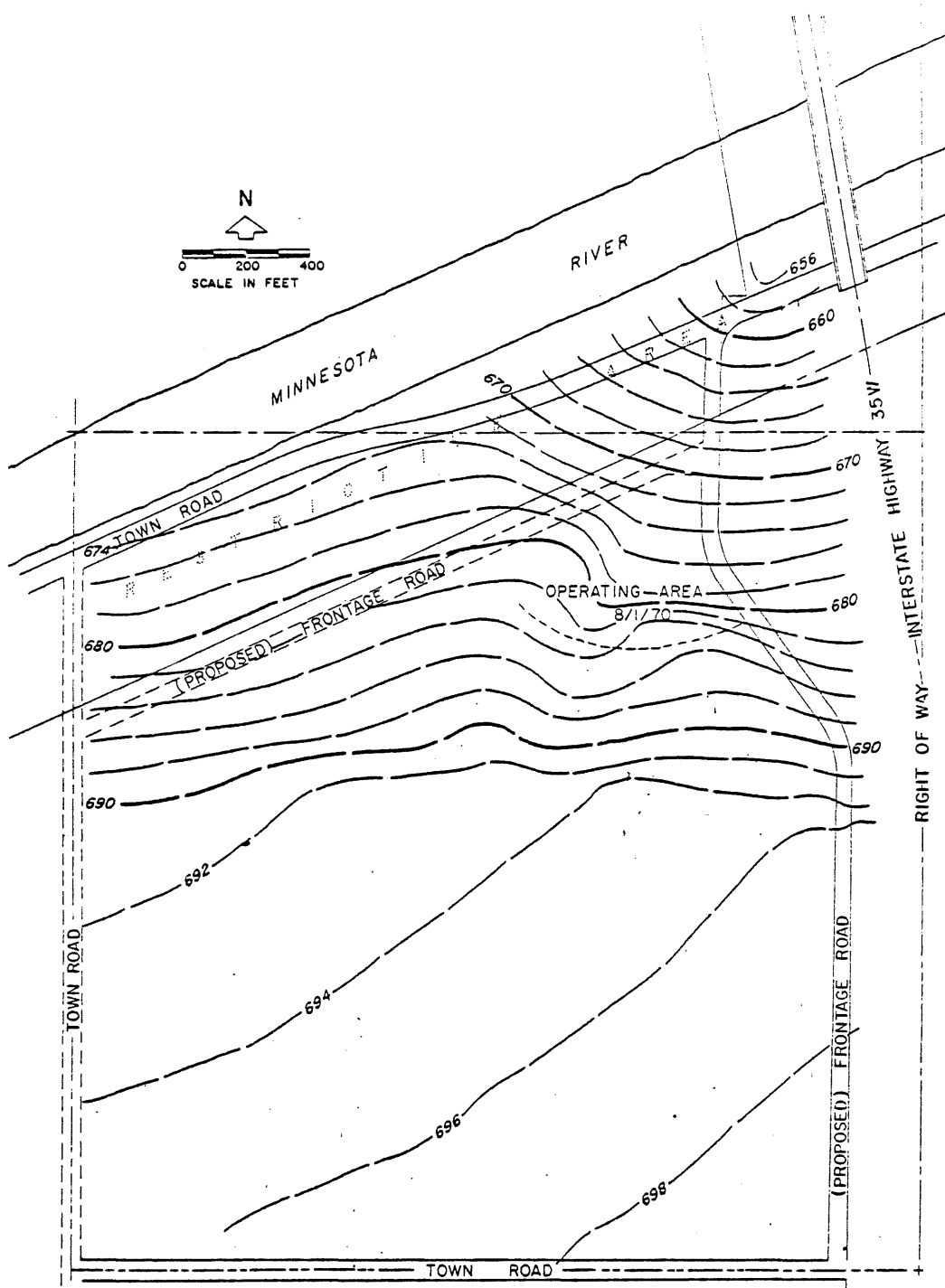
Well logs in the vicinity of the landfill indicate the Prairie du Chien Dolomite-Jordan sandstone contact is near elevation 560 in the landfill vicinity. The thickness of the Jordan ranges from 80 to 100 feet. The Jordan is underlain by the St. Lawrence Formation which is considered to effectively separate the Prairie Du Chien-Jordan aquifer from deeper aquifers. A bedrock column for the site is shown in Figure III-5.

Glacial Geology -- The area has been subjected to several episodes of glaciation during the Pleistocene Epoch. The area in the vicinity of the landfill is considered to have been part of the St. Croix Moraine and subsequently overlain by ground morainal deposits from the Des Moines Lobe. However, during the latter phase of the last period of glaciation in this area, the Glacial River Warren began flowing through the area that is now the landfill. In time what is now the Minnesota River valley was eroded by the Glacial River Warren through the St. Croix Moraine and into the subcropping Prairie du Chien Dolomite. The bedrock surface under the landfill site was subsequently covered with alluvial deposits, ranging in thickness from three to about 45 feet.



LOCATION OF SOIL BORINGS
AND
GROUNDWATER OBSERVATION WELLS

Figure III-3



BEDROCK SURFACE CONTOURS

Figure III-4

GEOLOGIC COLUMN IN VICINITY OF FREEWAY LANDFILL

Period	Geologic Unit	Range in Thickness (ft.)
Quaternary	Alluvial & Colluvial Deposits (Qd)	Variable
Ordovician	Prairie du Chien Group (Opc)	150 ⁺
Cambrian	Jordan Sandstone (Ej)	80-100
	St. Lawrence Formation (E _{sl})	175-200
	Franconia Formation (E _f)	
	Iron-ton Sandstone (E _i)	60-65
	Gales Sandstone (Eg)	
	Eau Claire Formation (E _{ec})	85-90
	Mt. Simon Sandstone (E _{ms})	over 200
Precambrian	Hinckley Sandstone (PE _h)	

Figure III -5

Soils -- An analysis of the soil samples showed the soil profile at the Freeway Landfill site to be made up of typical alluvial deposits. Borings along the northern boundary of the site showed soils from the surface to a depth of 7 to 9 feet to be mixtures of organic and granular materials consisting of sandy loams, fine sands, and fine loamy sands. Soils along the northern boundary from the 9 foot depth to bedrock are silty cohesive loams and clay loams with evidence of shells and sand lenses. The soil boring designated ST-1 on Figure III-3 in the northeast corner of the site indicated a sand and gravel strata at the 45 foot depth just above bedrock. Soil profiles in the central and southern portion of the site are composed of loams, peat, and some thin strata of silty cohesive materials. The depth from the ground surface to bedrock varied widely throughout the site ranging between 20 feet and 45 feet along the northern boundary and 3 feet to 10 feet along the southern property line.

Groundwater Hydrology

Regional Setting -- The Twin Cities Structural Basin contains several aquifer systems. The aquifer systems which underlie the landfill are the Prairie du Chien-Jordan, Ironston-Galesville, and Mt. Simon-Hinckley. Their relative relationship and thickness are shown in Figure III-6. The St. Peter Sandstone overlies the Prairie du Chien aquifer in the upland areas north and south of the landfill but has been eroded and is not present beneath it. A north-south hydrogeologic cross section showing the regional patterns of groundwater flow in the aquifer systems is shown in Figure III-6. As shown, the Minneota River and its valley serves as a regional discharge zone for groundwater in the Prairie du Chien-Jordan aquifer system and for groundwater in the glacial drift and St. Peter aquifers north and south of the valley. The aquifer systems beneath the Jordan aquifer do not appear to discharge into or to be influenced by the Jordan aquifer or the Minnesota River.

Since the landfill is located in the regional discharge zone for the Prairie du Chien-Jordan aquifer which immediately underlies the site, any water percolating through the existing landfill material will not penetrate significantly into the aquifer but will move to the Minnesota River.

Site Groundwater Hydrology -- Information was collected during a study to evaluate the existing groundwater conditions in the landfill area in 1970 (Barr Engineering). Site inspection of the Kraemer quarry was made and through the cooperation of Mr. Faye Pope, superintendent of the quarry, pumping and geological data were obtained. Information on the permeability of the Shakopee-Oneota and Jordan formations was obtained from records of past work by Barr Engineering Company and Adolph F. Meyer. This information was used to calculate the piezometric pressure profile in the Shakopee-Oneota formation to determine the effect of the dewatering operation at the Kraemer quarry. Calculations assumed a Shakopee-Oneota effective permeability of 80 feet per day and a quarry pumping rate of 1.5 MGD. Steady state flow and an aquifer of uniform thickness were also assumed.

GENERALIZED REGIONAL CROSS-SECTION THROUGH FREEWAY LANDFILL

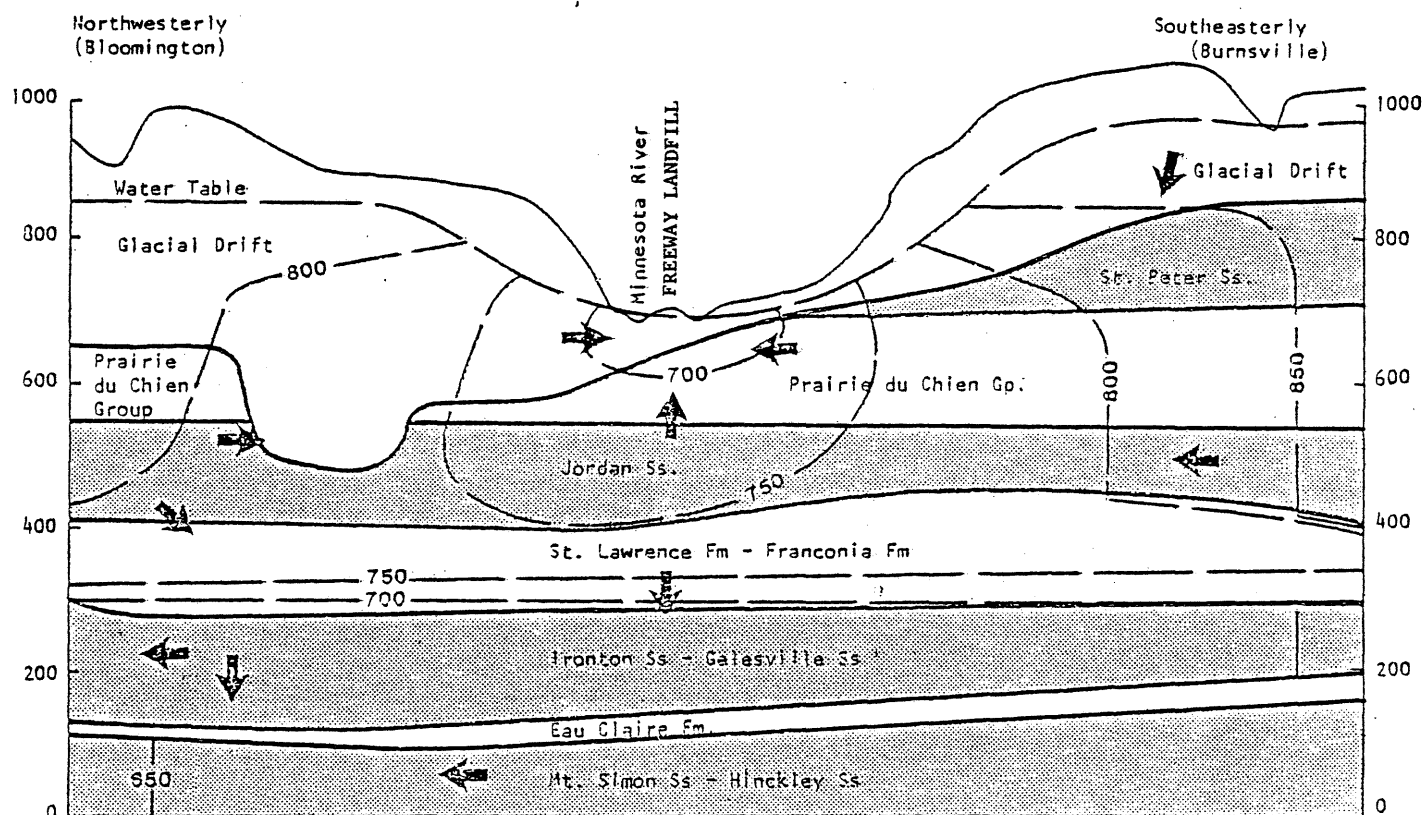


Figure III-6

Figure III-7 represents a vertical cross-section through the landfill and quarry and shows the measured water table at the landfill. The calculated piezometric pressure profile in the Shakopee-Oneota formation is also shown. The computed profile closely matched the elevation of the flowing observation well located in the northeast corner of the landfill site. As discussed previously, this well penetrates a sand and gravel aquifer adjacent to the underlying rock formation. With the existing quarry pumping rate, the piezometric level in the Shakopee-Oneota formation under the landfill varies from approximately 703 at the flowing well at the northeast corner of the landfill site to approximately 698 at the southern property line.

The direction of vertical flow between the alluvial soil and the underlying bedrock aquifers is determined by the relation between the elevation of the water table and the piezometric pressure level in the underlying aquifer. If the piezometric pressure level is above the water table, the vertical movement will be from the bedrock upward into the alluvial soil. If the piezometric level is below the water table, the vertical flow will be from the surface downward but not necessarily into the bedrock formations. The magnitude of the vertical flow is determined by the permeability of the formations. Pumping from the Kraemer quarry has reversed the piezometric gradient in the Shakopee-Oneota formation. A comparison of the measured water table and the calculated piezometric levels indicate that the vertical flow is from bedrock upward within the area approximately 2400 feet south from the river and that the vertical flow is from the water table downward toward bedrock over the southern 400 feet of the landfill. All of the water which percolates from the water table into the bedrock formation in this 400 foot wide area will be captured by the pumping operation at the quarry. Most of the water which percolates into the alluvial soil will be carried laterally into the Minnesota River. Only a small portion of the water which percolates into the alluvial soils under the southern 400 feet of the site will be carried toward the quarry.

At such time as pumping ceases at the quarry, the piezometric pressure in the Shakopee will stabilize at approximately 703 near the river and will slope upwards in a southerly direction across the section shown in Figure III-7. The vertical flow will then be from bedrock upward into the alluvial soils over the entire area. Since the direction of groundwater flow in the underlying aquifers is toward the river, the general piezometric gradient in the bedrock aquifer must generally slope upward toward the south.

Figure III-8 shows contours of piezometric pressure in the Jordan aquifer. Piezometric contours indicate that the Minnesota River acts as discharge area for the Prairie du Chien Jordan aquifer formations. The aquifers are recharged through the vertical percolation of precipitation falling on the upland areas out of the river valley. In order for the aquifer system to discharge to the river, the aquifer piezometric level at the river must be greater than the river stage. This conclusion is supported by the observation well

designated ST-1 in Figure III-3. As discussed previously, this well penetrates a sand and gravel strata directly connected to the bedrock aquifer and has a static water level above the elevation of the surrounding ground. This piezometric level was approximately 15 feet above the October 27, 1970 river state.

The analysis of groundwater, soil, and bedrock aquifer piezometric conditions at and adjacent to the Freeway Landfill site leads to the conclusion that leachate from the landfill will not, under existing or natural conditions, recharge water supply aquifers. Under natural conditions the piezometric pressure levels in the Jordan and Prairie du Chien aquifers are great enough to exclude percolation from the landfill area. Under natural conditions all leachate from the landfill will flow to the river.

The existing pumping scheme at the Kraemer quarry would cause a small portion of the leachate from the proposed landfill to flow into the bedrock formation and toward the quarry. Water in the quarry reservoir is currently being pumped to a drainage ditch which flows to the river. The quarry pumping operation serves as a collector for all the water percolating from the landfill area into the bedrock formation.

Since cessation of pumping will eliminate the piezometric pressure drawdown in the Prairie du Chien formation, leachate from the proposed landfill will not enter the water-bearing aquifers when pumping ceases. Any landfill leachate in the rock when pumping ceases will percolate upward to surface soils and will flow laterally to the Minnesota River.

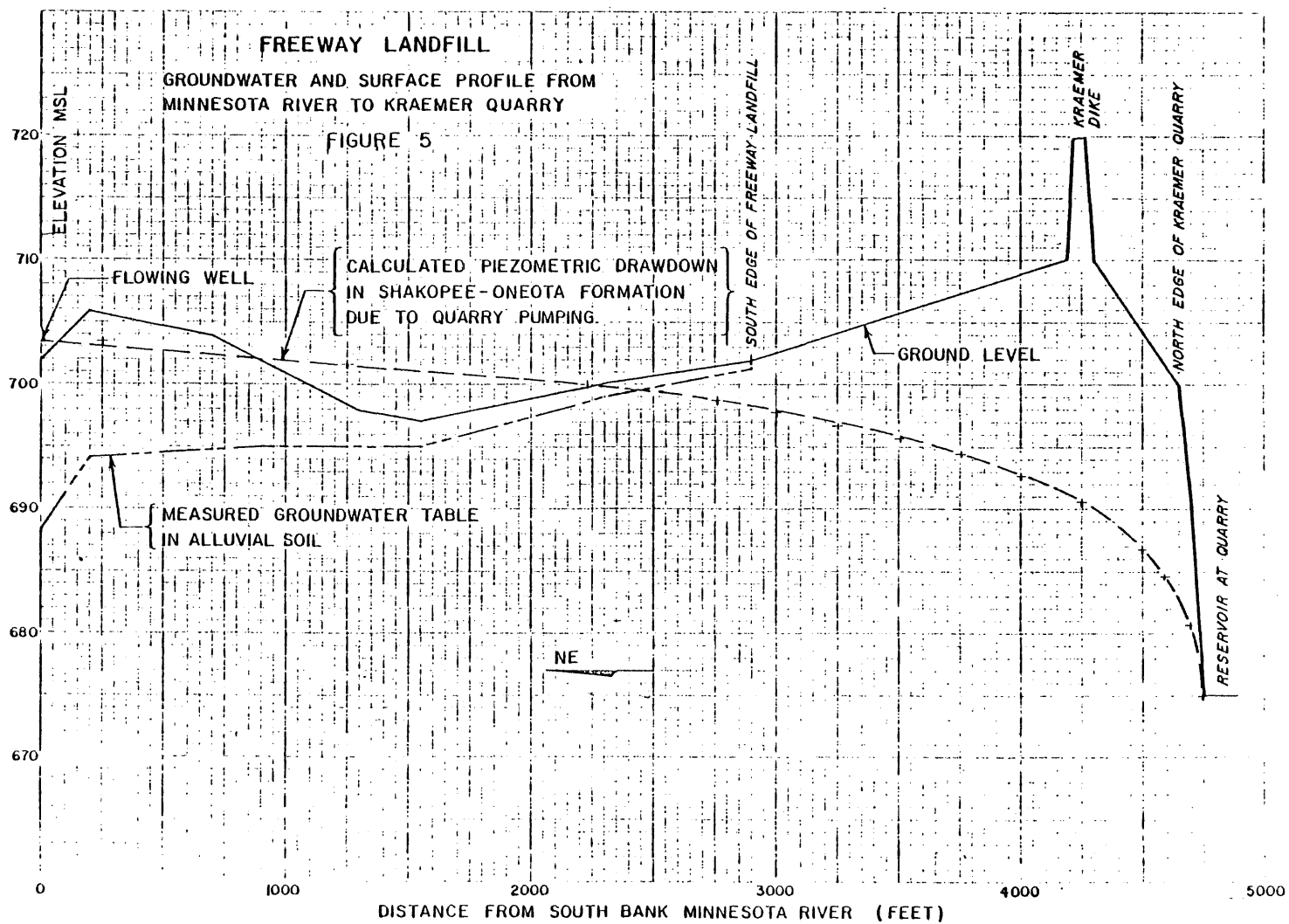
If the water table elevation in the landfill should rise above the piezometric level in the underlying bedrock, the flow of leachate from the landfill will still be toward the river. Because the recharge of the bedrock aquifers occurs over the upland areas above the river valley, the only outlets for the leachate are the river or groundwater wells which lower the bedrock piezometric level below the groundwater table at the landfill site.

Surface Water Hydrology

Surface waters near the landfill include the Minnesota River and the drainage ditch east of the landfill shown in Figure III-6. In addition, a small depression which is occasionally flooded, has been created northwest of the landfill by excavating the soil for cover material.

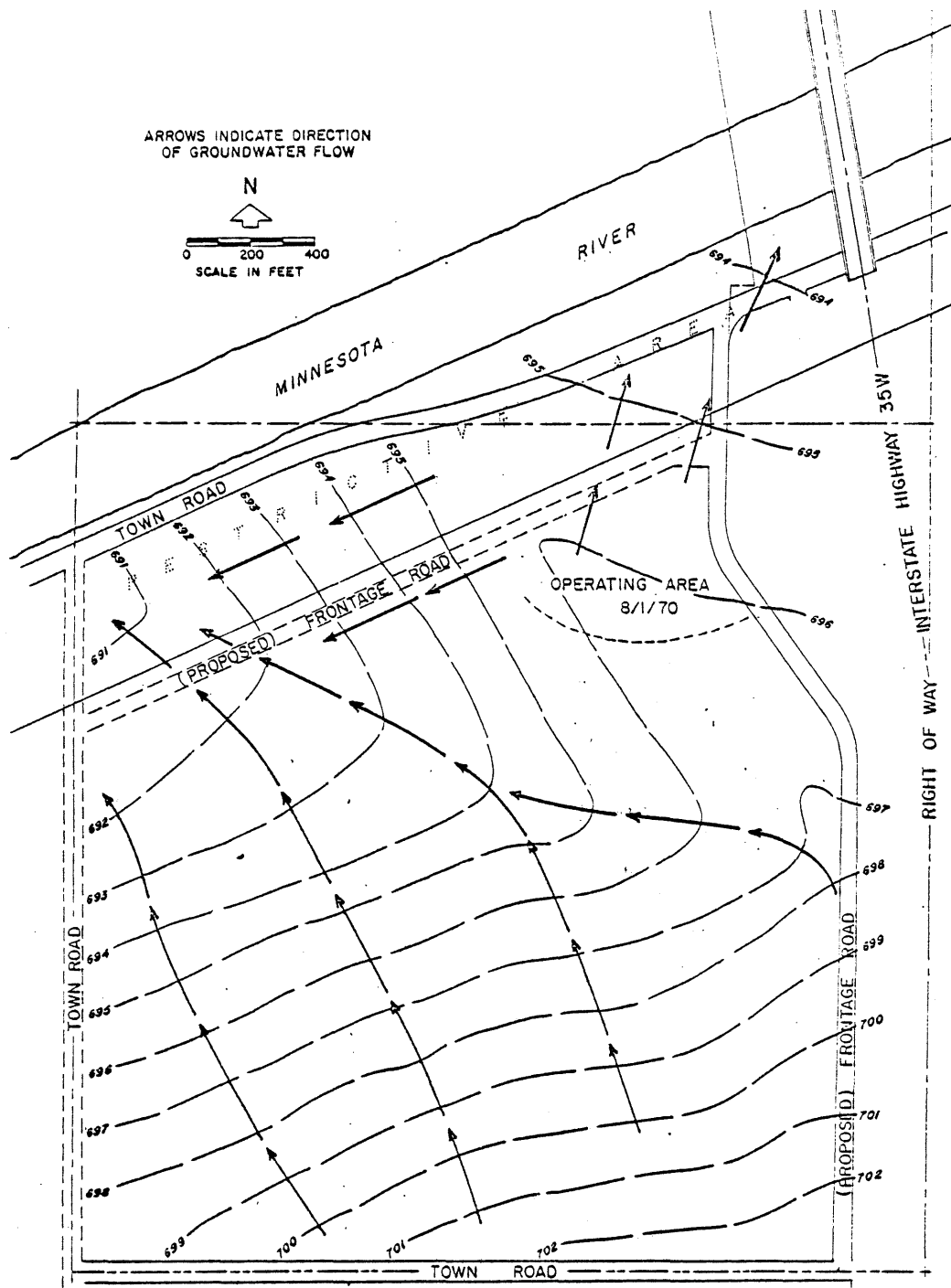
This section summarize the flood hydrology for both the Minnesota River and the eastern drainage ditch. Low flow hydrology is presented for the Minnesota River.

Information defining the surface water hydrology of the Minnesota River past the landfill is based primarily on the U. S. Geological Survey Gage on the Minnesota River at Jordan, Minnesota, and the U.S. Army Corps of Engineer's Port Cargill river gage records. The



GROUNDWATER AND SURFACE PROFILE FROM
MINNESOTA RIVER TO KRAEMER QUARRY

Figure III-7



CONTOURS OF PEIZOMETRIC PRESSURE
IN JORDAN AQUIFER

Figure III-8

period of record for the U.S.G.S. gage is 1935 through 1966, and 1944 to present for the Corps of Engineer's gage. The U.S.G.S. gage is located at River Mile 39, approximately 28 miles upstream of the landfill. There are no major tributary streams which significantly influence flood flows between the Jordan gage and the landfill. Low flow in the Minnesota River is influenced by seepage into the river between the Jordan gage and the landfill.

Flood Hydrology for the Minnesota River

The greatest recorded flood on the Minnesota River in the area of the landfill site occurred in April 1965 with an estimated peak discharge of 117,000 cfs (cubic feet per second) and peak stage at approximately Elevation 718.6 at the landfill site. This flood had a recurrence interval of approximately 100 years. Information on the five largest floods on the Minnesota River past the landfill site is presented in Table III-11.

In Minnesota, the regulated floodplain is defined by the limit of flooding from a flood with a one percent chance of occurrence in any given year. This flood is commonly referred to as a flood with a 100-year frequency recurrence interval. The U.S. Geological Survey conducted a statistical analysis of data collected at the Jordan gage to determine the frequency of various flood discharges on the Minnesota River and also carried out a computerized analysis to determine flood stages associated with various flood discharges. The results of the U.S. Geological Survey's hydrologic and hydraulic studies are included in the Flood Insurance Study for the City of Burnsville (FEMA 1972). Floodplain elevations at the landfill associated with various flooding events are summarized in Table III-12.

Encroachments into the floodplain such as fills or buildings reduce the capacity of the floodplain to carry flood water. The decrease in capacity will increase the flood heights which will increase flood hazards in areas upstream of the encroachment. The Flood Insurance Study for the City of Burnsville separated the area inundated by the 100-year frequency flood into a "floodway" and a "flood fringe." The floodway is made up of the river channel plus any adjacent floodplain area that must be kept free of encroachment so the 100-year frequency flood can be carried without a significant increase (0.5 feet in any reach) in flood height. The flood fringe makes up the remainder of the floodplain and is the area that can be filled or otherwise encroached upon without causing a substantial increase in flood height. The ordinance adopted after Freeway landfill was in operation, designated the flood fringe-floodway boundary around the landfill (i.e., along the western and northern boundaries). Therefore, the entire landfill area is in the flood fringe. Although placement of refuse in the existing landfill predates the floodplain studies in the area, the existing landfill is technically located in the flood fringe; however, filling has extended well above the flood level.

The face of the landfill is protected from the 100-year frequency flood by dikes built to the height of the 100-year frequency flood. During times of flooding, water can penetrate into the landfill along two general routes, namely, horizontally through the landfill dikes

LARGEST RECORDED
MINNESOTA RIVER FLOODS PAST
FREEWAY SANITARY LANDFILL

<u>Date</u>	<u>Discharge*</u> (cubic feet per sec.)	<u>Recurrence Interval</u>
April, 1965	117,000	101 years
April, 1969	84,600	40 years
April, 1951	64,100	19 years
April, 1952	60,600	16 years
June, 1957	40,800	7 years

* Department of the Interior, U.S. Geological Survey, Water Resources Data Gage 05330000, Minnesota River near Jordan, Minnesota, (period of record 1935-1978).

Table III-11

MINNESOTA RIVER FLOOD LEVELS
NEAR BURNSVILLE SANITARY LANDFILL

<u>Recurrence Interval</u>	<u>Discharge</u> (cubic feet per second)	<u>Flood Elevation</u> <u>at Landfill</u> (1929 MSL Datum)
10 year	48,400	708.1
100 year (without floodway)	115,000	718.2
100 year (with floodway)	115,000	718.3

Source: U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Burnsville, Dakota County, Minnesota.

TABLE III-12

and upward from beneath the landfill. Whether, or to what extent, this penetration does occur depends on the magnitude and shape of the flood hydrograph. The computed penetration of water through the landfill dikes during the regional flood is illustrated in a typical section in Figure III-9. Our calculations show that the penetration is gradual and that the river flood stage is not reflected within the landfill. When the flood stage begins to recede, the flow direction will be reversed and water will flow out of the landfill and into the river. The return flow through the landfill dikes into the river was calculated for the regional flood and is shown in Figure III-10. The maximum return flow during the regional flood is approximately .006 percent of the river discharge. This indicates the river flow has a tremendous diluting effect on the quality of the water entering the river. (Detailed information concerning effects of the landfill on the Minnesota River during flood conditions are available upon request from the Metropolitan Council.)

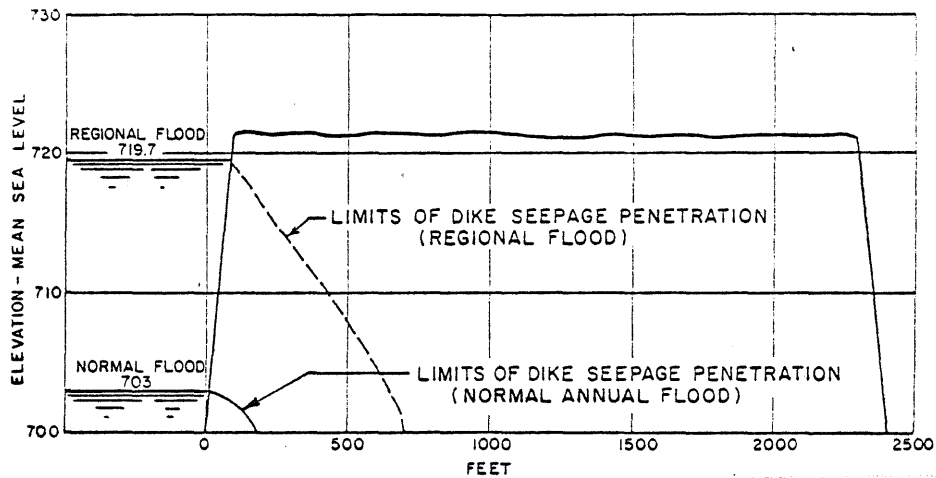
Flood Hydrology for the Easterly Drainage Ditch -- During periods of significant surface runoff such as occurred on March 30, 1978, flow in the drainageway increases and quality of the water in the drainageway changes significantly for the better. The degree to which runoff and drainage from other sources affects the quality of the drainageway discharge during these periods is unknown.

Last summer the drainage ditch had a large amount of standing water even though the river was not at high flood stage. According to the landfill owner, the flap gate was stuck thereby not allowing the water to drain into the Minnesota River. The Minnesota Department of Transportation (MnDOT) is responsible for the culvert and flap gate. It was checked recently and found to be in working order. MnDOT said it was possible there was something stuck in the gate not allowing it to open thereby damming the water into the drainage ditch.

Low-Flow Hydrology -- The U.S. Geological Survey has conducted a statistical analysis of the low flow in the Minnesota River at the gage near Jordan. The results of this analysis indicate that the seven consecutive day low flow with an average recurrence interval of 10 years is 168 cfs and the seven consecutive day low flow with an average recurrence of two years is 350 cfs.

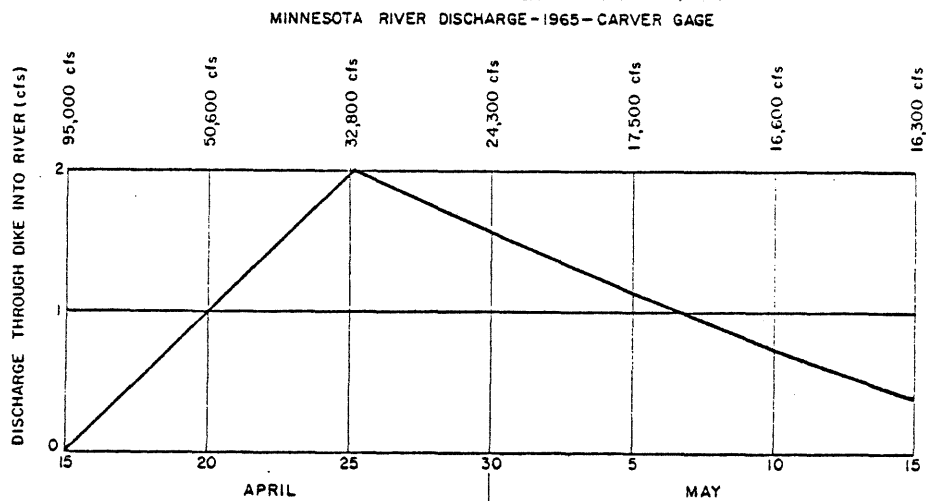
The low flow in the Minnesota River between the Jordan gage at River Mile 39 and the landfill site at River Mile 12 is influenced by groundwater seepage to the river. Studies conducted by Barr Engineering Co. in 1964 and 1968 for the Burnsville-Eagan-Bloomington Sanitary District indicate that groundwater seepage to this reach of the river under 10-year frequency low flow conditions is on the order of 47 cfs. Therefore, the seven day duration, 10-year frequency low flow at the landfill site has been assumed to be 215 cfs. The average annual low flow for a seven consecutive day, two year return frequency at the landfill site is estimated to be 450 cfs.

The Minnesota Pollution Control Agency (MPCA) has used 180 cfs as the seven day duration, 10-year frequency low flow for the lower Minnesota River.



LANDFILL DIKE SEEPAGE PENETRATION DURING FLOOD
GENERALIZED LANDFILL CROSS-SECTION

Figure III-9



DIKE SEEPAGE HYDROGRAPH WITH CORRESPONDING RIVER DISCHARGES
REGIONAL FLOOD

Figure III-10

Local Water Supply

All water supplies in the area south of the Minnesota River are obtained from wells, either central municipal wells or private wells on the property of the water user. Table III-13 lists the depth, surface elevation, and static water elevation for wells located within one mile of Freeway Sanitary Landfill. Figure III-11 gives the locations of these wells. Wells numbered one through nine (City of Burnsville municipal wells) are cased and grouted into the Jordan aquifer. At the maximum design pumping rates, the limit of the area influenced by the wells is, at its closest point, 3,200 feet from the landfill. Wells numbered ten through seventeen (private wells) are located north of the Minnesota River. Since the static water level in these wells is 40 to 100 feet above the normal near level Elevation 687, the area of influence of these wells will be limited to the north side of the Minnesota River. Well number eighteen is the water supply well for Freeway Landfill operations, and well number nineteen is a private water supply well for U.S. Salt Company. Well 18 and 19 are drinking wells in the area of influence of landfill leachate. Well 18 is at a depth of 60 feet which is well under the water table likely to be influenced by leachate. Both wells exceeded standards for total hardness, alkalinity and sulfates when tested in 1979 by the Department of Health. Although these parameters are not typical of leachate contamination, they should be carefully monitored in the future.

Ground water flow gradients, flow rates, and quality are summarized using information collected from the landfill monitoring program. Subcropping bedrock in the vicinity of the landfill is the Prairie-du-Chien dolomite. The Minnesota River Valley in general and the Minnesota River in particular are discharge areas for ground water in the glacial overburden and for ground water in the underlying Prairie-du-Chien and Jordan aquifers. The two important factors affecting ground water flow in the landfill area are dewatering from the quarry immediately south of the landfill and a natural silty clay levee running along the near channel along the northern boundary of the landfill

Total ground water inflow to the quarry occurs at a rate of approximately 1.5 million gallons per day. This water is pumped to the Minnesota River west of the western landfill boundary. The dewatering of the quarry results in a drawdown of the piezometric surface in the bedrock beneath the landfill, thus creating a ground water gradient to the quarry from the landfill area. A representation of this gradient is shown in Figure III-12.

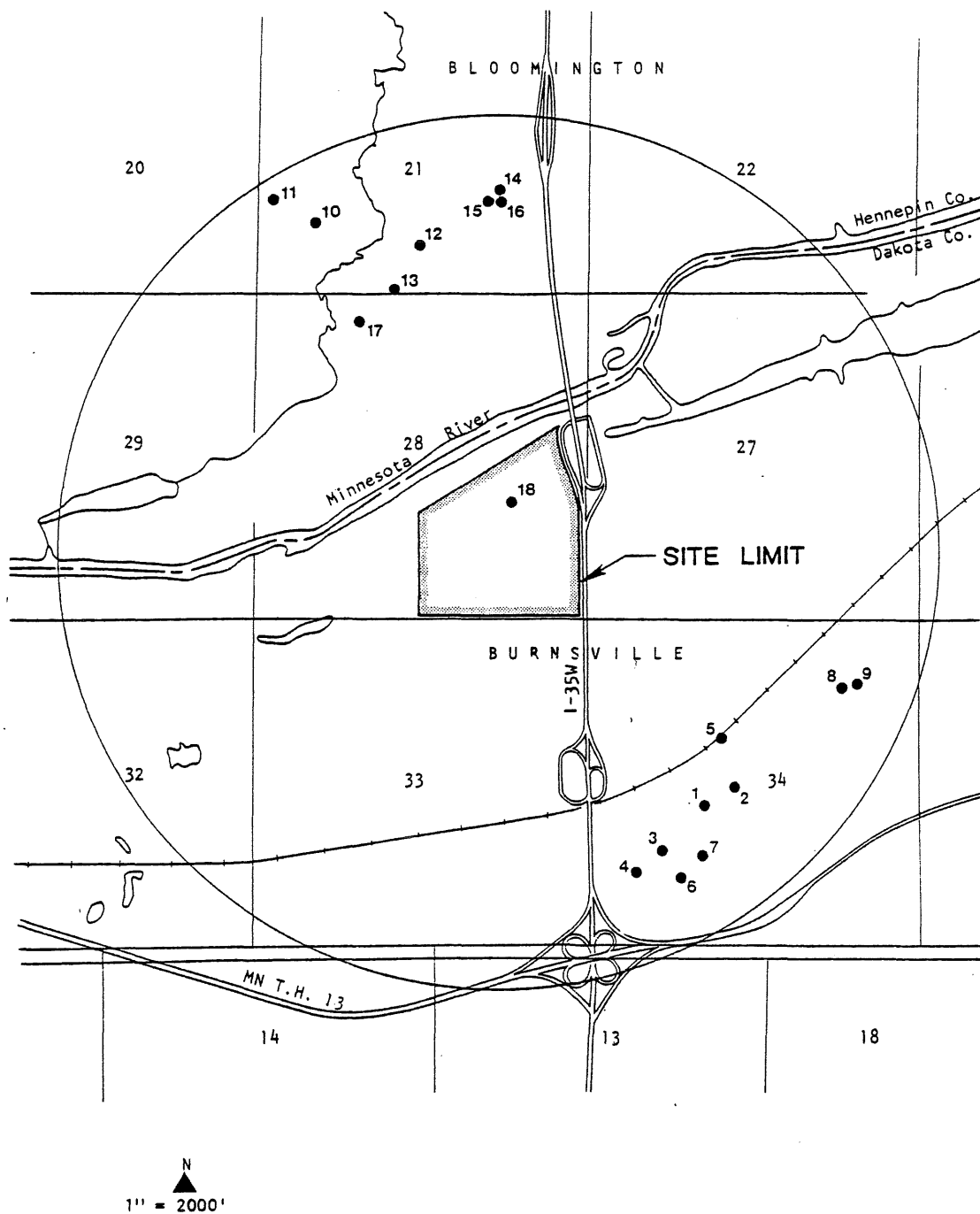
The naturally occurring silty clay levee near the northern boundary of the Freeway Landfill and adjacent to the Minnesota River is a relatively impermeable barrier and confines bedrock ground water in this area. The confined area coincides with the southern edge of an alluvial channel eroded into the bedrock. This channel has been filled with fine alluvial sediments. Thus, in moving toward the

<u>Well Number*</u>	<u>Depth(feet)</u>	<u>Surface Elevation</u>	<u>Static Level</u>	<u>Distance to Edge of Landfill (feet)</u>
1	298	760	760	3,900
2	306	760	753	3,900
3	314	781	745	4,100
4	335	786	726	4,300
5	265	725	725	4,100
6	356	834	755	4,700
7	357	830	747	4,600
8	957	- -	- -	4,700
9	383	- -	- -	4,700
10	118	812	790	5,000
11	114	819	791	5,600
12	234	810	755	3,700
13	157	809	734	3,500
14	161	832	752	4,100
15	162	830	- -	4,000
16	154	822	742	4,000
17	245	800	745	3,300
18	60	726	- -	0

* Wells numbered 1 through 9 are Burnsville municipal wells.
Wells numbered 10 through 18 are private wells.

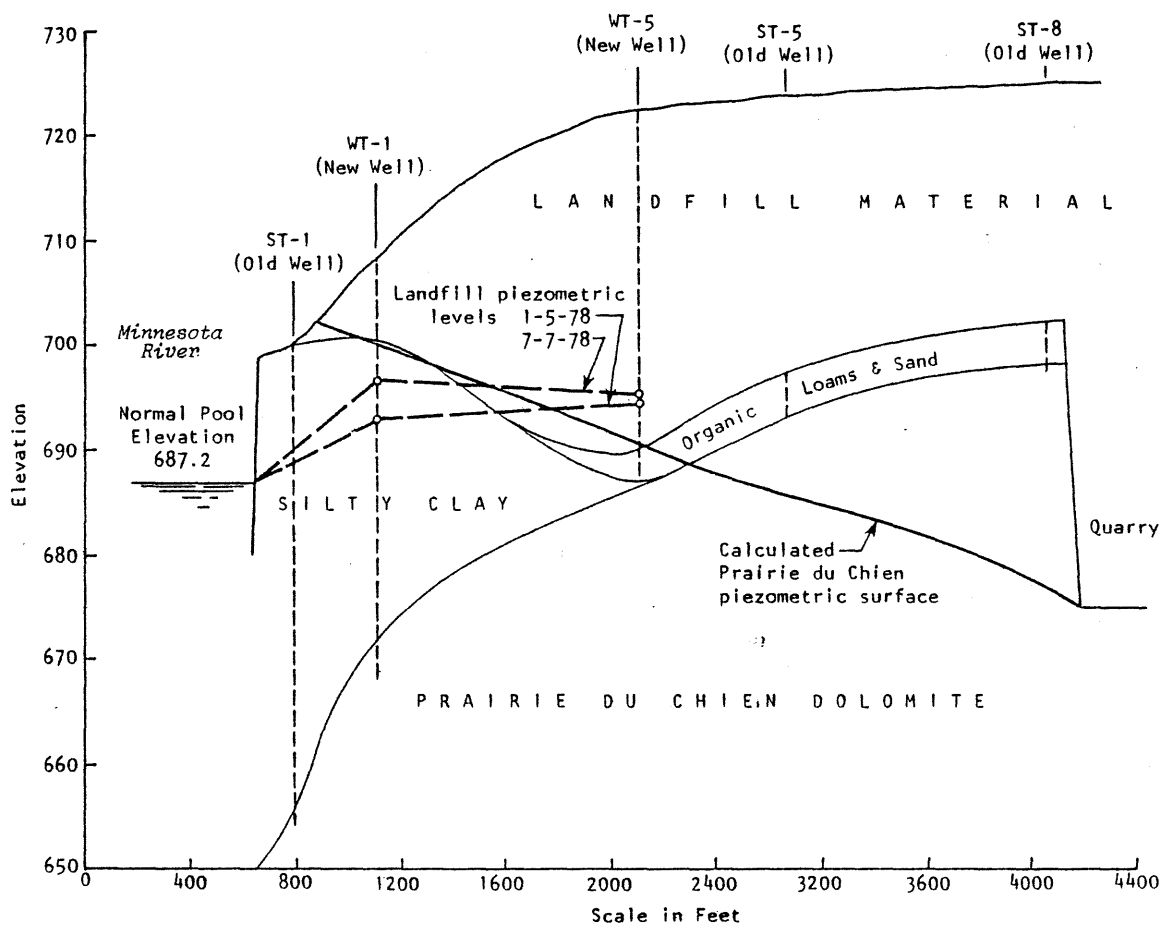
WATER SUPPLY WELLS FREEWAY LANDFILL VICINITY

Table III-13



LOCATION OF MUNICIPAL AND PRIVATE WATER
SUPPLY WELLS FREEWAY LANDFILL VICINITY

Figure III-11



REPRESENTATIVE CROSS SECTION THROUGH FREEWAY LANDFILL

Figure III-12

river, the bedrock surface represents a progressively lower portion of the aquifer. South of the clay levee, the bedrock is overlain by thin organic soils, and flow in the bedrock can be considered to be unconfined in this area.

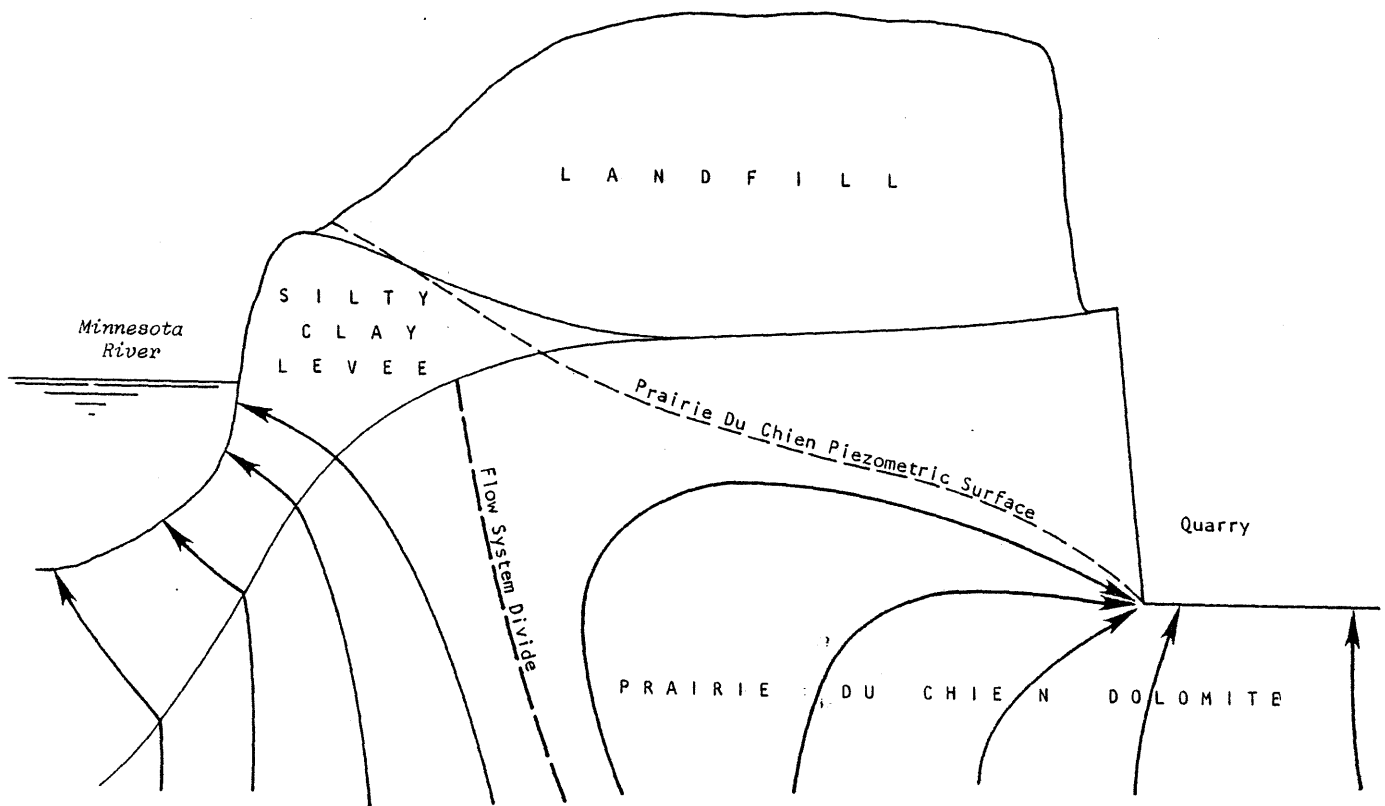
Flow Patterns -- As shown in Figure III-12, ground water flow within approximately 1,200 feet of the river's edge can be considered confined by the silty clay. The piezometric gradient along the bedrock surface under the landfill area slopes toward the quarry. This does not mean, however, that there is seepage from the river to the quarry since the piezometric pressure in the bedrock surface is higher than the river in the confined portion of the aquifer. Because flow in the bedrock aquifer is generally upward, piezometric levels increase downward into the aquifer. The upward movement of ground water and the close proximity of two discharge points--the Minnesota River and the quarry--create a ground water divide beneath the area covered by the silty clay (Figure III-13).

Seepage Rates --The two observation wells (WT-4 and WT-5) placed into the landfill measure the composite head of the water table and the piezometric levels beneath the landfill material. The two ground water surfaces shown in Figure III-12 represent the range of water table fluctuations measured in the landfill material during the period January 5 to July 7, 1978. These ground water levels are less than those in the bedrock aquifer for most of the area overlain by the silty clay. This indicates that any vertical ground water movement must be upward from the bedrock aquifer. Ground water in the overlying areas migrates either to the quarry through the unconfined portion of the bedrock, to the eastern drainageway through the landfill material or underlying alluvium, or to the Minnesota River.

In conclusion, all ground water flow from beneath the landfill ultimately enters the Minnesota River. Landfill leachate cannot influence the quality of ground water in bedrock aquifers beneath the landfill since the landfill area is a discharge location for the underlying aquifers.

Site Specific Water Budget

The water balance for the Freeway Sanitary Landfill has been determined for existing conditions using a method similar to the one used in the report, "Leachate Generation Potential from Landfills in the Twin Cities Metropolitan Area," dated March 1978, prepared by the Metropolitan Council. This method uses average annual precipitation and evaporation, transpiration and runoff losses, to estimate the infiltration into the landfill. The infiltration is an estimate of leachate release once the moisture content of the refuse reaches field capacity. It is generally assumed that refuse has an initial moisture content of approximately 15 percent and a field capacity of approximately 30 percent by weight.



THEORETICAL GROUND WATER FLOW SYSTEM DIVIDE
FREEWAY SANITARY LANDFILL

Figure III-13

The site specific water balance was determined using average monthly precipitation, evaporation, runoff and transpiration along with the following assumptions:

1. Sufficient precipitation is available to satisfy the land evaporation potential on an average monthly basis.
2. Runoff is based on the assumption that one rainfall event per month will produce runoff for the months of April through October and that snowmelt runoff will occur in March. The amount of runoff is a function of the amount of excess (i.e., precipitation minus land evaporation) monthly precipitation.
3. For vegetated areas, transpiration potential is applied to the amount of water remaining after applying monthly evaporation and runoff losses to the precipitation.
4. The estimated infiltration is equal to the precipitation minus land evaporation, runoff and transpiration.

The cover materials presently used on Freeway Sanitary Landfill consist of a silty clay loam excavated from the area immediately west of the landfill site and therefore water balance calculations would result in a low percolation rate and a low annual volume of leachate production. Results of the Metropolitan Council 1978 study using the water balance method indicate that the average annual percolation at Freeway Landfill will be 2.67 inches, and the time required for maximum leachate production will be 14 years from the beginning of landfill operation. These calculations were based on the assumption that cover material is highly organic peat with some sand from dredging instead of silty clay loam.

The estimated average annual infiltration rate used for water balance calculations for this analysis for the existing permitted area before and after final closure is 5.0 and 3.0 inches per year, respectively. Table III-14 summarizes the site specific water balance for the landfill under existing conditions (before and after final closure). The infiltration rates for vegetated and nonvegetated areas of three and 30 percent slope are also shown in Table III-14. For the current operation, the estimated annual surface runoff is 4.3 inches per year. For turfed areas, the average annual land evaporation and transpiration is 13.9 inches and 9.0 inches, respectively.

SURFACE WATER QUALITY

State Regulations

The MPCA has established surface water quality standards based on water use classifications for all interstate and intrastate waters in Minnesota. The water use classifications are described and defined in WPC 14 and WPC 15.

SITE SPECIFIC WATER BALANCE
EXISTING LANDFILL

<u>LANDFILL CONDITION</u>	<u>Estimated Average Annual Infiltration Rate</u>
Existing Conditions (During Operation)	5.0"/yr.
Existing Conditions (After Closure)	3.0"/yr.
 <u>SUB-AREA CONDITIONS</u>	
Vegetation - Landfill top (Slope Less than 3%)	4.5"/yr.
Vegetation - Landfill Side (Slope of 30%)	2.5"/yr.
No Vegetation - Landfill Top (Slope Less than 3%)	13.3"/yr.
No Vegetation - Landfill Sides (Slope of 30%)	9.8"/yr.

Table III - 14

All rivers of the state have been assigned one or more water use classifications as listed in WPC 24 and WPC 25. That portion of the Minnesota River of concern with respect to the Freeway area, from Carver Rapids to its confluence with the Mississippi River, has been assigned WPC use classifications 2C and 3B. The regulation that classifies State receiving waters also states that all receiving waters are classified 3C (industrial consumption--cooling and materials transport), 4A and 4B (agriculture and wildlife), 5 (navigation and waste disposal), and 6 (other uses) where such uses are possible. In addition, receiving waters in the 3B classification must be generally comparable to waters classified as 1D (domestic consumption--high degree of treatment) with the exception that the 1D standards for chloride, hardness, pH and fecal coliform need not be met. In summary, classifications applicable to the reach of the river potentially impacted by the existing land fill include: 1D, 2C, 3B, 4A, 4B, 5 and 6. Standards applicable to these classifications are summarized in Table III-15. These standards are applicable at all river flows equal to and greater than the seven day duration, 10-year frequency low flow.

All other surface waters in the Freeway Sanitary Landfill area are included under WPC use classifications 2B, 2C, 3B, 3C, 4A, 4B, 5 and 6 for intrastate waters. This would include the wetland areas near the landfill.

The state solid waste regulations require that the fill and trench areas of a sanitary landfill be at least 1,000 feet from the normal high water mark of a lake, pond, or flowage and at least 300 feet from a stream (SW 6(1)). The Minnesota River is located within 400 feet of the northern boundary of the landfill and, thus, would be subject to this regulation.

State solid waste regulations also require that sanitary landfills be constructed and cover material graded so as to promote surface water runoff without excessive erosion and that surface water drainage be diverted around and away from the landfill operating area (SW 6(2)). Finally, the solid waste regulations require that a water monitoring program be constructed and operated to determine leachate impacts on surface water and that a leachate collection and treatment system be installed where required to protect surface waters (SW 6(2)).

Regulatory Compliance

Minnesota River -- This section estimates the impact of sanitary landfill leachate on Minnesota River water quality at the seven day duration, 10-year frequency low flow and compares the estimated Minnesota River water quality to state water quality standards for this reach of the river.

The quality of the Minnesota River has been monitored for many years. In recent years, a computerized data system has been developed to maintain information in a more organized and accessible form. The State and federal agencies involved in monitoring the quality of the river include the U. S. Geological Survey (USGS), the Metropolitan Waste Control Commission (MWCC) and the MPCA.

STANDARDS FOR MINNESOTA RIVER IN VICINITY OF FREEWAY LANDFILL

<u>Parameter</u>	<u>MPCA Water Quality Standard</u>	<u>Limiting Classification</u>
Copper	10 µg/l	2C
Turbidity	25 NTU	2C
Conductivity	1000 µmhos/cm @ 25°C	4A
Chloride	100 mg/l	3B
pH	6.5-8.6	4A
Ammonia	1.5 mg/l as N	2C
Dissolved Oxygen	5 mg/l ⁽¹⁾	2C
Total Dissolved Solids	700 mg/l	4A
Total Alkalinity	250 mg/l as CaCO ₃	4A
Sulfate	10 mg/l as SO ₄	4A
Total Hardness	250 mg/l as CaCO ₃	3B
Sodium	60% of total cations in meq/l	4A
Cadmium	10 µg/l	1D
Lead	50 µg/l	1D
Arsenic	50 µg/l	1D
Selenium	10 µg/l	1D
Fluoride	1.5 mg/l	1D
Phenols	0.1 mg/l	2C
Chromium	0.05 mg/l	2C
Barium	1 mg/l	1D
Boron	0.5 mg/l	4A
Cyanide	0.02 mg/l	2C
Silver	50 µg/l	1D

(1) 4 mg/l during the period December 1 through March 31

Table III - 15

Since 1972, the MWCC and the USGS have been cooperating in a program to monitor the quality of the river. The cooperative program was designed to provide information on the mass transfer of water quality constituents through the Twin Cities Metropolitan Area. From 1972 through 1977, this network was made up of the MWCC Water Quality Sampling Program, an MWCC-USGS Cooperative Water Quality Surveillance Program and the MPCA Routine Water Quality Monitoring Program.

The MWCC program consisted of weekly and monthly grab sampling. The samples were analyzed by the MWCC laboratory at the Metropolitan Wastewater Treatment Plant. The MWCC-USGS Cooperative Program consisted of grab sampling and automatic monitoring of the Minnesota River. Analyses were performed at the USGS laboratory and included such parameters as dissolved oxygen, temperature, chloride, phosphorus, hardness, heavy metals, radio-chemical parameters, and biological organisms.

The MPCA's Routine Water Quality Monitoring Program has been operating since 1952. Sampling stations are located throughout the State, and since 1968 have been sampled on a monthly basis. Many of the stations are located below significant point discharges which exert a major influence on water quality. In the fall of 1977, the MPCA discontinued their sampling program on the lower Minnesota River because of a duplication of effort with the USGS and MWCC programs.

The water quality sampling station nearest the Freeway Sanitary Landfill is the MWCC station located at River Mile 14.3 approximately three miles upstream of the landfill. However, only some of the parameters of interest are routinely monitored at this station. The nearest water quality station at which almost all the parameters of interest were monitored is the former MPCA water quality station at River Mile 7, approximately four miles downstream of the landfill.

Various reaches of the major rivers and streams in the State have been classified by the MPCA as either "water quality limited" or "effluent limited." If a reach is classified as water quality limited, it has been determined that the quality does not meet applicable water quality standards and/or is not expected to meet standards in the future even if secondary treatment of municipal discharges and best practicable treatment of industrial discharges are used. Effluent limited segments are those where it has been determined that water quality standards are being met and where, with secondary or best practicable treatment, water quality standards will be met in the future.

The reach of the Minnesota River past the Freeway Sanitary Landfill is classified as water quality limited indicating that, even with secondary or best practicable levels of treatment, the river is not expected to meet stream standards.

Several parameters exceed water quality standards for the lower Minnesota River on a regular basis. These parameters include:

- o Turbidity
- o Conductivity
- o Ammonia
- o Dissolved oxygen
- o Copper
- o Total dissolved solids
- o Bicarbonates (or M-Alkalinity)
- o Sulfate
- o Hardness
- o Temperature

Available data indicate that turbidity exceeded the applicable water quality standards almost half the time at the River Mile 7 monitoring station. Elevated turbidity levels appear to be seasonal in nature with the highest turbidities occurring during the summer months.

Specific conductance exceeded State standards twice during the period 1975-1977 at the River Mile 7 station. The high values occurred during January and February 1977. During this period, the flow in the river was very low and runoff containing deicing chemicals used on streets and roads probably contributed to the elevated specific conductance. This conclusion is supported by the fact that the highest chloride concentrations also occurred during January and February 1977. The low flow condition during January and February, 1977 also resulted in ammonia concentrations which exceeded the stream standards.

Once during the summer of 1974 and once during the summer of 1976 the reported dissolved oxygen concentration in the Minnesota River dipped below the standard.

Seven of the copper concentrations exceeded State stream standards for this section of the river. A major problem with the available copper data is that the stream standard is the same as the detection limit of the technique used in the analysis. Normal analytical variation may have produced many of the apparent violations of the standard.

The total dissolved solids concentration in the river exceeded State standards twice and the alkalinity values exceeded the standard several times. Sulfate and hardness both periodically exceeded water quality standards on a continuing basis. The sulfate standard, however, is based on the production of wild rice and is probably not applicable to this reach of the Minnesota River.

During major rainfall events and during snowmelt in the spring, surface runoff leaves the landfill site. The amount of runoff and its quality is influenced by the slope, vegetal cover, and the rainfall intensity and duration. During the growing season, side slopes and finished areas of the landfill are vegetated soon after completion. Of the 126-acre existing landfill, only about 20 acres are not vegetated. The surface runoff quality, therefore, is generally similar to runoff from open grass areas and from areas of exposed soil.

Given the large size of the watershed tributary to the Minnesota River, it can be concluded that the surface runoff from 105 acres of grassland and 20 acres of exposed soil will have a negligible impact of the quality of the river.

The Minnesota River is governed by State water quality standards, and may potentially be impacted by leachate from the landfill. Based on the ground water flow patterns associated with the area beneath the Freeway Landfill, seepage from the landfill could influence the Minnesota River quality in three general ways: seepage to the eastern drainageway and subsequent discharge to the river, seepage directly to the river either through or over the silty clay levee, and seepage to the quarry and subsequent discharge to the river.

To assess the impact of leachate from the existing landfill on the river quality two general methods were used. The first method considered each of the three sources of seepage to the river separately. The second method considered the estimated leachate produced from the landfill as one source to the river without regard to drainageway dilution or soil attenuation. A simple dilution model was then employed to predict the change in river quality caused by all the landfill leachate. The second method probably provides more conservative results. Also the second method was the same used for river impact analysis for Burnsville Sanitary Landfill Expansion (Draft Environmental Impact Statement available from Metropolitan Council) and therefore affords direct comparison and assessment of cumulative impacts from both landfills.

Separate Source Method of River Impact Analysis -- Loadings (pounds/day) from the three sources were computed and used to evaluate the influence of landfill seepage on two Minnesota River flow conditions. The two river flow conditions were:

flow and quality measured in the river and monitoring wells on November 3, 1977 and flow and quality measured in the drainageway on November 22, 1977.

the 7-day duration, 10-year frequency, low flow (103 mgd) in the river and drainageway flow and quality measured on November 22, 1977.

The assumptions used to estimate the loading from each potential source are discussed in the following paragraphs.

As discussed previously a portion of the seepage from beneath the landfill discharges into the drainageway along the eastern boundary of landfill. This drainageway also carries surface runoff from the tributary watershed which includes a portion of Interstate 35W through this area. Water quality and flow data measured in the drainageway on November 22, 1977 were used to calculate the loading of various parameters (pounds/day) to the river. The discharge rate measured on November 22, 1977 was 6.7 gpm and the quality of the drainageway flow on that date is summarized and available upon request from the Metropolitan Council. During periods with no surface runoff to the drainageway, the flow rate and quality of the flow past Station S-6 was found to be quite constant, and thus the loadings to the river calculated for November 22, 1977 are believed to represent a good measure of loadings to the river from the landfill seepage to the drainageway. During periods of significant surface runoff such as occurred on March 30, 1978, flow in the drainageway increases and quality of the water in the drainageway changes significantly. The degree to which runoff and drainage from other sources affects the quality of the drainageway discharge during these periods is unknown.

The saturated material is generally isolated from the river by an impermeable soil barrier consisting primarily of clays and silty clay materials. The permeability of this material limits seepage to the river from the landfill material to approximately 1×10^{-4} gpm during times when ground water levels are below the top of this barrier. During periods of above average precipitation or snowmelt, groundwater levels may rise above the natural soil barrier. During such a period in July, 1978, the calculated rate of seepage to the river was on the order of 13 gpm.

Water quality data from monitoring Wells WT-1, WT-2, and WT-3 on November 3, 1977 were used to estimate the ground water loading to the river at a seepage rate of 1×10^{-4} gpm. This is an estimate of the loading to the river during a period when ground water levels are below the top of the silty clay levee. Water quality data from monitoring Wells WT-4 and WT-5 on November 3, 1977 along with a

seepage rate of 13 gpm were used to estimate loadings to the river associated with periods when ground water levels overtop the buried silty clay levee.

The ground water analysis indicates that ground water beneath the landfill also discharges to the quarry south of the landfill. At the quarry, seepage from beneath the landfill is mixed with seepage into the quarry from other directions and is discharged to the river at a rate of approximately 1.5 million gallons per day. This water is discharged to the river upstream of Station S-10. It was not possible to directly measure the quality of seepage to the quarry. The best that could be done was to measure the quality of the entire quarry discharge. The quality of the quarry dewatering is generally similar to the quality of ground water measured in monitoring wells WT-1, WT-2, and WT-3. The quality of the quarry dewatering measured on November 3, 1977 was used along with a quarry discharge rate of 1.5 million gallons per day to estimate loadings to the river from the quarry. This likely overestimates the loading to the quarry from the landfill since the remaining ground water inflow to the quarry undoubtedly contributes measurable concentrations of various parameters.

As discussed in the introductory paragraph to this section of the report, the effects of the loadings to the river from three potential sources were investigated under river flow conditions that occurred November 3, 1977 and under a 7-day duration, 10-year frequency river low flow conditions. Since the quarry dewatering enters the river well upstream of the landfill, the assessment of the impact of quarry dewatering on river quality was separated from the assessment of impacts from the other two sources. The impact of the quarry dewatering discharge on Minnesota River quality is illustrated on Table III-16. November 3, 1977 river flow and quality conditions were used in the analysis. A comparison between the measured river quality and the computed river quality indicates that the quarry discharge has very little effect on river quality and actually slightly improves river quality for many parameters.

As the next step in the analysis, the effect of the discharge from the eastern drainageway and seepage directly to the river on river quality was assessed. The results of these investigations are summarized in Tables III-17 through III-20. Table III-17 is based on eastern drainageway loadings and ground water seepage conditions to the river as they existed November 3, 1977 superimposed on November 3 river conditions. Table III-18 is based on the same drainageway and seepage loadings superimposed on the 7-day duration, 10-year frequency low flow river condition. Table III-19 is based on ground water seepage conditions that likely occurred during July, 1978, namely overtopping of the impervious silty clay levee superimposed on November 3 river conditions. Table III-20 is based on the same loadings superimposed on the 7-day duration, 10-year frequency low flow condition.

Calculations indicate that groundwater and drainageway flows have only a very small impact on the quality of the river even under low

MINNESOTA RIVER						
PARAMETER	QUARRY SUMP QUALITY ^a		Upstream Quality		Calculated Downstream Quality	
	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l ^b
BOD (filtered)	<37.5	<3	28,039	4	28,076.5	3.99
COD (filtered)	350.5	28	420,588	60	420,938.5	59.77
Chloride	262.9	21	273,382	39	273,644.9	38.87
Ammonia	<2.5	<0.2	1,122	0.016	1,124.5	0.16
Dissolved Solids ^c	5,032	402	3,112,351	444	3,117,383	443.70
Phenol	0.025	0.002	<14	<0.002	<14	<0.002
Chromium	0.02	0.0016	13.3	0.0019	13.3	0.0019
Copper	0.005	0.0004	11.9	0.0017	11.9	0.0017

a. Based on a quarry sump discharge rate of 1.5 mgd and quarry water quality for November 3, 1978.

b. Based on 25 percent of November 3, 1977 river flow (210 mgd) available for mixing with loading for quarry sump.

c. Based on $0.64 \times \text{specific conductance} = \text{dissolved solids}$.

IMPACT OF QUARRY DISCHARGE ON MINNESOTA RIVER (November 3, 1977 condition)

Table III- 16

PARAMETER	LOADINGS				MINNESOTA RIVER					
	Ground Water ^a		Drainageway ^b		Upstream Quality Measured at S-10		Downstream Quality			
	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	Measured at S-11	Calculated	lbs/day	mg/l ^e
BOD	1.8×10^{-5}	15 ^d	1.1	14	28,039	4	35,049	5	28,040.1	4.00
COD	1.7×10^{-4}	140 ^d	29.5	368	420,588	60	392,549	56	420,617.5	60.01
Chloride	4.7×10^{-5}	39	62.7	781	273,382	39	343,480	49	273,444.7	39.03
Ammonia	1.9×10^{-6}	1.6	2.0	25	1,122	0.16	1,612	0.23	1124	0.16
Dissolved Solids	4.5×10^{-4}	376	251.2	3,136	3,112,351	444	3,497,880	449	3,112,602.2	444.12
Phenol	1.2×10^{-8}	0.01	0.001	0.015	<14	<0.002	105	0.015	<14	<0.0001
Chromium	3.6×10^{-9}	0.003	2×10^{-4}	0.003	13.3	0.0019	13	0.0018	13.3	0.0019
Copper	7.2×10^{-9}	0.006	7.2×10^{-5}	0.0009	11.9	0.0017	13	0.0019	11.9	0.0017
Oil	-	-	0.2	3	<7,010	<1	7,101	1	<7,010	<1

- a. Based on average water quality measured for WT-1, WT-2, and WT-3 and a calculated ground water discharge rate of 1×10^{-4} gpm.
b. Based on a drainageway discharge of 6.7 gpm measured on 11/22/77.
c. Based on stream flow of 840 mgd (U.S.G.S.) on November 3, 1977 at Jordan (provisional).
d. Filtered sample.
e. Assumes 25 percent of river flow available for mixing.

IMPACT OF FREEWAY LANDFILL ON MINNESOTA RIVER
(Data for November 3, 1977)
(Ground water levels below buried silty clay levee)

Table III-17

PARAMETER	LOADING				MINNESOTA RIVER			
	Ground Water ^c		Drainageway ^d		Measured Upstream Quality ^e		Calculated Downstream Quality	
	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l ^f
BOD	1.2×10^{-5}	10 ^g	1.4	18	430	0.5	431.4	0.50
COD	8.8×10^{-5}	74 ^g	21.9	272	6,876	8	6,897.9	8.02
Chloride	3.1×10^{-5}	26	94.2	1,170	14,617	17	14,706.2	17.26
Ammonia	1.6×10^{-6}	1.3	1.8	23	43	0.05	44.8	0.06
Dissolved Solids	4.7×10^{-4}	388	159	1,984	-	a	159	0.73
Phenol	1.1×10^{-8}	0.009	0.0005	0.006	-	a	0.0005	2.3×10^{-6}
Chromium	3.6×10^{-9}	0.003	0.0006	0.0072	-	a	0.0006	2.8×10^{-6}
Copper	7.2×10^{-9}	0.01	0.0002	0.0029	-	a	0.0002	9.2×10^{-7}
Oil	-	-	<0.08	<1	-	a	<0.08	$<3.7 \times 10^{-4}$

- a. Below detection limits of analysis procedure or no available data, concentration of 0 assumed for calculation purposes.
b. 7-day, 10-year low flow for Minnesota River is 103 mgd.
c. Based on average water quality values measured at WT-1, WT-2 and WT-3 for all sampling dates and a calculated ground water discharge of 1×10^{-4} gpm.
d. Based on a discharge rate and water quality measured in drainageway on 11/22/77.
e. Based on lowest recorded concentration in Minnesota River between Jordan and Fort Snelling by NMCC during the period 1972-1977.
f. Assumes 25 percent of river flow (26 mgd) available for mixing.
g. Filtered sample.

IMPACT OF FREEWAY LANDFILL ON MINNESOTA RIVER
(7-day, 10-Year Low Flow Conditions)^b
(Ground water levels below buried silty clay levee)

Table III-18

PARAMETER	LOADING				MINNESOTA RIVER ^c					
	Ground Water ^a		Drainageway ^b		Upstream Quality Measured at S-10		Downstream Quality			
	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	Measured at S-11 lbs/day	mg/l	Calculated lbs/day	mg/l
NO ₃	24	155 ^d	1.1	14	28,039	4	35,049	5	28,064.1	4.01
CO ₃	113	726 ^d	29.5	368	420,388	60	392,549	56	420,730.5	60.07
Chloride	125	800	62.7	783	273,182	39	343,480	49	273,569.7	39.10
Ammonia	5	32	2.0	25	1,122	0.16	1,612	0.23	1,129	0.164
Dissolved Solids	481	3,082	251.2	3,136	3,112,351	444	3,497,890	449	3,113,083.2	444.36
Phenol	0.01	0.063	0.001	0.015	<14	<0.002	105	0.015	<14	<0.0002
Chromium	0.001	0.007	0.0002	0.003	13.3	0.0019	13	0.0018	13.3	0.0019
Copper	0.00016	0.001	7.2 x 10 ⁻⁵	0.0009	11.9	0.0017	13	0.0019	11.9	0.0017
Oil	-	-	0.2	3	<7,010	<1	7,010	1	-	<1

- a. Based on average water quality measured for WT-4 and WT-5 on November 3, 1977, and a calculated ground water discharge rate of 13 gpm.
b. Based on a drainageway discharge of 6.7 gpm as measured on November 22, 1977.
c. Based on stream flow of 840 mgd (U.S.G.S.) at Jordan (provincial) on November 3, 1977.
d. Filtered sample.

IMPACT OF FREEWAY LANDFILL ON MINNESOTA RIVER UNDER ELEVATED GROUND WATER LEVELS (Data for November 3, 1977)

Table III-19

PARAMETER	LOADING				MINNESOTA RIVER			
	Ground Water ^c		Drainageway ^d		Measured Upstream Quality ^e		Calculated Downstream Quality ^f	
	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l ^g
NO ₃	24	155 ^R	1.4	18	430	0.5	455.4	0.61
CO ₃	113	726 ^R	21.9	272	6,876	8	7,010.9	8.49
Chloride	125	800	94.2	1,170	14,612	17	14,831.2	17.73
Ammonia	5	32	1.8	23	43	0.05	49.8	0.09
Dissolved Solids	481	3,080	159	1,984	-	a	640	2.93
Phenol	0.01	0.063	0.0005	0.006	-	a	0.073	1.4 x 10 ⁻⁴
Chromium	0.001	0.007	0.0006	0.0072	-	a	0.0016	7.4 x 10 ⁻⁶
Copper	0.00016	0.001	0.0002	0.0029	-	a	0.00036	1.6 x 10 ⁻⁶
Oil	-	-	<0.08	<1	-	a	<0.08	<3.7 x 10 ⁻⁶

- a. Below detection limits of analysis procedure or no data available, concentration of 0 assumed for calculation purposes.
b. Calculated 7-day, 10-year low flow for Minnesota River is 103 mgd.
c. Based on average water quality values measured for WT-4 and WT-5 on November 3, 1977, and a calculated ground water discharge of 13 gpm.
d. Based on discharge rate and water quality data measured in drainageway on November 22, 1977.
e. Based on lowest recorded concentration in Minnesota River between Jordan and Fort Snelling by MNCC during the period of 1972-1977.
f. Assumes 25 percent of river flow (26 mgd) available for mixing.
g. Filtered Sample

IMPACT OF FREEWAY LANDFILL ON MINNESOTA RIVER UNDER ELEVATED GROUND WATER CONDITIONS (7-day, 10-Year Low Flow Conditions)^b

Table III-20

flow conditions. The calculated increases in parameter values are generally several orders of magnitude lower than measured variations in water quality in the river. In no case do calculated increases approach levels that could cause the river to exceed MPCA standards established for the river. The impact of landfill seepage on the quality of the Minnesota River is minimal and is masked by the temporal and spacial variations in quality that occur naturally in the river.

Single Source/Dilution Model Method of River Impact Analysis -- The amount of leachate reaching the river was determined by the water balance of the landfill. Average annual leachate production was estimated to be 3.0 inches per year (0.044 cfs from the 126 acres of existing landfill) for the Freeway Landfill.

Information on the quality of leachate was obtained from two sources. The first is Freeway drainageway seep samples. Data obtained from these samples is contained in Table III-21 and was used to help define leachate quality. Not all of the parameters of interest were analyzed in these samples. For parameters not analyzed in the leachate samples, literature values based on median leachate concentrations were used in the analysis. These concentrations are presented in Table III-21. Although leachate attenuation and biodegradation are important processes and likely act to reduce the strength of the leachate reaching the river from the landfill, their effect was assumed to be negligible for purposes of this impact analysis.

The loading of potential pollutants to the river as predicted by the leachate loading model can be expressed as follows:

$$L = C_{LL} \times Q_L \times 5.4$$

where

L = loading of the potential pollutant to the Minnesota River from the Burnsville Landfill (lbs/day)

C_{LL} = concentration of potential pollutant in landfill leachate (mg/l)

Q_L = rate of leachate production from the landfill (cfs)

DATA DESCRIBING LANDFILL LEACHATE QUALITY

<u>Parameter</u>	<u>Literature¹ Concentration</u>	<u>Measured² Concentration</u>
Ammonia	82 mg/l as N	77 mg/l as N
Cyanide	0.028 mg/l as CN	-
Oil	24 mg/l	3 mg/l
Phenol	0.77 mg/l	0.30 mg/l
Bicarbonata (Alkalinity)	1225 mg/l as CaCO ₃	-
Boron	4.7 mg/l	-
Specific Conductance	6100 umhos/cm @ 25°C.	5500 umho @ 25 C
pH	6.8	6.9
Chromium	0.05 mg/l	0.033 mg/l
Copper	0.05 mg/l	0.044 mg/l
Arsenic	Not Detectable (0.00 mg/l)	-
Barium	2.25 mg/l	-
Cadmium	0.03 mg/l	-
Chloride	562 mg/l	1620 mg/l
Hardness	1600 mg/l as CaCO ₃	-
Fluoride	0.4 mg/l	-
Lead	0.10 mg/l	-
Selenium	Not Detectable (0.00 mg/l)	-
Total Dissolved Solids	5346 mg/l	-
Total Organic Carbon	-	-
Turbidity	-	150 NTU
Sodium	357 mg/l	-
Sulfate	153 mg/l as SO ₄	-
Silver	0.01 mg/l	-
Zinc	-	-
BOD ₅	1500 mg/l	35 mg/l
COD	4490 mg/l	408 mg/l

¹Median Values from Data in Thomas Clark and Rauf Pisking, Environmental Geology, Vol. 1, page 329, 1977.

²Samples collected by Barr Engineering Co. and analyzed by SERCO laboratories. Measured concentrations given are the highest obtained from the drainageway surface water stations since November, 1977.

Table III-21

The impact of the loading of each potential pollutant on river quality can be calculated using the following formula:

$$C_{DS} = \frac{L + 5.4(Q_R C_{US})}{5.4(Q_R + Q_L)}$$

where

C_{DS} = concentration of potential pollutant in mixing zone of the river downstream of the landfill (mg/l)

L = loading of potential pollutant to the Minnesota River from the Burnsville Landfill (lbs/day)

Q_R = flow in the mixing zone of the river (cfs) -- for modeling purposes 25 percent of the river's flow was assumed available for mixing

C_{US} = concentration of potential pollutant in the river upstream of the landfill

Q_L = flow of leachate into the river (cfs)

For the impact analysis, the river quality upstream of the landfill was based on averages from samples taken at River Mile 7, River Mile 3 and River Mile 36 sampling stations. The quality of the river based on the averages is summarized in Table III-22. During the drought of 1976, a flow about equal to the 7-day duration, 10-year frequency low flow occurred during September. Water quality data measured on river samples collected in September, 1976, were compared with the average river quality data shown in Table III-22 to check for any obvious differences between the average values and values actually measured during low flow conditions of September, 1976. The river concentrations in Table III-22 are representative concentrations for low flow conditions. Although much of the data were collected downstream of the landfill, it was assumed that it was representative of conditions upstream. This leads to a "worst case" analysis, in that higher concentrations will be predicted downstream of the landfill.

The influence of landfill leachate at the 7-day duration, 10-year frequency low flow was evaluated. The 7-day duration, 10-year frequency low flow for the Minnesota River at the landfill has been estimated to be 215 cfs. The calculated influence of the Freeway Landfill on the quality of the Minnesota River at the 7-day duration, 10-year frequency low flow is summarized in Table III-23.

ASSUMED BACKGROUND QUALITY OF
MINNESOTA RIVER DURING LOW FLOWS

<u>Parameter</u>	<u>Low Flow Quality</u>
Copper	12 µg/l
Turbidity	76.6 NTU
Conductivity	730 µmhos/cm @ 25°C
Chloride	45 mg/l
pH	8.1
Ammonia	0.70 mg/l as N
Total Dissolved Solids	573 mg/l
Total Alkalinity	258 mg/l as CaCO ₃
Sulfate	123 mg/l as SO ₄
Total Hardness	369 mg/l as CaCO ₃
Sodium	34.3 mg/l
Cadmium	10 µg/l
Lead	11 µg/l
Arsenic	8.6 µg/l
Selenium	2.8 µg/l
Fluoride	0.32 mg/l
Phenols	0.004 mg/l
Chromium	0.007 mg/l
Barium	0.16 mg/l
Boron	0.16 mg/l
Cyanide	0.4 mg/l
Silver	<10 µg/l
BOD ₅	5.3 mg/l
COD	42.5 mg/l

Table III-22

IMPACT OF EXISTING LANDFILL ON MINNESOTA RIVER QUALITY
7 DAY DURATION - 10 YEAR FREQUENCY LOW FLOW

PARAMETER	Minnesota River	Freeway Landfill		Minnesota River	
	UPSTREAM CONCENTRATION	LEACHATE CONCENTRATION	LANDFILL LOADING LBS./DAY	DOWNSTREAM CONCENTRATION	MPCA WATER QUALITY STANDARD
Copper ug/l	12	316	7.4	12.0	10
Turbidity NTU	76.6	150 ⁶	35.6	76.6	25
Conductivity phos/cm @ 25 deg. C.	730 ²	5500 ⁶	1307	733.5	1000
Chloride mg/l as Cl	45	1620 ⁶	384.9	46.3	100
pH	8.1	7.0 ⁶	--	--	6.5-8.5
Ammonia mg/l as N	0.70	77 ⁶	18.3	0.76	1.5
Total Dissolved Solids mg/l	573	5346	1270	576.6	700
Total Alkalinity mg/l as CaCO ₃	258	1225	291	258.6	250
Sulfate mg/l as SO ₄	123	1080	257	123.7	10
Total Hardness mg/l as SO ₄ CaCO ₃	368	1600	380	368.8	250
Sodium mg/l as Na	34.3	357	85	34.5	122 ⁴
Cadmium ug/l as C	10	30	7.1	10.0	10
Lead ug/l as Pb	11	100	24	11.1	50
Arsenic ug/l as As	8.6	ND	--	8.6	50
Selenium ug/l as Se	2.8	ND	--	2.8	10
Fluoride mg/l as F	0.32	0.4	.09	0.320	1.5
Phenols ug/l	0.004	.025 ⁶	.006	0.004	0.1
Chromium mg/l as Cr	0.007	.014 ⁶	3.3	.007	0.05
Barium mg/l as Ba	0.16	2.25	.53	.162	1
Boron mg/l as B	0.16	3.0 ⁶	.71	.162	0.5
Cyanide mg/l as CN	0.4	0.028	.007	.40	0.02
Silver ug/l as Ag	<10	10	2.4	10	50
BOD ₅ mg/l	5.3	35 ⁶	35 ⁶	6.5	--
COD mg/l	42.5	464 ⁶	110	42.8	--

- Median values from data in Clark & Piskins, Environmental Geology, Volume 1, 1977, unless other noted.
- 0.65 x specific conductance - total dissolved solids (mg/l)
- Turbidity is assumed to be a linear function, this value may be considered to be a loading number, of one NTU is assumed equal to one mg/l.
- MPCA standard is based on sodium being less than 60% of the total equivalent of cation. To calculate the standard, the hardness was assumed to the other cation source, and all of the hardness was assumed to be calcium ions.
- Not detectable.
- Freeway Landfill seepage concentration May 3, 1979.

TABLE III-23

In most cases, the impact of the existing Freeway Landfill on the quality of the Minnesota River at the 7-day, 10-year low flow are not analytically discernable. The concentration of most parameters in the river upstream of the landfill is essentially the same as it is downstream of the site. The three parameters predicted to result in the greatest increase are BOD, ammonia and chloride. All other parameters result in less than a two percent increase. Even with increases of .06 mg/l (as N) for ammonia (8.6 percent increase), and 1.3 mg/l (as Cl) for chloride (2.9 percent increase), the modeled downstream concentrations are well below the MPCA standards for the River. BOD is predicted to increase 23 percent. However, there is no standard governing this parameter for the River.

In summary, the leachate dilution impact model shows that Minnesota River quality is influenced only minimally by leachate from the existing Freeway Landfill because of attenuation by dilution. The parameters which show the greatest increase are BOD, ammonia, and chlorides in that order. No increases due to landfill leachate cause violations of the MPCA water quality standards.

Other Surface Waters in the Landfill Area -- The easterly drainage ditch which was formerly called Thornton Creek is also subject to State water quality standards. The drainage ditch receives surface runoff from the tributary watershed which includes a portion of Interstate 35W, from the landfill and until recently, it received Kraemer's quarry dewatering effluent. At present the drainage ditch is largely dry. The water in the drainageway exceeds several water quality standards including chloride, ammonia, specific conductance and turbidity on a consistent basis and copper on an occasional basis. It is currently being appraised by the MPCA for reclassification to proposed class 7: limited resource value waters. This class includes surface waters of the state which are of limited value as a water resource and where water quantities are intermittent or less than one cubic foot/sec at the once in 10 year, seven day low flow. These waters shall be protected to as to allow secondary body contact use, to preserve the groundwater for use as a potable water supply, and to protect the aesthetic qualities of the water.

GROUND WATER QUALITY

State Regulations

The MPCA has established ground water standards that would be applicable to operation of the Freeway Sanitary Landfill. Perhaps the most stringent standard is WPC 22. This standard states that wastes shall be controlled as may be necessary to ensure that to the maximum practicable extent the underground waters of the state are maintained at their natural quality. This standard, then, is essentially a non-degradation standard. WPC 14 also applies to ground waters. Where differences exist between WPC 14 and WPC 22, the more stringent conditions are applied.

Other standards that would apply include those under SW6. SW6 states that solid wastes shall not be deposited in such a manner that material or leachings may cause pollution of underground or surface water. SW6 also states that the proposed separation between the lowest portion of the landfill and the high water table elevation shall be a minimum of five feet. Finally, SW6 provides that a water monitoring program shall be constructed and operated to determine whether or not solid waste or leachate is causing pollution of underground or surface water and that an approved leachate collection and treatment system shall be used where required.

From a practical standpoint, the location of the ground water potentially influenced by the Freeway Landfill limits the potential use of the ground water. The landfill is located adjacent to the Minnesota River and the ground water potentially influenced by landfill leachate discharges naturally to the river. The proximity of the landfill to the river along with the fact that the area between the river and the landfill is zoned as floodway and cannot be developed, precludes any future ground water use between the landfill and the river. The only existing wells in the area of potential leachate influence are the Freeway Landfill truck shed well and U.S. Salt Company well. The water from these wells is used primarily for domestic uses and drinking water.

The limited value of the ground water under the Freeway Landfill has been recognized by the Minnesota Pollution Control Agency. In a February 4, 1980 internal Agency memorandum, the Director of the Water Quality Division indicates that the impact of the Freeway Landfill leachate should be considered as it potentially may influence the quality of the Minnesota River (Schade 1980).

Regulatory Compliance

The quality of ground water in the vicinity of the landfill is monitored on a quarterly basis including four surface stations and five ground water wells. The locations of these wells are shown in Figure III-3. Typical values of monitoring data collected from the ground water stations near the Freeway Landfill are presented in Table III-24.

Ground water quality in nearby areas not affected by the landfill has not been monitored by the landfill monitoring program. Water quality data are available for the dewatering of the nearby quarry; however, this ground water is indicative of ground water in the Shakopee-Oneota Dolomite and is not necessarily indicative of ground water in the overlying alluvium. Water quality data from the quarry dewatering are summarized in Table III-24.

A comparison of the ground water monitoring test results with WPC 14 shows that standards were exceeded for copper in Well 1, for copper and ammonia in Well 2, for ammonia in Well 3, for chloride, ammonia, specific conductance, and copper for Well 4 and for chloride, ammonia and specific conductance for Well 5. Leachate that is produced

GROUND WATER QUALITY¹

WELLS ALONG RIVER

Parameter	WT-1			WT-2			WT-3		
	11/3/77	1/5/78	3/30/78	11/3/77	1/5/78	3/30/78	11/3/77	1/5/78	3/30/78
BOD, 5-day, mg/l	3	<3	7	30	8	13	65	8	4
BOD, 5-day (filtered), mg/l	3	<3	10	30	3	11	12	8	4
Chloride, mg/l as Cl	<1	11	24	74	32	33	3	<1	2
Ammonia, mg/l as N	0.36	0.52	0.8	2.4	1.2	1.2	2.1	0.50	2.6
Specific Conductance, μ mho @ 25°C (lab)	414	408	528	841	806	795	511	598	558
pH (lab)	7.1	7.8	7.8	7.6	7.5	7.4	7.6	7.7	7.8
Phenol, mg/l	0.008	0.005	0.005	0.012	0.005	0.01	0.015	0.01	<0.002
Total Chromium (filtered), μ g/l as Cr	1.5	7.0	1.2	5.5	4.8	3.8	1.2	4.5	1.9
Copper, (filtered), μ g/l as Cu	0.9	15	2.8	20	1.4	1.5	<0.2	4.0	0.9
COD, mg/l	88	16	28	128	80	52	3320	40	116
COD (filtered), mg/l	196 ³	36 ²	28	104	54	52	120	28	44
Polychlorinated Biphenyls, μ g/l	-	<0.2	-	-	<0.1	-	-	<0.1	-

1. Samples collected by Barr Engineering Co. and analyzed by SERCO Laboratories.
2. Near detection limits for parameter, possible influences from filter
3. Appears to be anomalous data

WELLS PLACED THROUGH REFUSE

QUARRY SUMP

Parameter	WT-4			WT-5			QUARRY SUMP		
	11/3/77	1/5/78	3/30/78	11/3/77	1/5/78	3/30/78	11/3/77	1/5/78	3/30/78
BOD, 5-day, mg/l	280	60	90	280	15	100	<3	3	<3
BOD, 5-day (filtered), mg/l	265	7	14	45	7	20	<3	<3	<3
Chloride, mg/l as Cl	974	681	5 ³	626	1300	6 ³	21	-	70
Ammonia, mg/l as N	47	26	29	17	4.1	46	<0.2 ²	<0.08	2.3
Specific Conductance, μ mho @ 25°C (lab)	4840	3050	3250	4790	4630	4980	-	628	-
pH (lab)	7.0	7.3	7.4	7.0	7.1	7.8	7.8	7.7	8.0
Phenol, mg/l	0.081	0.042	0.03	0.047	0.045	0.03	0.002	0.002	0.002
Total Chromium (filtered), μ g/l as Cr	9.2	26	12	4.9	29	9.5	1.6	1.4	3.3
Copper, (filtered), μ g/l as Cu	1.0	18	6.0	<0.2	1.6	3.0	0.4	2.2	0.9
COD, mg/l	1733	2810	2820	11200	1280	1420	28	56	20
COD (filtered), mg/l	933	456	424	520	544	444	20	28	20
Polychlorinated Biphenyls, μ g/l	-	401	-	-	10.4	-	-	-	-

1. Samples collected by Barr Engineering Co. and analyzed by SERCO Laboratories.
2. Limited sample volume
3. Data appears to be anomalous

LANDFILL GROUND WATER QUALITY

Table III- 24

from the Freeway Landfill may percolate through the peat relatively unattenuated, but in some places the existence of clay layers may either cause high attenuation or laterally divert the percolation to the surface, causing leachate springs to occur at the edge of the fill. If leachate enters the bedrock aquifer, it will flow very rapidly through fractures and channels in the dolomite, and discharge into the Minnesota River, where attenuation will occur by dilution.

The location of the site within a floodplain and near a surface of highly permeable bedrock may cause leachate formation by flooding. Although the site has been diked to prevent floodwaters from entering the site, it has been reported that a moderate amount of seepage into the site has occurred through the highly permeable bedrock. Seepage of floodwaters into the solid waste rapidly adds moisture to the base of the landfill and may produce large volumes of leachate. As mentioned in the Site Specific Water Balance section, the estimated leachate production rate is 3.0 inches per year after closure.

As discussed earlier, due to the groundwater flow characteristics the potential extent of landfill leachate on ground water quality is limited to the area between the landfill and the river, between the landfill and the drainage ditch east of the landfill, and immediately south and west of the landfill. The principal impact of the leachate is the effect it has on the quality of the river.

LOCAL WATER SUPPLY QUALITY

State Regulations

As previously discussed, adjacent properties to the Freeway Landfill use individual wells for water supply. The MPCA standards in WPC 14 apply to individual water supply wells. Table III-25 shows WPC 14 standards that apply to domestic consumption. Class A standards apply to drinking water without treatment of any kind while the other classes require various degrees of treatment. Other uses of water from individual supply wells would be covered by the WPC 14 standards shown in Table III-15.

The Minnesota Department of Health (MDOH) has also promulgated standards for drinking water; however, for public water supplies only. There are no MDOH standards for drinking water from individual wells. Table III-26 shows the MDOH maximum contaminant levels for inorganic and organic chemicals contained in public water supplies.

Regulatory Compliance

Figure III-14 shows the approximate location of a number of wells that have been sampled recently that are located in the Burnsville Landfill area. As can be seen, the parameters (Table III-27) tested met most of the applicable standards contained in Table-25 and all of the applicable standards contained in Table III-26. Some of the wells exceeded WPC 14 standards for iron and manganese. The Portland Cement and U. S. Salt company wells exceeded standards for phenols.

WATER QUALITY STANDARDS IN REGULATIONS WPC 14
OF THE MINNESOTA POLLUTION CONTROL AGENCY
WPC CLASSIFICATION - DOMESTIC CONSUMPTION

Substance or Characteristic	Class A Limit or Range	Class B Limit or Range	Class C Limit or Range	Class D Limit or Range
Total coliform organisms:	1 most probable number per 100 milliliters	10 most probable number per 100 milliliters	200 most probable number per 100 milliliters	200 most probable number per 100 milliliters
Turbidity value	5		25	
Color value	15			
Threshold odor number	3			
Methylene blue active substance (MBAS)	0.5 milligram per liter			0.05 milligram per liter
Arsenic (As)	0.01 milligrams per liter			
Chlorides (Cl)	250 milligrams per liter			
Copper (Cu)	1 milligram per liter			
Carbon Chloroform extract	0.2 milligrams per liter			
Cyanides (CN)	0.01 milligrams per liter			0.2 milligrams per liter
Fluorides (F)	1.5 milligrams per liter			1.5 milligrams per liter
Iron (Fe)	0.3 milligrams per liter			
Manganese (Mn)	0.05 milligrams per liter			
Nitrates (NO ₃)	45 milligrams per liter			
Phenol	0.001 milligram per liter			
Sulfates (SO ₄)	250 milligrams per liter			
Total dissolved solids	500 milligrams per liter			
Zinc (Zn)	5 milligrams per liter			
Barium (Ba)	1 milligram per liter			1 milligram per liter
Cadmium (Cd)	0.01 milligram per liter			0.01 milligram per liter
Chromium (Hexavalent, Cr)	0.05 milligram per liter			0.05 milligram per liter
Lead (Pb)	0.05 milligram per liter			0.05 milligram per liter
Selenium (Se)	0.01 milligram per liter			0.01 milligram per liter
Silver (Ag)	0.05 milligram per liter			0.05 milligram per liter
Radioactive material	Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.			Not to exceed the lowest concentrations permitted to be discharged to an uncontrolled environment as prescribed by the appropriate authority having control over their use.

Table III - 25

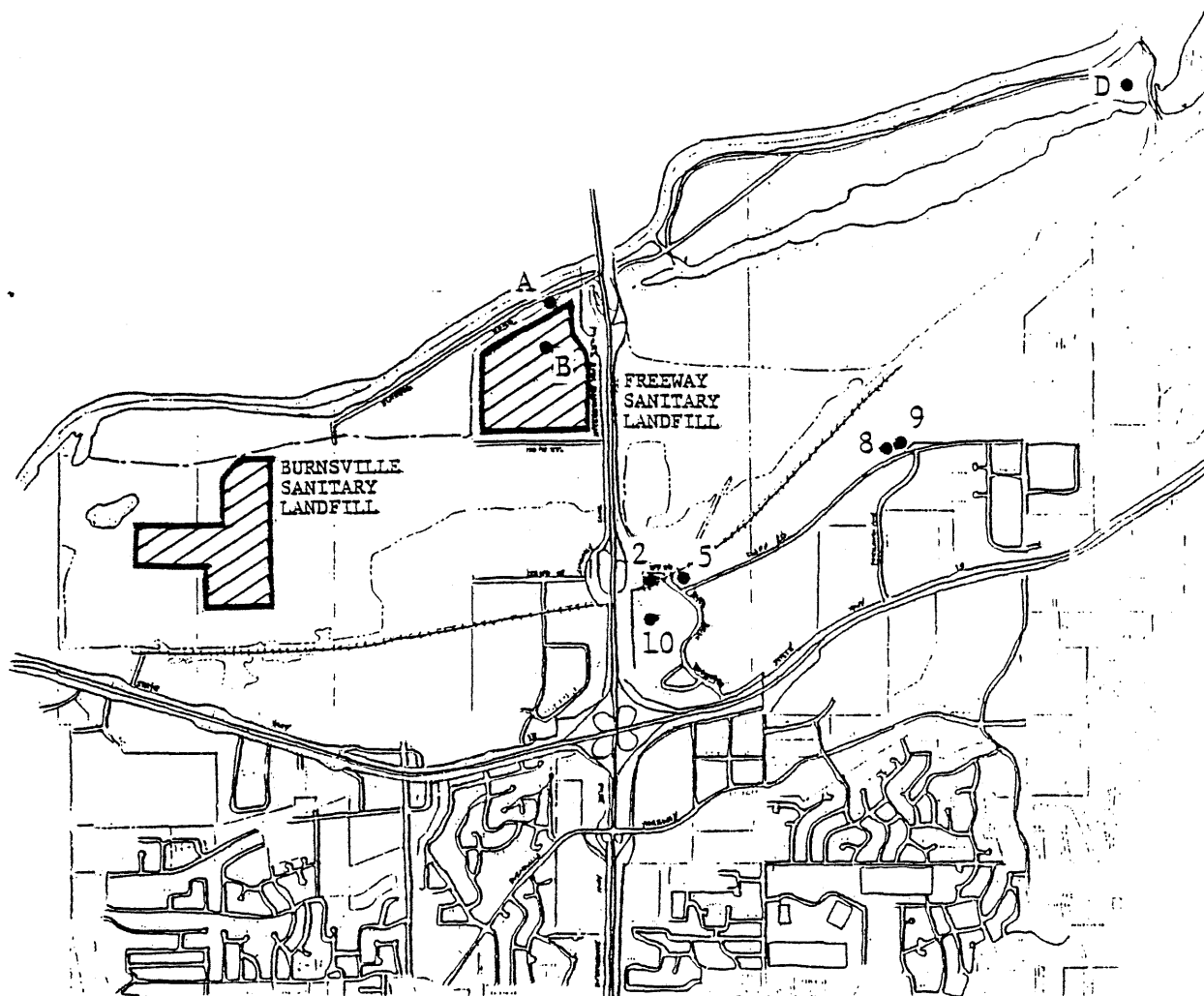
1978 PUBLIC WATER SUPPLY STANDARDS
MINNESOTA DEPARTMENT OF HEALTH

Maximum Contaminant Levels for Inorganic and Organic Chemicals

<u>Inorganic Chemicals</u>	<u>mg/l</u>
Arsenic	0.05
Barium	1.0
Cadmium	1.010
Chromium	0.05
Fluoride	2.4
Lead	0.05
Mercury	0.002
Nitrate	10
Selenium	0.01
Silver	0.05
<u>Organic Chemicals</u>	
Endrin	0.0002
Lindane	0.004
Methoxychlor	0.1
Toxaphene	0.005
Chlorophenoxys	0.1
Silvex	0.01

Table III - 26

LOCATION OF MUNICIPAL WATER SUPPLY WELLS
TESTED BY MDoH



- A U.S. Salt Well
- B Freeway Landfill Truck Shed Well
- C Minnesota Masonic Home Well
- D NSP Black Dog Plant Well
- 2 Burnsville Municipal Well
- 5 Burnsville Municipal Well
- 8 Burnsville Municipal Well
- 9 Burnsville Municipal Well
- 10 Burnsville Municipal Well

Figure III-14

Analytical Data - Various Water Supply Wells, Burnsville Area 1979

Private Wells in Burnsville & Bloomington	NSP Blackdog Plant. Wellwater before Demineral- ization	US Portland Cement, Well. S.T.	Freeway Landfill Truck Shed S.T.	US Salt Well	Minnesota Masonic Home	Well #10 Municipal Well	Well #9 Municipal Well	Well # 2,5,8,11 Municipal Wells
Sample Number	27667	3943	28084	28083	3105	8096	8097	8098, 8099 8100, 8101
Date	6/11/79	8/2/79	7/3/79	7/3/79	9/20/77	12/6/79	12/6/79	12/6/79
Coliform Group MPN/100 ml Organisms	<2.2	<2.2	<2.2	<2.2	0	0	0	0
Total Solids mg/l	240	320	300	290		300	290	
Total Hardness mg/l. as CaCO ₃	290	290	279	264		270	260	
Alkalinity as CaCO ₃	290	300	270	270		280	270	
pH	7.7	7.7	7.7	7.7		7.5	7.4	
Iron mg/l.	.09	1.1	.08	.65		.25	.38	
Manganese mg/l.	.08	.06	.48	.03		.06	.04	
Chloride mg/l	.68	1.4	.08	1.1		.19	.08	
Sulfate mg/l	15	7.3	11	12		19	21	
Fluoride		.10	.22	.22	.19	.27	.25	
Calcium mg/l. as CaCO ₃	170	190	180	170		170	170	
Sodium mg/l	2.7	4.	4.1	4.0		3.1	3.8	
Potassium mg/l	1.6	2	2.1	2.0		2.5	4.0	
Specific @ 25 Conductance (umho/cm)	490	540	500	480		500	500	
Phenols µg/l	<2.0	3.0	<2.0	2.6				
Total Kjeldahl mg/l Nitrogen	<.4	<.4	<.4	<.4	<.5	<.4	<.4	
Manganese as CaCO ₃ mg/l	130	100	99	94				
Arsenic µg/l.	<50	<50			<50			
Barium µg/l	<1000	<1000			<1000			
Chromium µg/l	<50	<50			<50			
Cadmium µg/l	<10	<10			<10			
Lead µg/l	<30	<.1			<50			
Mercury µg/l	.20	<.1			<.1			
Selenium µg/l	<10	<10			<10			
Silver µg/l	<50	<50			<50			
Ammonia mg/l		.34						
Total Organic Carbon mg/l	.14	1.6	<1.0	2.9				

Table III - 27

None of the parameters measured, including those exceeding standards, would indicate the presence of leachate in the ground water system. Practically all of the parameters measured were considerably below or below typical low value ranges for leachate. Notwithstanding, these wells should be periodically tested in the future.

WQFY01

TERRESTRIAL AND AQUATIC ECOLOGY

VEGETATION

The Freeway Sanitary Landfill is located in the Lower Minnesota River Valley. The River Valley is classified as a northern floodplain forest plant community. Located in a prairie-forest transition zone, the valley is influenced by the maple basswood forest and the oak savannah community.

The undeveloped area to the west of the landfill is open meadowland with some wetland marshy areas. To the south is a dolomite quarry owned by Edward Kraemer and Sons Inc. surrounded by meadowland areas and occasional large stands of mixed trees. Highway 35-W lies along the eastern boundary of the landfill shielded to some extent by a strip of aspen, cottonwood and willow mostly over 20 feet in height. A small creek runs along this boundary draining into the Minnesota River. The Minnesota river lies 400 feet directly north of the landfill. The area between the landfill and the river is characterized by dense cottonwood, aspen, and willow stands.

Vegetation surveys by Metropolitan Council Staff of the landfill and adjacent land were conducted on February 24, and May 1, 1980. The objective of these surveys was to identify the major plant communities as characterized by dominant or conspicuous species found on and adjacent to the landfill in order to determine vegetation and habitat impacts.

Figure III-15 shows the location of various vegetative cover types identified in the landfill area. Four general cover types are present on the landfill: sparse stands of mixed trees, intermediate shrubs, grassland and barren graded soil. Wetlands are located in various areas immediately surrounding the landfill.

Sparse-Mixed Trees

Infrequent stands of mixed trees are found on the Freeway Landfill, dominated by quaking aspen (Populus tremuloides), cottonwood (Populus deltoides) and willow (Salix sp.). The majority of these trees are on the eastern landfill border adjacent to the creek.

Intermediate Shrubs and Forbs

Intermediate shrubs and forbs are scattered throughout the landfill. Dominant species are indicative of disturbed areas such as young poplar (Populus sp.), mullein (Verbascum so.), prickly ash (Zanthoxylum americanum), and dogwood (Cornus sp.). Forbs sighted on the landfill include: sunflower (Helianthus giganteus), goldenrod (Solidago sp.), Canada Thistle (Cirsium arvense) and evening primrose (Oenothera biennis).

VEGETATIVE COVER TYPES ON FREEWAY SANITARY LANDFILL

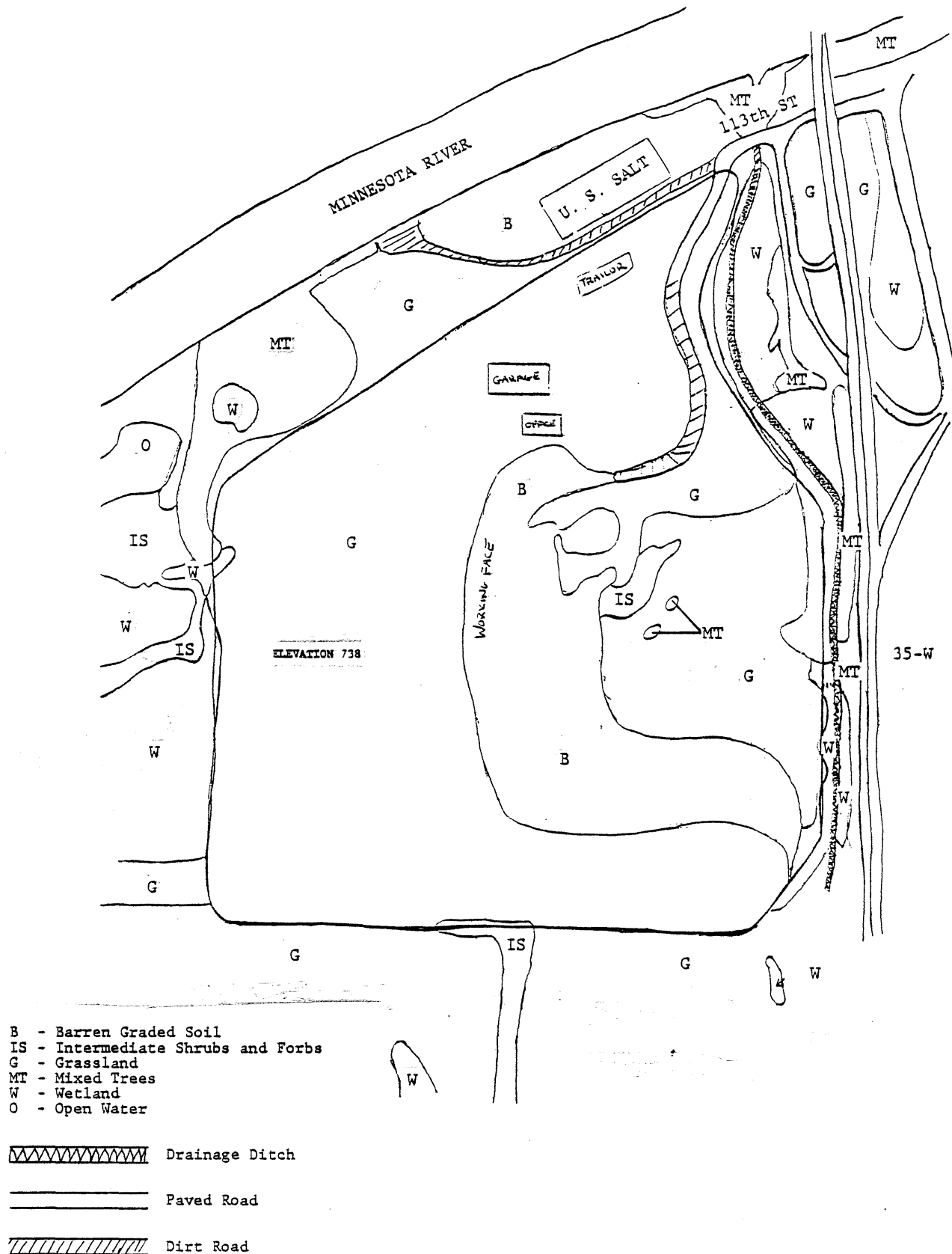


Figure III-15

Grassland

Grassland areas which exist on the landfill as vegetative cover are a variety of grasses and herbaceous species such as brome grass (Bromus sp.), field clover (Petalosternum sp.), dock (Rumex sp.), canary reed grass (Phaluns arundinacae), cocklebur (Xanthium chinense), burdock (Artium minus), gumweed (Grindelia squarrosa), shepard's purse (Capsella bursa-pastoris), mint (Labiatae sp.) and moss.

Most of the filled areas of the landfill have not been seeded but have regenerated naturally with pioneer species of grasses and short dry forbs such as those listed above. The areas that have been seeded are very similar in species type and quantity to the unseeded areas.

Barren-Graded Soil

The remainder of the landfill area has no vegetation cover due to excavation operations where the soil is scraped for daily cover material, and due to the landfiling procedures at the working area of the landfill.

Wetland

Wetland areas exist on the eastern and western borders of the landfill. These areas are characterized by typical regional wetland species. Shrub-carr, wet meadow, and emergent aquatic vegetation are found in this type of area, including such species as dogwood (Cornus sp.), willow (Salix sp.), cattail (Typha latifolia), reed grass (Phragmites sp.), and sedge (Carex sp.). The landfill owner states that there are no spots on the presently permitted landfill that have standing water year round.

WILDLIFE

Wildlife species which are likely to be found within the Freeway Sanitary Landfill area would include those species commonly associated with the previously described plant communities. Figure III-15 shows the location of the general plant communities on and near the landfill. The following species of mammals, birds, amphibians and reptiles were actually sited on the landfill: rabbit (Sylvilagus floridanus), squirrel (Sciurus carolinensis), deer (Odocoileus virginianus), racoon (Procyon lotor), red tail hawk (Buteo lineatus), rough-legged hawk (Buteo lagopus), common crow (Corus brachyrhynchos), killdeer (Charadus vociferous), pheasant (Phasianus colchicus) and snapping turtle (Chelydra serpentina). This survey was not an extensive one and is intended to indicate the type of animals that populate the landfill area. For an exhaustive list of animal species found in the Lower Minnesota River Basis, see Warner, 1979, Wildlife Inventory of the Lower Minnesota River Valley. While not specifically identified, insects at the Freeway Sanitary Landfill are a primary unit in the site's ecosystem as a basic link in the food web.

AQUATIC ECOLOGY

Minnesota River

The major emphasis aquatic ecology systems and impact analysis was on the Minnesota River. All available information collected to data on the various biological communities within the river was reviewed to provide a description of the current status of population diversity, composition and abundance. Summaries of the results of this literature review describing plankton, phyton, benthos and fisheries populations within the lower Minnesota River are available from the Council.

The effects of leachate pollution from the presently permitted landfill on the aquatic ecology of the Minnesota River will probably be minimal because of diluted concentrations. Most fish and other mobile organisms are able to avoid or escape elevated levels of pollution from point source discharges. The aquatic communities that have the greatest potential for adverse impact are the phyton and benthic organisms. Any rooted plants or sensitive benthos in the area of leachate discharge may be susceptible to damage. However no aquatic plant or animal life of these types were identified in the area of the landfill. Most sensitive organisms have already been eliminated or reduced in this stretch of the river due to high turbidity, nutrient enrichment, fluctuating water levels, scouring action of moving bottom materials and depressed dissolved oxygen concentrations. Additional stress on aquatic populations due to leachate from the existing landfill will be relatively minor in comparison.

Other Surface Waters

The only other surface water bodies potentially impacted by the landfill are the easterly drainage ditch (formerly Thornton Creek) and the small adjacent wetlands. Although once a small trout stream in the late 1950's and early 1960's, this "creek" is presently dry and most likely contains no fish life when flowing. Its present use as a drainage ditch receiving runoff from the City of Burnsville, Interstate 35W, and the landfill, affects its water quality and limits its resource value. The easterly drainage ditch receives direct leachate seepage from the older portion of Freeway landfill and currently exceeds several water quality standards. MPCA has recommended that the drainage ditch be reclassified to proposed class 7: limited resource value waters (see Water Quality discussion).

WETLAND

Wetlands, in general, play a vital role in the retention and release of water. During periods of flooding, wetlands act as storage basins by impounding water in open ponds and storing water in their organic soils. Wetlands have many valuable ecological functions, including wildlife inhabitation, water storage and water recharge potential, and pollutant filtration capability.

There are no wetlands located on the working areas of the landfill. There are wetland areas that border the landfill on the east and on the west. These areas are classified as Type 2 inland fresh meadow by the USDA Soil Conservation Service. The soil in these wetlands is usually without standing water during most of the growing season but is probably waterlogged within at least a few inches of its surface. Representative plants of inland fresh meadow include corex, rushes, redtop, reedgrasses, mannagrasses, prairie cordgrass, and mints.

RARE AND ENDANGERED SPECIES

Minnesota has enacted a law for the protection of threatened and endangered species (M.S.A. 97.488); and state listings of regulated species are presently being compiled. According to DNR records, there are no rare or endangered species in the landfill area, with the exception of some bald eagle sitings in the Minnesota River Basin area

There are no endangered species of fish in the lower Minnesota River. The Higgin's eye mussel is recognized as an endangered species by the federal government and did occur in the lower Minnesota River in the late 1940's. The Minnesota River from Shakopee to the mouth is presently devoid of mussel life according to the U. S. Fish and Wildlife Service. The recent Minnesota River has been attributed to organic loadings and the use of biacides. The Minnesota River discharges into the Mississippi River and consequently adversely affects the Higgin's eye located downstream in the Mississippi River.

SO001J

SOCIO-ECONOMICS

LAND USE, ZONING

Land Use

The Freeway Sanitary Landfill is located in the City of Burnsville. The landfill is located approximately 1.5 miles east of the City of Savage. Directly north, approximately 400 feet, is the Minnesota River.

Figure III-16 shows the land use surrounding the landfill area. Directly north of the landfill is United States Salt, a commercial business which sells salt. Further north, across the Minnesota River, is the Minnesota Valley National Wildlife Refuge and Recreation area. Located within the Minnesota Valley National Wildlife Refuge and Recreation Area, across from the landfill is Bloomington's Diseased Tree Utilization and Disposal Facility. The operation processes diseased elm trees into chips and lumber. They also burn non-usable material.

The eastern edge of the landfill is bounded by Interstate 35W. Further east is undeveloped, open land.

Directly south and southwest of the landfill is a dolomite quarry operated by Edward Kraemer and Sons, a mining and processing firm. Further south are several commercial and retail establishments including the following: Commercial Asphalt, Black Dog Volkswagen, Knox Lumber, and Levitz Furniture. Further southwest is the Burnsville Sanitary Landfill and along Highway 13, east of County Road 5, are a variety of commercial enterprises. Southeast of the landfill are All State U Lock Storage and South Side Dodge.

Directly west is open, undeveloped land.

Zoning

Figure III-17 shows zoning for the areas adjacent to and in the general area of the landfill. As can be seen, land immediately surrounding the landfill is zoned for general industrial use. Other zoning in the landfill area includes areas designated for such uses as limited industrial, general business, residential, commercial recreation, and institutional.

Regional Development Framework Plan

The Metropolitan Council has adopted a Development Framework plan to guide present and future decision making in the seven county region. This plan designates general areas for future urban and rural services and provides standards for making decisions with respect to these services. The Pine Bend Sanitary Landfill Environmental Impact Statement describes the various urban and rural use classifications contained in the plan.

GENERALIZED LAND USE BURNSVILLE AREA

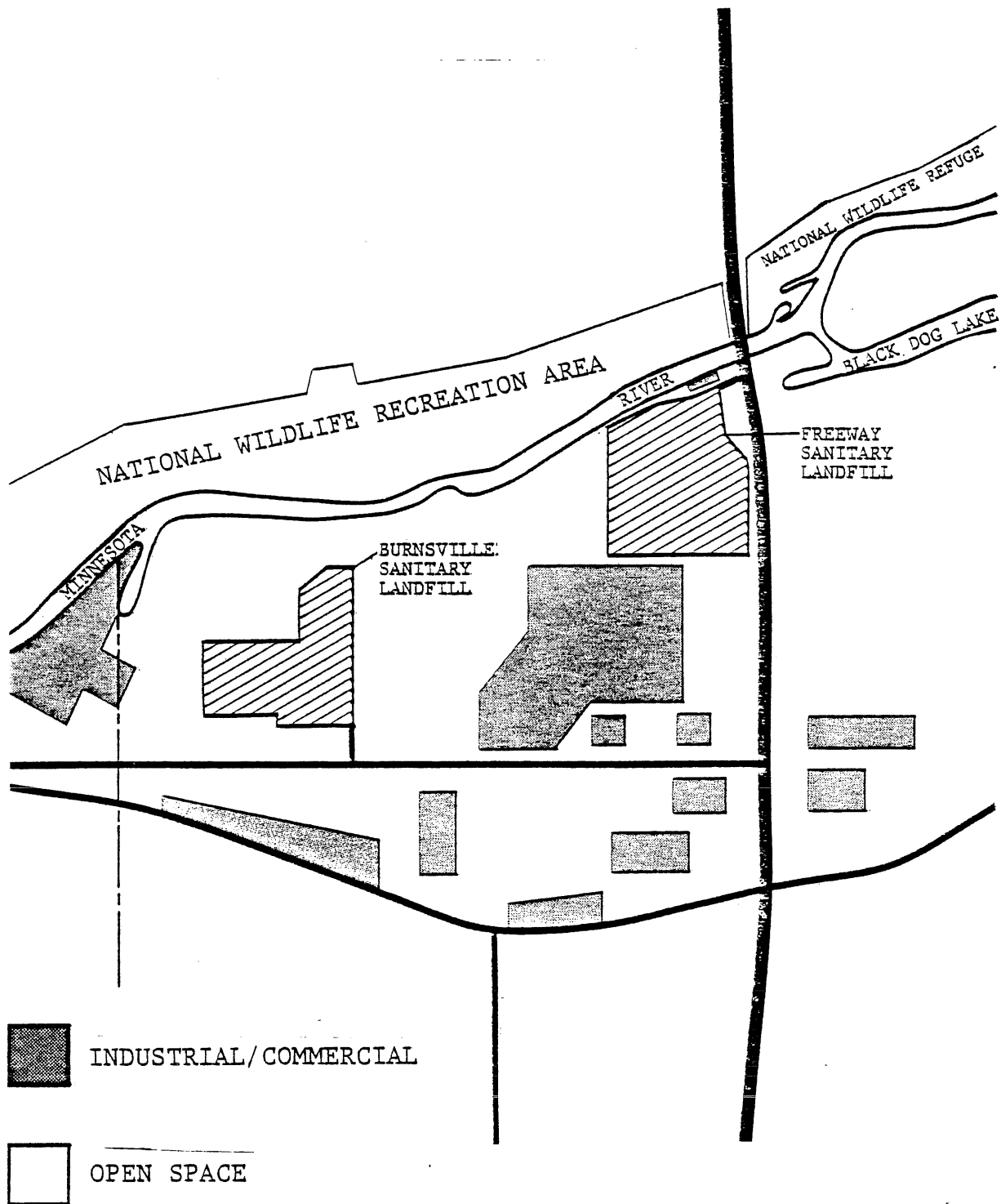
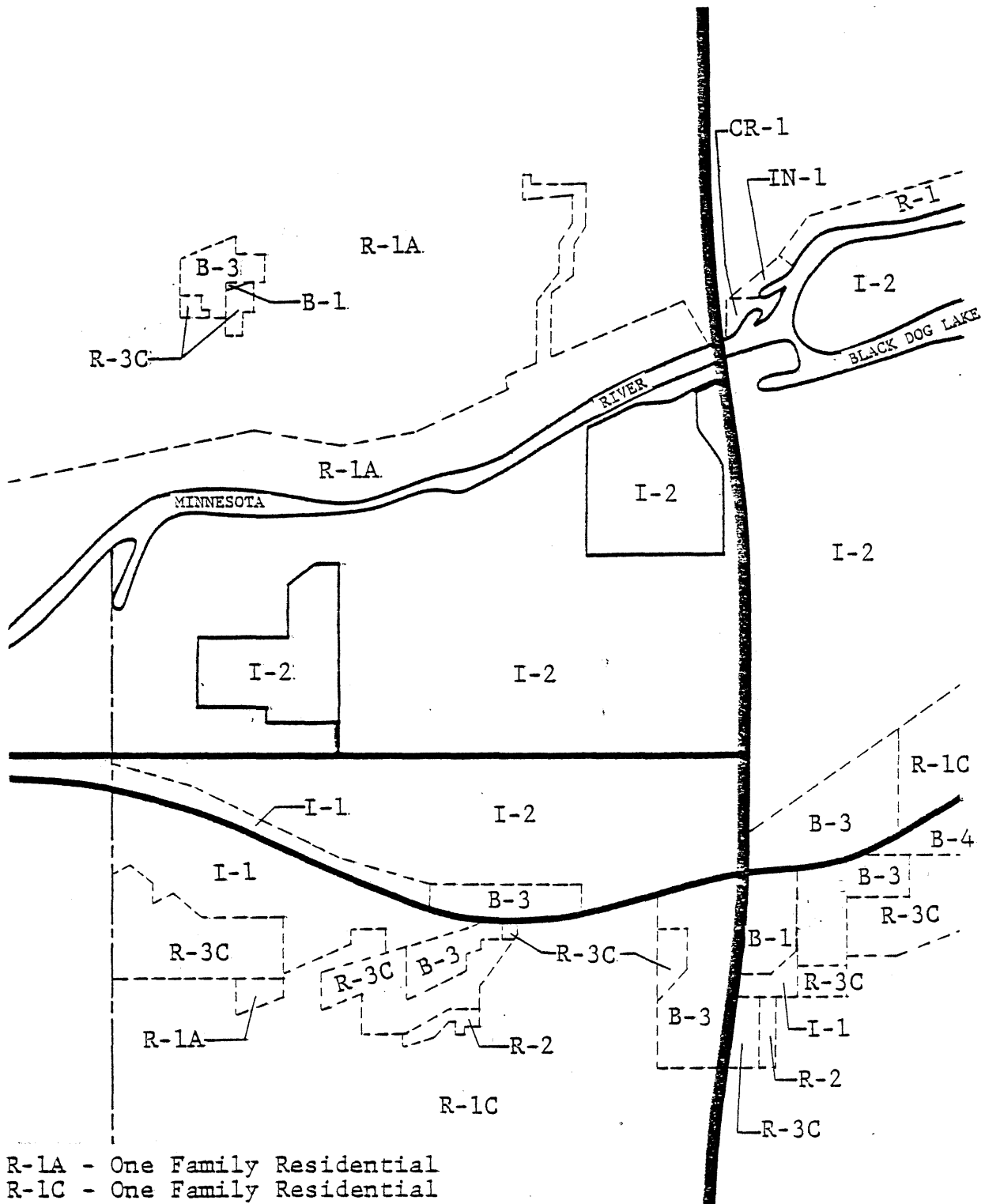


Figure III-16

ZONING MAP

BURNSVILLE — BLOOMINGTON



- R-1A - One Family Residential
- R-1C - One Family Residential
- R-2 - Two Family Residential
- R-3C - Multiple Residential
- B-1 - Limited Business
- B-3 - General Business
- B-4 - Shopping Business
- I-1 - Limited Industrial
- I-2 - General Industrial
- CR-1 - Commercial Recreation
- IN-1 - Institutional

Figure III-17

The Burnsville area, including the Freeway Sanitary Landfill, is located within the Metropolitan Urban Service Area. This area is provided with metropolitan services including highways, transit, and interceptor sewers. Burnsville is considered a developing suburban community according to the Council's Development Framework.

PUBLIC FACILITIES AND SERVICES

Fire Services

There are two fire stations in Burnsville which could respond in the event of a fire at the landfill. One is located north of County Road 42, just east of Burnhaven Drive. The other is located on Cliff Road, just east of the intersection with Portland Avenue.

There are also six fire stations in Bloomington which could respond to a fire at the landfill.

Storm Sewer Services

The City of Burnsville adopted an overall drainage plan in the early stages of the community's development. By planning ahead, the direction of drainage was established throughout the entire City which determined the direction in which all streets and storm sewers should direct storm water. The system has been in place for several years and is performing satisfactorily.

The Freeway Sanitary Landfill area, however, is not serviced by a storm sewer system. The natural drainage pattern within the City has been disturbed to some extent by man's improvements. Generally, the City's natural drainage pattern can be approximately equated to the present drainage pattern.

Park and Recreation Open Space Facilities

Currently, there are 26 developed park facilities in Burnsville. The closest city parkland to the landfill consists of approximately 1330 acres of the Minnesota River Valley Floor east of I-35W and west of NSP's Black Dog Power Plant (see shaded portion of Figure III-18). The U. S. Department of Fisheries and Wildlife is currently in the process of acquiring fee title and easements for this area which will become a portion of the Minnesota Valley National Wildlife Refuge and Recreation Area.

In 1976, a law was passed which established the Minnesota Valley National Wildlife Refuge and the National Recreation Area. This enabling legislation allowed the U. S. Fish and Wildlife Service, the State of Minnesota, counties and municipalities to protect and preserve approximately 17500 acres of the Minnesota River floodplain from Fort Snelling State Park to Jordan, Minnesota. It will be a nature oriented outdoor recreational facility providing valuable habitat for both migratory birds and residential wildlife.

Bloomington has four city parks located along the Minnesota River: Welters Wildwood, Anderson Park, Hopkins Park, and Mounds Springs

EXISTING PARKLAND NEAR FREEWAY SANITARY LANDFILL

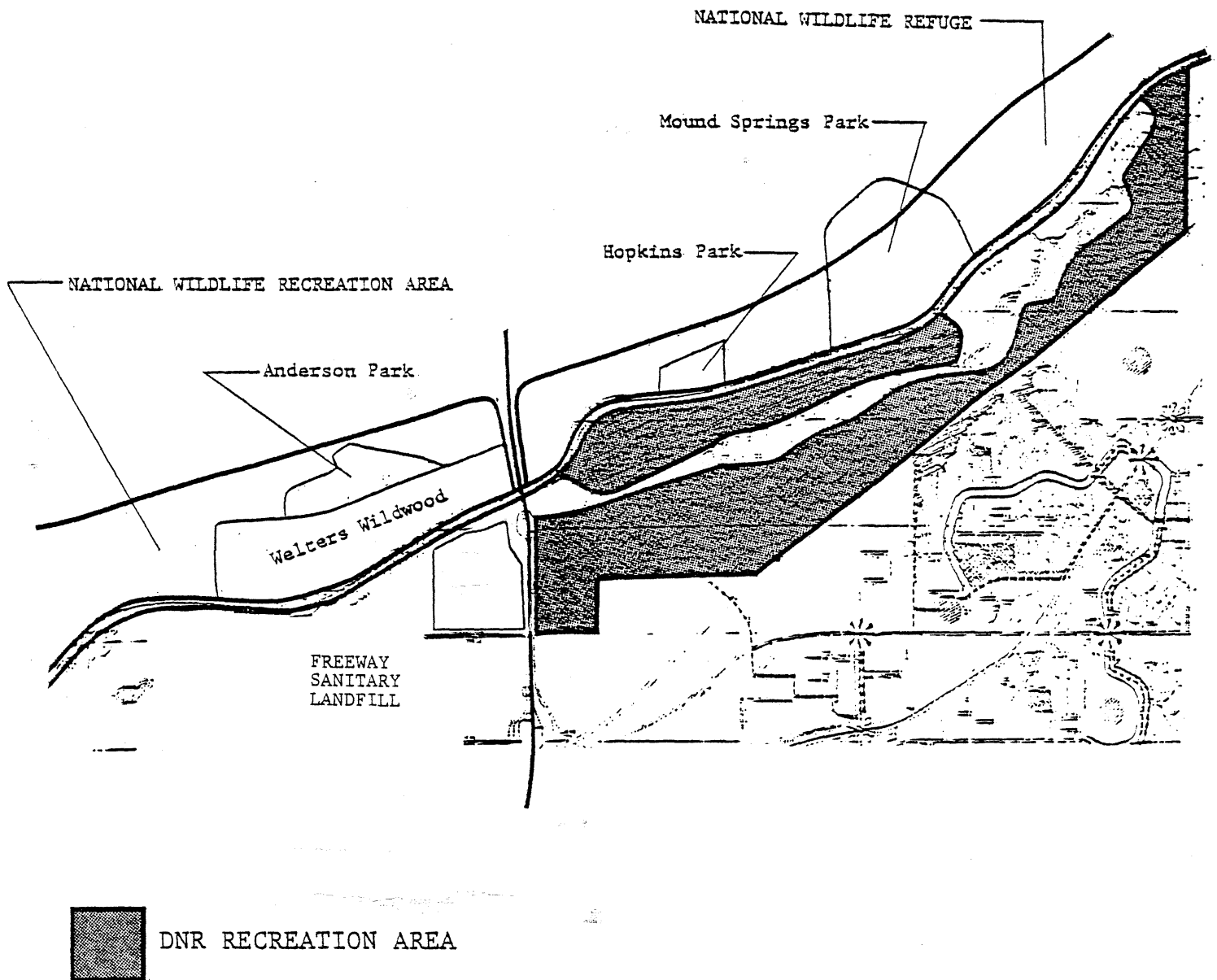


Figure III -18

Park. Welters Wildwood and Anderson Park are city-owned parks located within the National Wildlife Recreation Area across from the Burnsville and Freeway Sanitary Landfills. Hopkins and Mound Springs Parks are presently owned by Bloomington and are located within the National Wildlife Refuge.

Easements or title to all land within the Bloomington portion of the Minnesota River Floodplain are expected to be acquired for the wildlife refuge and recreation area. Mound Springs Park is the only developed park. Developed recreation facilities include 2.7 miles of pedestrian paths, limited parking area, 17 permanent picnic tables and eight picnic grills. The park is also one of the three day camp sites in the City's recreation program. Within Welters Wildwood is a hiking and cross-country skiing trail, unofficially referred to as Nine-Mile Creek Trail. Welters Wildwood, Anderson Park, and Hopkins Park are undeveloped, natural areas.

The Minnesota Department of Natural Resources has plans to develop a continuous recreational trail system, the Minnesota Valley State Trail, between Fort Snelling State Park and LeSueur, Minnesota. The trail system, approved by the 1969 Minnesota Legislature, consists of a series of state parks and waysides joined by municipal, private and industrial lands. Camping and access areas along the route will accommodate canoeists and other boaters on the rivers. The State is pursuing the possibility of developing the Minnesota Valley State Trail on both sides of the Minnesota River. The south trail is likely to be open to hikers, horsemen, skiers, and snowmobilers. The trail on the north side of the river will probably be restricted to hikers, skiers, and bicyclists. Currently only minor links in the trail system have been completed and no state trails are in the vicinity of the landfill.

COMMERCIAL AND RECREATIONAL USE OF THE MINNESOTA RIVER

The lower Minnesota River is one of the major waterways in the Upper Midwest. The river is used for navigation, recreation, industrial water supply, and assimilation of storm water and industrial and municipal wastewater effluents. The major transportation use of the river is commercial barge traffic. The average shipping season on the Minnesota River is approximately 239 days from mid-March through mid-November. During the 1976 shipping season there were 874 vessel round trips. The approximate barge traffic is 2500 barges. The peak of the shipping season occurs in June. This peak month accounts for 15 percent of the barge activity on the lower Minnesota River. The Corp of Engineers projects that commercial barge traffic will double by the year 2000 to 6,600,000 tons. Water taken from the river is used for sewage treatment or cooling for industrial purposes. Four waste treatment facilities and eight industrial facilities located between Shakopee and Fort Snelling return water to the Minnesota River.

Recreational uses of the Minnesota River include boating, canoeing and fishing. The following rough fish comprise approximately 93 percent of all the fish caught in the vicinity of the landfill: Carp, Gizzard Shad and River Carpsucker. Game fish account for the remaining seven percent which are comprised of Smallmouth Bass,

Walleye, and Sauger. The majority of the future recreational use of the Minnesota River in the landfill's vicinity will probably occur east of I-35W adjacent to the National Wildlife Refuge Area.

Two main uses of the Minnesota River are commercial and recreation. Recreation is the least important of the two uses. Barges are occasionally moored along the south side of the Minnesota River by the Freeway Sanitary Landfill. The state is pursuing the possibility of using land adjacent to the river and landfill for recreation purposes.

TRANSPORTATION

General

The Freeway Sanitary Landfill watershed covers approximately nine hundred square miles and includes portions of Dakota, Hennepin, Ramsey and Scott Counties. Twenty-eight municipalities, two townships and the Fort Snelling area deposit refuse to varying degrees, at the Freeway Sanitary Landfill. As shown in Figure III-19, this landfill's watershed extends from Minneapolis' north boundary southward to Lakeville in Dakota County and from St. Paul's east boundary westward to Hopkins in Hennepin County. Approximately sixty percent of the refuse annually deposited at the landfill is generated within the Central Cities with Minneapolis contributing forty-five percent and St. Paul fifteen percent. An additional twenty percent of deposited refuse is generated in its first-tier suburbs located west and south of Minneapolis including the Fort Snelling area. The remaining twenty percent originates from western Dakota County and eastern Scott County municipalities and townships.

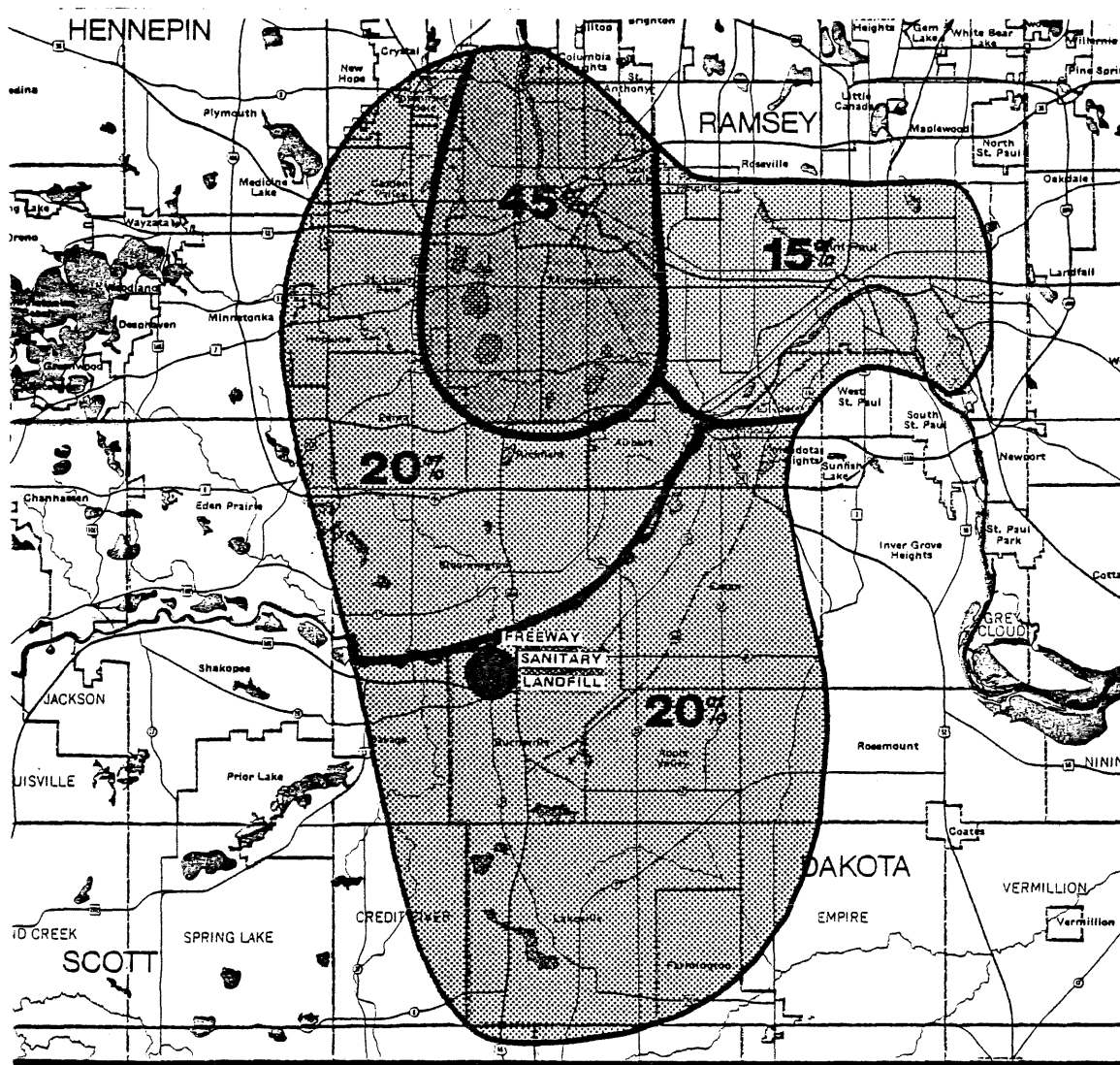
Principal Haul Routes

The total refuse deposited at the Freeway Sanitary Landfill is estimated to be 170,000 tons per year. The principal haul routes to Freeway Sanitary Landfill exhibit a north-south orientation. Figure III-20 shows these locations and estimated relative importance of these haul routes. From the north the principal haul route extends from downtown Minneapolis southward on Interstate 35W to the landfill located adjacent to this freeway and immediately south of the Minnesota River. This route carries up to eighty percent of the refuse annually deposited at the Freeway Sanitary Landfill. From the south the principal haul route extends from Lakeville northward on Interstate 35W to the landfill. This route carries up to twenty percent of the refuse annually deposited at the landfill.

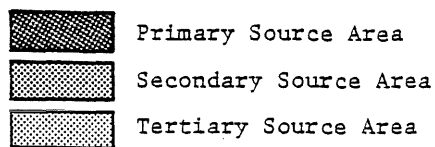
Important Secondary Haul Routes

In addition to the principal haul routes six important secondary haul routes have been identified (see Figure III-20). The most important of these six routes is Interstate 94 between downtown St. Paul and downtown Minneapolis which carries approximately fifteen percent of this landfill's annually deposited refuse. The other routes are Inter-state 494 east and west of Interstate 35W, the Crosstown Freeway (TH 62) also east and west of Interstate 35W, and the TH 100 from TH 55 in Golden Valley to Crosstown Freeway in Edina. These five routes carry a total of approximately twenty-one percent of the

FREEWAY SANITARY LANDFILL WASTESHED, 1980



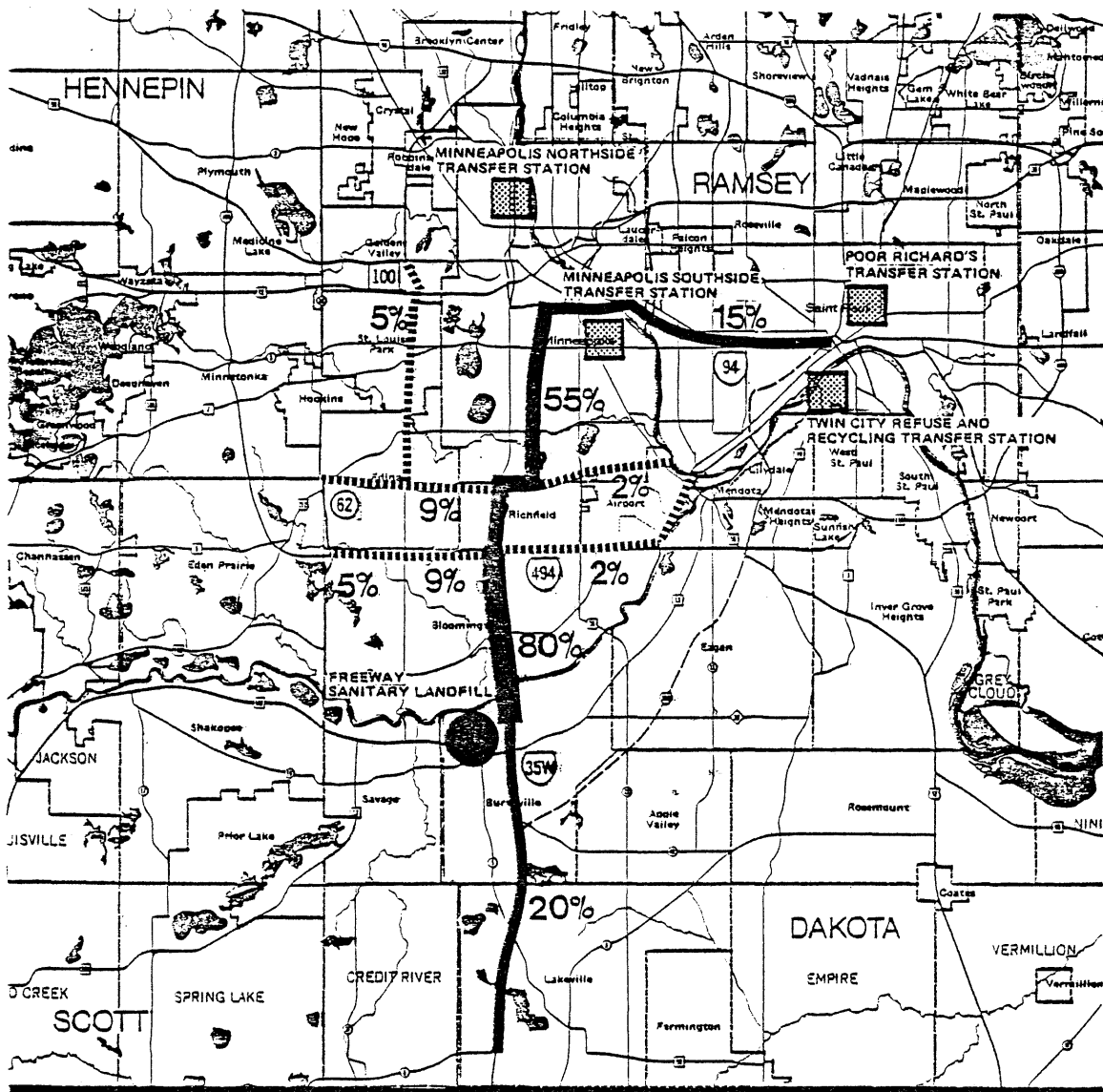
% - Estimated Relative Contribution of Designated Wasteshed to Total Refuse Deposited at Freeway Sanitary Landfill (170,000 tons/year)



Source: Richard B. McGowan Co./Metropolitan Council

Figure III -19

PRINCIPAL AND IMPORTANT SECONDARY HAUL ROUTES TO FREEWAY SANITARY LANDFILL



Principal Haul Route
 Important Secondary Haul Route
 (Haul Routes Show Percentage of Annual Total Refuse
 Deposited at Freeway Sanitary Landfill)
 % - Estimated Percentage of Annual Total Refuse
 Deposited at Freeway Sanitary Landfill by
 Principal and Important Secondary Haul Routes

Source: Richard B. McGowan Co./Metropolitan Council

Figure III - 20'

total annual deposited refuse at the Freeway Landfill. The existing functional classification of both principal and important secondary haul routes is shown in Figure III-21.

Existing Traffic Volumes in the Vicinity of Freeway Sanitary Landfill

Approximately 71,500 average daily vehicle trips (ADT) occur on Interstate 35W at the 113th Street interchange of which 4500 of these vehicles are trucks. 113th Street, a two lane bituminous surface is the only access to the Freeway Sanitary Landfill. Figure III-22 shows the average daily vehicle and truck trips on I-35W in the vicinity of the landfill. The present 150 average daily truck trips generated by the Freeway landfill represent less than one percent of ADT and approximately three percent of total truck trips on Interstate 35W at the 113th street interchange.

Types of Trucks Hauling to Freeway Sanitary Landfill

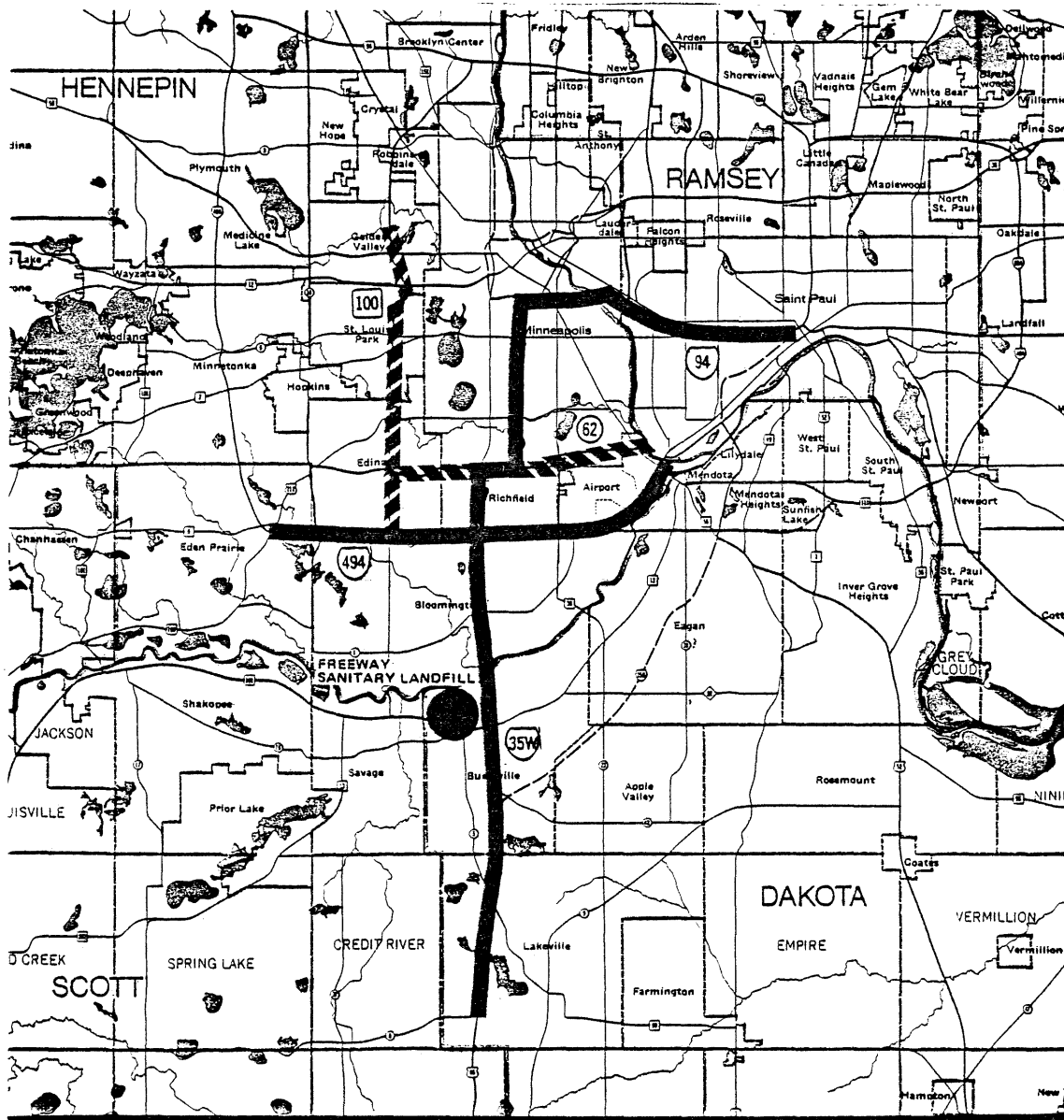
Four types of trucks are used to haul refuse to the Freeway Sanitary Landfill. Their identification and capacities are given in Table III-28. Packer and dump trucks account for approximately seventy percent of total daily truck trips. The remaining thirty percent of daily truck trips are made by Roll-Offs and Tandems.

Table III- 28 TYPES AND CAPACITIES OF HAUL TRUCKS
TO FREEWAY SANITARY LANDFILL

<u>Type</u>	<u>Capacity</u> <u>(in cubic yards)</u>	<u>Percent of Average</u> <u>Total Daily Truck Trips</u>
Open-Top Semi	100	--
Roll-Off	10-40	10%
Tandem	25-35	20%
Front-End Loader	25-35	--
Packer	17-18	40%
Dump	5-15	30%

Source: Richard B. McGowan Company

FUNCTIONAL CLASSIFICATION OF
PRINCIPAL AND IMPORTANT SECONDARY
HAUL ROUTES TO FREEWAY SANITARY LANDFILL

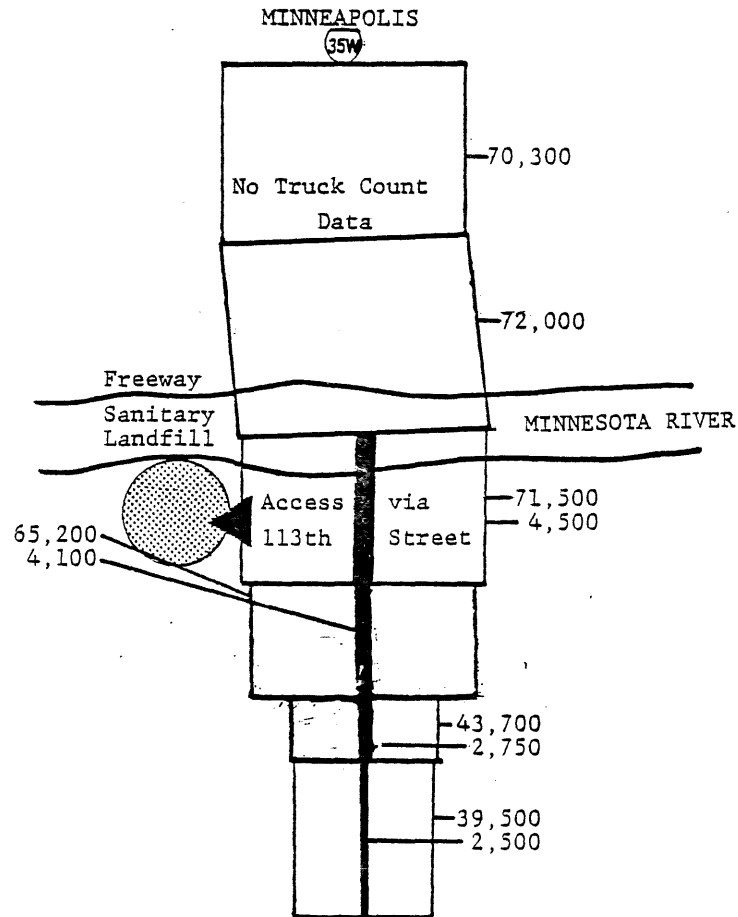


Source: Metropolitan Council

- Principal Arterial
- Intermediate Arterial

Figure III - 21

AVERAGE DAILY TOTAL VEHICLE
AND TRUCK TRIPS IN VICINITY
OF FREEWAY SANITARY LANDFILL,
1978



Source: MnDOT

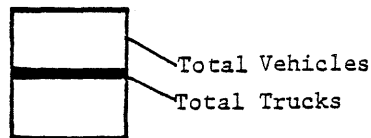


Figure III - 22

Identified Issues Relating to Refuse Hauling to Freeway Sanitary Landfill

A telephone survey of municipalities located on principal haul routes to Freeway Sanitary Landfill was conducted to identify issues relating to the hauling of refuse through their communities. The two major issues that have been identified are:

1. Traffic operational deficiency at the I-35W/113th Street interchange
2. Litter about the I-35W/113th Street interchange

Table III-29 summarizes the findings of this telephone survey.

Transportation-related emissions and noise from vehicles using and operating within the landfill are not considered to be significant problems due to the relatively few vehicles involved, the extended spacing of trips (approximately 15 "in/out" trips per hour. Minor adverse air quality and noise impacts are possible on wildlife habitat on and adjoining the Minnesota River in the vicinity of the landfill. These adverse air and noise impacts are discussed in detail under the respective chapter headings.

Regional access to the Freeway Sanitary Landfill could be periodically interrupted due to 100-year floods on the Minnesota River. However, the chance of a 100-year flood occurring on the stretch of the Minnesota River during the five-year extension of the use of the landfill is minor.

COLLECTION AND MANAGEMENT SYSTEM COSTS

See the Pine Bend Sanitary Landfill Environmental Impact Statement for a discussion on Metropolitan Area solid waste collection and management system costs.

HISTORIC/ARCHAEOLOGICAL

Upon reviewing the Freeway Sanitary Landfill location, the Minnesota Historical Society concluded the site contains no historic, architectural, cultural or archaeological significance. There are no sites in the area which are on the National Register or eligible for inclusion on the National Register. However, in 1836 a Sioux Indian village, named Penichon's Village was located on the present site of the Freeway Sanitary Landfill.

Table III- 29 IDENTIFIED ISSUES RELATING TO REFUSE HAULING
TO FREEWAY SANITARY LANDFILL

<u>Municipality</u>	<u>Issue</u>	<u>Interviewee</u>
Minneapolis	None	Roger Stolsom Department of Public Work
Bloomington	None	Russell Langseth Director of Public Works
Richfield	None	Thomas Morgan Public Safety Director
Burnsville	Traffic operational deficiency at I-35W/113th Street Interchange (short, steep-gradient access weaving lane)	Charles Siggerud City Engineer
	Litter about I-35W/113th Street Interchange (Probable cause: Sharply curved egress ramp)	
Lakeville	None	James Robinette Director of Public Works

AESTHETICS

General

Aesthetic concerns are generally more related to the collection of solid waste rather than its disposal, simply because solid waste disposal sites are usually located in out of the way, remote locations. However, where disposal sites are located near communities, residential areas, or heavily traveled roads, visual appearance will often affect human emotional reactions more so than perhaps other impacts that might be associated with a particular site. Other miscellaneous environmental effects associated with the aesthetics of a site include fugitive dust, litter, noise and odors.

Visual

Metropolitan Council staff visited several homes overlooking the Minnesota River Valley in Bloomington. The purpose was to determine whether the landfill was visible and if any adverse environmental effects were noticeable from the landfill. Residents did state that on hot, windy days an odor could be detected emanating from one or both of the landfills (see Air Quality, Section III). Some residents have a partial view of the landfill, however, the majority do not. Most residents did not find the landfill objectionable from a visual point of view.

Council staff also walked along the north side of the Minnesota River to determine the visual impacts of the landfill from this area. No view of the landfill was possible due to extensive vegetative growth along the south bank of the river. A limited view of the landfill is possible while driving along Highway 13 north of the landfill area.

The existing landfill operation is readily seen while driving along I-35W. Vegetative growth along the eastern portion of the landfill partially obstructs the view. A screening berm upon completion will initially block the view of the operation until the elevation of the fill area exceeds the elevation of the screening berm.

For a discussion of impacts from fugitive dust, litter, noise odors, refer to Air Quality, Sections III, IV and V.

SE3FW

FREEWAY SANITARY LANDFILL EXPANSION

SECTION IV

ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

Primary Impacts

The construction and operation of the vertical expansion area at the Freeway Sanitary Landfill will have no effect on the large scale (macro-climate) meteorological processes (i.e., prevailing winds, air masses, semi-permanent pressure centers) which basically determine the climate of the Minneapolis-St. Paul vicinity. Local factors, however, can affect the climate on a small scale (micro-climate). The construction and operation of the expansion area could have a small but essentially undetectable impact on the micro-climate since virtually all human activity influences the micro-climate to a certain degree. Routine maintenance, closure and post-expansion will have no significant impact on the existing climate of the area.

Direct or Indirect Effects That Cannot Be Avoided

The construction, operation, maintenance, closure and post-closure activities associated with the proposed expansion will have no direct or indirect effects on meteorology/climatology.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources associated with meteorology/climatology will result from the construction, operation, maintenance, closure and post-closure activities of the proposed expansion area.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The construction, operation, maintenance, closure and post-closure activities associated with the proposed expansion will have no impact on short-term uses of man's environment and the relationship between maintenance and enhancement of long-term productivity.

Cumulative Impacts

The construction, operation, maintenance, closure and post-closure activities associated with the proposed expansion will have no cumulative impacts.

AIR QUALITY

Primary Impacts

Fugitive Dust -- The construction, operation, maintenance, closure and post-closure activities associated with the proposed expansion will generate fugitive dust. Activities such as landclearing, excavation, grading, stockpiling, moving heavy equipment over unpaved areas, the transport of cover materials, and the movement and unloading of refuse trucks will generate fugitive dust.

The dust impacts from the new expansion will not vary significantly in magnitude from those resulting from the existing landfill since the nature and level of dust generating activities will be similar to existing conditions.

No significant adverse dust impacts are expected. In fact, proper operation of the proposed new expansion area should reduce the level fugitive emissions presently produced at the existing facility.

Methane Gas -- The proposed expansion area has the potential for adverse methane gas impacts. Since an additional 1.2 million tons of refuse are being proposed for the disposal in the expansion areas, the increase in methane production will correspond accordingly. Based on lysimeter and full-scale landfill tests it appears that typical generation rates of .2 to .75 std. cu. ft. of methane/lb. can be expected from the landfill. Given that generation rate, an approximate gross production of 1.2 billion cu. ft. of methane gas can be expected from the landfill including the proposed expansion area. If structures are placed on the former fill area or near the perimeter of the landfill, there exists the potential for gas to accumulate in these structures to explosive concentrations.

Proper operation of the landfill should, however, minimize potential methane impacts to satisfactory levels. Methane gas that is produced within the landfill will be vented through the cover material and at the landfill perimeter, ultimately dissipating at harmless concentrations into the atmosphere.

The existing landfill has not demonstrated methane gas problems.

Odors -- The proposed new expansion area has the potential for adverse odor impacts. However, proper design and operation of the landfill should minimize odor impacts to satisfactory levels.

The existing landfill has not demonstrated odor problems.

Other Air Pollutants -- The operation of equipment and the movement of refuse trucks into the expansion area will cause low levels of carbon monoxide, nitrogen oxides, sulfur oxides, and hydrocarbons to be emitted to the ambient air. However, these activities should not cause significant adverse impacts other than that occurring at the existing landfill. The proposed expansion will not increase the number of vehicular trips to the landfill or the operation of on-site equipment.

Direct or Indirect Effects That Cannot Be Avoided

No significant direct or indirect effects associated with the proposed expansion are anticipated to occur in the area of air quality.

Fugitive Dust -- Fugitive emissions from a landfill are an effect that cannot be avoided. However, state-of-the-art engineered operational procedures, can minimize a large percentage of the fugitive emissions.

Construction-related activities associated with the proposed expansion such as landclearing, excavation, grading, stockpiling, moving heavy equipment over unpaved areas and the transport of fill material will unavoidably generate fugitive dust for relatively short periods of time. However, dust impacts from construction activities will be minimal.

Routine operational and maintenance activities associated with the proposed expansion area will also generate fugitive dust in similar quantities to that produced by the existing landfill. Such activities in the past have not produced any serious fugitive dust problems. Therefore, no significant impact on the existing environment by these activities will result from fugitive dust emissions.

No significant adverse impacts regarding transportation-related emissions will occur since the proposed expansion will not generate any increase in vehicular traffic to the site.

Some fugitive dust will be generated by activities associated with closure of the landfill including the proposed expansion area. However, these impacts will be minimal. In the long run, dust emissions from the landfill will be reduced by revegetation.

Methane Gas -- The potential for adverse methane gas impacts will be increased by the proposed expansion area. The impact that methane gas generation has had on the environment at other landfills has generally been minimal. In some instances, methane gas has killed vegetation and trees at landfill sites.

What appears to have happened in those instances is that methane has vented through fissures and eroded portions of the cover material in concentrations high enough to be toxic to vegetation. Operational practices employed at the Freeway Sanitary Landfill should prevent such impacts from occurring at the site.

Odors -- The potential for adverse odor impacts will be increased by the proposed expansion. However, no significant adverse impacts are anticipated. The placement of cover material should minimize the emission of odorants into the air to satisfactory levels.

Other Air Pollutants -- Low levels of carbon monoxide, nitrogen oxides, sulfur oxides, and hydrocarbons will be emitted into the air by construction and operational activities associated with the proposed expansion area. The impacts from these pollutants should be negligible.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of air resources will result from the activities associated with the proposed expansion area.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The short-term impacts due to construction of the proposed expansion area will involve potential fugitive dust and transportation-related emissions. No significant adverse air quality impacts on the maintenance and enhancement of the long-term productivity of the existing environment will result from the construction activities.

Short-term impacts due to operation of the proposed expansion areas involve potential fugitive dust emissions, odor and methane emissions, and transportation-related emissions. Air quality impacts on the maintenance and enhancement of the long-term productivity of the existing environment from these operations will be minimal.

Short-term impacts due to closure and post-closure activities of the proposed expansion area involve potential fugitive dust and transportation-related emissions. Adverse air quality impacts on the maintenance and enhancement of the long-term productivity of the existing environment from these operations will be minimal. Revegetation will actually reduce dust emission from the landfill in the long-term.

Cumulative Impacts

Fugitive Dust -- Fugitive dust will be generated by construction activities. However, construction activities will be performed in stages and will only be an intermittent source of dust. Consequently, no cumulative impacts are expected to occur.

Methane Gas -- The potential for cumulative impacts of methane will increase with the expansion of the landfill. However, the total cumulative effects are not expected to be significant.

Other Air Pollutants -- Cumulative impacts are not expected to result from the emission of other air pollutants by the proposed expansion area.

NOISE

Primary Impacts

The construction, operation and closure of the proposed expansion area are activities that will produce noise. Noise will be generated by equipment used at the proposed expansion area for hauling, compacting and covering the refuse. The level of noise generated, however, by activities at the proposed expansion area should not be any greater than that of the current landfill operation.

The closest sensitive receptor (home) to the proposed expansion area is located approximately 2,900 feet from the southern border of the proposed expansion areas. As a general rule, sound from an essentially localized source spreads out uniformly as it travels away from the source, and the sound level drops off at the rate of 6 dBA for each doubling of distance. Assuming that a bulldozer producing 88 dBA measured at 50 feet is operated at the proposed expansion area for an hour, noise levels at the receptor would be approximately 53 dBA. This is within the MPCA NAC-1 daytime hourly noise standard of 65 dBA. The preceding analysis does not take into account topographical variations which would further reduce noise at the receptor.

Activities associated with the proposed expansion areas will not affect nighttime noise levels since the landfill is not operational during the night.

Direct or Indirect Effects That Cannot Be Avoided

The generation of noise from the operation of a landfill is an effect that cannot be avoided. However, proper operation of the proposed expansion area should reduce noise impacts to satisfactory levels.

There have been no adverse noise impacts associated with the existing landfill operation.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitments of resources with regards to noise generating activities will occur from the proposed expansion area.

Relationship Between Local Short-Term Uses of Man's Environment
and Maintenance and Enhancement of Long-Term Productivity

Short-term impacts due to construction, operation and closure of the proposed expansion area will involve potential noise emissions. The major long-term benefit of the proposed action will be to provide an environmentally acceptable outlet for the regional disposal of solid waste.

Cumulative Impacts

Cumulative noise impacts are not expected to result from the proposed expansion area.

SO001E

WATER QUALITY

GROUND WATER QUALITY

Primary Impacts

The average annual rate that leachate will be generated from the proposed expansion was estimated to be the same as for existing conditions in Section III, 5.0 inches per year during operation and 3.0 inches per year after closure (see Table III-14). The proposed action is a vertical expansion only. If operating procedures, final contours, cover and vegetation are not changed from the presently operating landfill, the infiltration rate into the landfill should not change significantly. Since annual leachate production is mainly dependent on the infiltration rate and the area of the landfill and these two factors remain the same for the expansion, the leachate production rate should remain the same.

The construction, operation, closure or post-closure of the proposed expansion will have no significant impact on the ground water hydrology of the landfill site. Ground water gradients and the movement of ground water beneath the site are not expected to change significantly from what they are under existing conditions.

The primary ground water impact from the proposed expansion will be the increased length of time in which leachate will be produced. The leachate production rate should not increase because of the vertical expansion, therefore the area where groundwater is potentially influenced by leachate should not increase. Refuse in the existing landfill probably has not reached field capacity. The proposed expansion should delay the time until the entire landfill reaches field capacity from approximately 1985 to 1999.

It is uncertain whether or not any of the leachate constituent parameters will increase in concentration due to the expansion. It is known that leachate strength generally decreases in time after refuse is buried and after decomposition has begun. However, specific predictions as to the exact time when concentrations are at a maximum are very difficult to obtain without more accurate field monitoring data. Therefore, the cumulative effect on leachate strength of placing new refuse within the vertical expansion on top of existing and presently decomposing material is virtually unpredictable.

Direct or Indirect Effects Which Cannot be Avoided

The area potentially impacted by the existing landfill is essentially the same as the area potentially impacted by the proposed expansion under the same assumptions. The landfill will produce leachate which will affect local groundwater quality unless leachate is completely cut off by an impervious seal and leachate is collected over the entire landfill site.

Irreversible and Irretrievable Commitment of Resources

The presence of the landfill and the floodway zoning ordinance restricts any further use of the ground water in the vicinity of the landfill (see discussion in Local Water Supply Quality). Although the expansion will extend the period of time the entire landfill will produce measurable leachate, this will not occur indefinitely. The length of this period of potential ground water contamination is unknown.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed action will not significantly change the impact of the existing landfill on ground water quality other than to extend the period of time in which the landfill will produce measurable leachate. The expansion will allow the landfill to operate for an additional 3 to 6 years while providing a method of disposal for the Region's refuse.

Cumulative Impacts

It is uncertain whether or not the expansion will change the concentrations of leachate produced from the existing landfill. The results of the impact analysis showed no indications that the expansion would significantly increase the production rate or concentrations of leachate produced. Therefore, there are no significant cumulative impacts predicted on ground water.

SURFACE WATER QUALITY

Primary Impacts

The construction, operation, closure or post-closure of the proposed expansion will not significantly impact the flood hydrology or low flow hydrology of the Minnesota River, or the hydrology of the drainage ditch east of the landfill. The vertical expansion is well above the 100-year frequency flood level and will not affect flooding on the Minnesota River.

The only significant primary impact from the expansion on quality of the Minnesota River should be prolonging the period of time in which the landfill will be producing measurable amounts of leachate. The ground water influenced by the leachate from the landfill will ultimately discharge into the river. Tables III-17 through III-20 and III-23 quantify the impact of the present landfill on the Minnesota River. The expansion should not add to the production rate of leachate. It is uncertain whether the expansion will change the concentrations since there presently is no method available to accurately quantify the effects of the expansion on these leachate concentrations. Parameters affected by leachate analyzed in the Minnesota River should not change significantly due to the expansion.

Leachate contamination is presently significant in the eastern drainageway and water quality standards are being exceeded. Concentrations in the drainageway will probably not change significantly due to the expansion of the landfill. MPCA is considering reclassification of the drainageway to the proposed class 7: limited resource value.

Direct or Indirect Effects That Cannot be Avoided

As a result of the proposed expansion the landfill will discharge leachate over a longer period of time, extending any potential contamination hazard to the Minnesota River. The steady-state discharge of leachate to the river should not occur for a number of years, at least until after the landfill has reached field capacity. Given attenuation of the leachate by dilution in the river, the effect of leachate on the river will be negligible.

The River drainageway, and nearby wetlands will receive additional sediment as a result of filling the expansion, a direct effect that cannot be avoided. Sanitary landfilling by its very nature is a construction activity; surface runoff, particularly over fill areas yet to receive final cover and attain vegetative growth, will carry minor amounts of suspended solids to nearby receiving areas. Implementation of current operational procedures while filling the expansion should be sufficient to mitigate major erosion of these areas and sediment discharge to the pond areas. Although minor increases of sedimentation of the River and wetlands will occur as a result of the proposed actions, the net effect should be negligible.

Irreversible and Irretrievable Commitment of Resources

Minor leachate seeps and erosion of the landfill surface may degrade the drainageway and nearby wetlands to some degree. These areas may further degrade from operations associated with the filling of the expansion area. The net effect, however, of the proposed actions should be negligible since the drainageway and wetlands are not within the area of proposed construction.

No other significant irreversible or irretrievable commitments of surface water resources are associated with the proposed filling and construction activities.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The long-term use of the nearby wetlands may be impacted by the filling activities of the expansion operation. Depending on their use, the wetlands should be carefully monitored after closure of the landfill. Particular attention should be given to leachate seeps that might occur and flow to these areas since the wetlands are very sensitive and can be used as secondary indicators of leachate contamination of surface and discharging groundwaters.

Significant long-term impacts on the Minnesota River should not result from the expansion. However, the proposed expansion should delay the time it takes the entire landfill to reach field capacity and thereby prolong the period of potential pollution. Although there are no indications that production rate or concentration of leachate will increase significantly due to the expansion, total amount of leachate over time will increase with the expansion.

These negative impacts must be balanced with the advantage of the additional 1860 acre-feet of disposal capacity provided by the expansion.

Cumulative Impacts

There should be no or very minor cumulative impacts on the water quality of the Minnesota River from the expansion of the existing landfill by itself. Table IV-1 shows the estimated cumulative impact of both Freeway and Burnsville landfills assuming that both expansions are approved. The combined effect of the landfills with expansions increases ammonia concentration in the river by 43%, Boron by 38%, BOD by 19%, barium by 19% and phenols by 13%. Other parameters are affected by less than 10%. Although the combined effects of the landfills significantly increase some parameters they never drive them over water quality standards.

There are no other cumulative impacts on surface water resources resulting from activities associated with the proposed expansion.

LOCAL WATER SUPPLY QUALITY

Primary Impacts

The area of groundwater impacted by leachate from the landfill is currently restricted from use by two factors. The area between the landfill and the river is designated as floodway. No development in the floodway is allowed and therefore no future wells will be placed in this area. In addition, commercial and industrial areas to the south are served by municipal water supplies which are taken from deep wells located between Cliff Road and Burnsville Parkway east of Interstate 35W and within the downtown area of Savage. The expansion of the Burnsville water supply wells is planned to occur east of Interstate 35W and Savage has no plans for expanding its water supply system.

As discussed in Section III Water Quality, the two wells within the area potentially influenced by leachate from Freeway Landfill are the U.S. Salt Company and Freeway Landfill wells. Since the expansion should not increase the leachate production rate, and since it is uncertain whether or not concentrations of leachate constituents will increase with the expansion, the only potential primary impact of the expansion of these two wells will be a continuation of the leaching period from the landfill. However, as long as the pumping rates from

TABLE VI-1

CUMULATIVE IMPACT OF FREEWAY AND BURNSVILLE LANDFILLS WITH THEIR EXPANSIONS

7-Day Duration - 10-Year Frequency Low Flow

PARAMETER	Minnesota River	Freeway Landfill	Landfill	Burnsville Landfill	Landfill	TOTAL LOADING TO RIVER	DOWNSTREAM CONT.	Minnesota River %	MPCA
	UPSTREAM CONT.	LEACHATE CONT.	TO RIVER CFS	LEACHATE CONT. ¹	TO RIVER CFS	FROM FREEWAY & BRNSVLE.		INCREASE DUE TO LANDFILLS	WATER QUALITY STANDARD
Copper mg/l as CU	12	31 ⁷	1.36	50	1.85	3.21	12.04	.33	10
Turbidity NTU	76.6	150 ⁷	6.6	130 ⁶	4.81	11.4	76.7	.13	25
Conductivity umhos/cm @25 deg. C.	730 ²	5500 ⁷	242.0	6100 ²	225.7	467.7	737.6	1.0	1000
Chloride mg/l as Cl	45	1620 ⁷	71.3	1610 ⁶	59.6	130.9	47.4	5.3	100
PH	8.1	7.0 ⁷	-	6.0 ⁶	-	-	-	-	6.5-8.5
Ammonia mg/l as N	0.70	77 ⁷	3.4	350 ⁶	13.0	16.4	1.00	43	1.5
Total Dissolved Solids mg/l	573	5346	235.2	5346	197.8	433	580	1.2	700
Total Alkalinity mg/l as CaCO ₃	258	1225	53.9	1225	45.3	99.2	276.5	7.2	305
Sulfate mg/l as SO ₄	123	153	50.7	1080 ⁶	40.0	90.7	124.5	1.2	10
Total Hardness mg/l as CaCO ₃	368	1600	70.4	1600	59.2	129.6	369.9	.52	250
Sodium mg/l as Na	34.3	357	15.7	357	13.2	28.9	34.8	1.5	122 ⁴
Cadmium mg/l as Cd	10	30	1.32	30	1.1	2.4	10	0	10
Lead mg/l as Pb	11	100 ⁵	4.4	100	3.7	8.1	11.1	.9	50
Arsenic mg/l as As	8.6	ND ⁵	-	ND ⁵	-	-	-	-	50
Selenium mg/l as Se	2.8	ND ⁵	-	ND ⁵	-	-	-	-	10
Fluoride mg/l as F	0.32	.4	.018	0.4	.015	.033	.32	0	1.5
Phenols mg/l	0.004	.025	.0011	0.77	.028	.029	.0045	12.50	0.1
Chromium mg/l as Cr	0.007	.05	.0022	0.05	.0019	.0041	.0071	1.4	0.05
Barium mg/l as Ba	0.16	2.25	.099	2.25	.083	.182	.163	18.8	1
Boron mg/l as B	0.16	4.7	.21	3.0 ⁶	.111	.32	.166	37.5	0.5
Cyanide mg/l as CN	0.4	.028	.0012	0.028	.0010	.002	.4	-	0.02
Silver mg/l as Ag	<10	10	.44	10	.37	.81	10	-	50
SOD, mg/l	5.3	35 ⁷	1.54	1500	55.5	57.0	6.3	18.9	-
COD, mg/l	42.5	464 ⁷	20.4	4490	166.1	186.5	45.9	8.0	-

1. Median values from data in Clark & Piskins, Environmental Geology, Volume 1, 1977, unless otherwise noted.

2. 0.65 x specific conductance = total dissolved solids (mg/l).

3. Turbidity is assumed to be a linear function, this value may be considered to be a loading number if one NTU is assumed to equal one mg/l.

4. MPCA standard is based on sodium being less than 60% of the total equivalents of cations. To calculate the standard, the hardness was assumed to be the other major cation source, and all of the hardness was assumed to be calcium ions.

5. Not detectable

6. Burnsville Landfill seepage concentration May 3, 1979.

7. Freeway Landfill seepage measurement.

these two wells do not increase and no additional wells are located in the immediate area, they should continue to remain free of leachate influence based on the groundwater flow characteristics underneath the landfill. Section V recommends expanding the monitoring of these water supply wells.

The landfill and the proposed expansion should not impact any other existing water supply wells at their current pumping rates. The potential does exist for impacting water supply wells if additional wells of sufficiently high capacity are placed close enough to the landfill. The likelihood for placing such wells is limited since the major portion of the area is in the floodway, the area to the south is served by municipal water supply systems.

Direct or Indirect Effects Which Cannot be Avoided

The vertical expansion will increase the time frame in which leachate contamination from the landfill will be a potential hazard. The quality of leachate, however, may not be affected; therefore, the effect of the lengthened time frame should not be a significant one on the local water supply.

Irreversible and Irretrievable Commitment of Resources

No further area will be impacted by leachate by the landfill expansion.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

By increasing the length of time leachate will be generated from the landfill the safe disposal of refuse at this location will be extended by three to six years.

Cumulative Impacts

There are no cumulative impacts on the local water supply from the proposed action.

WQFY4

TERRESTRIAL AND AQUATIC ECOLOGY

VEGETATION AND WILDLIFE

Primary Impacts

Construction activities associated with the proposed vertical expansion include the construction of a screening berm along the eastern edge of the landfill. Construction of the screening berm will remove vegetative cover along the eastern border of the landfill. No further vegetation will be removed from the landfill except areas that are already presently permitted for future filling.

Various wildlife populations are likely supported by vegetative cover on existing permitted areas of the landfill and the adjacent surrounding area. The creek bed area adjacent to the eastern boundary of the landfill and the willow/cottonwood shrubs and trees which have not been disturbed on the existing permitted areas of the landfill, are habitats and food sources for cottontail rabbits and rodents, and nesting area for songbird species. These and other species utilizing these areas will be displaced during the construction of the screening berm and the filling of the remaining permitted areas of the landfill including the vertical expansion area. The area between the eastern boundary of the landfill and 35-W is not very wide, it is therefore likely that most of the present wildlife inhabiting the area will be pushed out or severely restricted. As filling moves closer to the eastern boundary, the movements of deer, fox and other mammals will be restricted, primarily during daylight hours. The proposed vertical expansion by itself will have no greater affect on wildlife than filling the remaining permitted areas of the landfill except that it will extend the time period before the habitat is restored so that it can support wildlife again.

The indigenous vegetation and associated wildlife species located on the landfill and adjacent area are not unique to these areas. The total individual members of the affected populations are very small in comparison to the total available areawide resources. In effect, the proposed vertical expansion and berm area construction activities will not result in significant direct impacts on terrestrial populations.

The operating phase of the landfill with respect to the proposed expansion area will consist of, for each successive work area, actual waste placement, cover placement, and environmental control operations (i.e., litter control, dust control, etc.). Day-to-day operations will affect a larger area than the active face area due to refuse truck and landfill equipment traffic on the access points. Wildlife populations, which have presumably adjusted to existing landfill activities, will not be additionally affected by the expansion area operations.

The closure phase of the expansion area will consist of, for each successive work area, final cover placement and revegetation activities. Since the closure period is relatively brief, such activities have only very minimal impacts on terrestrial vegetation and wildlife.

The potential, however, exists for more substantive impacts on terrestrial populations, and particularly terrestrial flora, due to biological processes inherent at a landfill site during the post-closure period. Specifically, decomposition of landfilled organic materials results in or contributes to leachate generation and methane gas production. For surface oriented flora and fauna, leachate generation would not be expected to have significant impacts. Methane gas production, on the other hand, has resulted in numerous cases in the creation of anoxic root zone conditions resulting in slow growth or die-off of associated plant species. Potential impacts are generally unpredictable in practice, as well as, generally localized in extent. Given the site topography (elevated), type of cover soil (relatively impermeable) and site history (no evidence of methane problems) no substantial impacts are expected either on or off-site. Should substantial vegetative stresses develop, a number of mitigative measures are available (see Section V).

As discussed in the Water Quality section, the proposed expansion will probably delay the time it takes the entire closed landfill to reach field capacity thereby extending the period of any potential vegetative damage. It is unknown whether or not leachate concentrations will increase due to the expansion.

Direct or Indirect Effects That Cannot be Avoided

The existing landfill is already presently permitted to remove all vegetation that would be affected by the vertical expansion, therefore, no further direct or indirect impacts on vegetation and wildlife are predicted from this activity. Construction of the screening berm will remove a minor amount of vegetative growth along the eastern boundary of the landfill, a direct effect that cannot be avoided. The subsequent impact of this activity, however, on vegetation and wildlife will be negligible.

Irreversible and Irretrievable Commitments of Resources

No irreversible or irretrievable commitment of vegetative and wildlife resources is implicated in the vertical expansion of the landfill.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The primary short-term impacts associated with the vertical expansion are negligible since most primary impacts on vegetation and wildlife have occurred from filling the existing landfill. In the long-term, revegetation of the site would occur. However, normal plant

successional growth patterns could potentially be modified due to the combined earth/decomposing waste substrata available for plant growth.

Operation of the proposed landfill expansion area eliminates no new acreage from natural ecological production. It does, however, extend the time period before the habitat is restored so that it can support vegetation and wildlife again. Operation should result in the secure disposal of an additional 1,860 acre feet of refuse over a four to six year period.

No significant short-term impacts are expected due to closure and post-closure activities of the vertical expansion. Long-term use for the 126 acre landfill is designated as general and limited industrial area.

Cumulative Impacts

No significant cumulative impacts on vegetative and wildlife resources are expected from the activities of filling of vertical expansion area and the construction of the screening beam.

AQUATIC ECOLOGY

Primary Impacts

As discussed in the Water Quality section, the proposed expansion will probably delay the time it takes the entire closed landfill to reach field capacity thereby extending the period of any potential aquatic ecology impacts. It is unknown whether or not the expansion will cause increases in leachate concentration, or if it occurs, for what specific parameters.

The water body of primary concern is the Minnesota River. Most fish and other mobile organisms in the river should be able to avoid the area near the drainage ditch discharge and thereby escape any potentially harmful effects of elevated levels of the leachate constituents. Attached and rooted phyton and sensitive benthos were not identified near the shoreline in the area of leachate influence and therefore there should be no primary impacts on these organisms.

The only other water body potentially affected is the drainage ditch. The primary impact of the expansion would be limited to the extension of the period of leaching from the landfill. There is no indication of a change in the extent of the landfill's impact on the drainage ditch due to the expansion with respect to production rate or quality of leachate.

Direct or Indirect Effects Which Cannot Be Avoided

The most significant effect of the expansion on aquatic ecology is leachate contamination of the River. Although the period of threat from leachate contamination may be extended, there is no indication that the expansion will change the production rate or quality of leachate.

Irreversible and Irretrievable Commitments of Resources

There are no irreversible commitments of resources since any river system has the potential to recover from point source inputs, especially considering the uncertainty of increased loadings from the expansion and the finite nature of the landfill's field capacity.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There will be a certain minimal risk to the long term aquatic ecology of the river associated with the expansion. This continued leachate pollution into the river will only slightly hamper the general effort to improve the river's water quality. The beneficial aspects of a means of disposal of municipal solid waste is also a long-term advantage of the expansion.

Cumulative Impacts

Any impacts on organisms in the river resulting from the proposed expansion would be in addition to those impacts currently experienced due to leachate from the permitted landfill. Also any impacts of the expansion would be in addition to impacts caused by other pollution sources along the river.

WETLANDS

Primary Impacts

There is potential for soil erosion from the activities of the proposed actions, with sediment potentially entering adjacent off-site wetlands. Leachate and landfill gas production will occur during operation, closure and post closure activities associated with the proposed expansion area. Gas migration cannot occur through saturated soil and, as such, there would be no expected impact on the wetlands via horizontal or vertical gas migration. Although leachate production may occur for a number of years, adequate final cover should substantially reduce the production of leachate.

Direct of Indirect Effects That Cannot be Avoided

The generation of leachate and methane gas is inevitable; however, the impact of leachate and gas on off-site wetlands will be limited due to the distance and landfill design. No significant adverse impacts are expected.

Irreversible and Irretrievable Commitments of Resources

No additional wetland resources will be irrevocably committed because expansion area activities will not occur in the wetlands, and mitigative measures to control sedimentation will be employed.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

In the short-term, the off-site wetlands will be minimally stressed by activities of the proposed expansion and berm areas. In the long-term, the proposed action will provide the Metropolitan Area with a continued outlet for the disposal municipal solid wastes.

The use of appropriate mitigative measures will limit short-term and long-term impacts on the wetlands. No significant adverse impacts are expected.

Cumulative Impacts

Current surface water runoff will remain the same with the proposed expansion. Hills of refuse will be constructed with fairly steep slopes. The surface runoff is directed to adjacent drainage ditches which then flow into the Minnesota River north of the site.

The present condition of the off-site wetland area as a viable functioning upland wetland ecosystem would be affected by expansion of the existing landfill. However, the apparent lack of significant impacts of this area by the existing landfill and the environmental controls currently used and proposed for the expansion and berm areas suggest that additional impacts would not be significant.

RARE AND ENDANGERED SPECIES

Primary Impacts

No significant impacts on rare or endangered species will occur on-site or the surrounding area as no bald eagles have been sited on or close to the landfill area. The food chain within the River will not be substantially impacted by any leachate constituents due to the dilution factor of the River water volumes.

Direct or Indirect Effects That Cannot be Avoided

There are no bald eagles or rare or endangered species associated directly with the landfill area; therefore, no impacts on such populations will occur.

Irreversible and Irretrievable Commitments of Resources

No bald eagles or rare or endangered species are associated with the landfill area; therefore, no commitments of such resources will be involved with the proposed actions.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

No significant adverse impacts on neighboring populations of rare, endangered, or "unusual" species are expected.

Cumulative Impacts

No cumulative impacts on rare or endangered species are predicted.

S0001K

SOCIO-ECONOMICS

LAND USE, ZONING

Primary Impacts

A significant impact of the proposed action on future land use is the delay of Freeway's plan to utilize the land for other purposes such as general industrial purposes. If the expansion is granted, the City will have to delay any development by approximately three to six years. The proposed actions are consistent with present land use and zoning for the area.

The only potential significant impact of the landfill on the Minnesota Valley National Wildlife Refuge and Recreation Area would be increased water quality degradation caused by leachate contamination. Analysis of the existing landfill conditions indicates that dilution in the river will be sufficient to reduce any significant threat of leachate pollution even during low flow conditions.

For a further discussion, see Surface Water Quality, Section III.

Direct or Indirect Effects that Cannot be Avoided

The only direct or indirect effect of the expansion on land use will be the delay in developing the land for other purposes.

Irreversible and Irretrievable Commitment of Resources

No irreversible or irretrievable commitment of resources relating to land use or zoning will result from the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The filling of the proposed vertical expansion area will have no significant impact on the short-term uses of man's environment. Upon the landfill's closure, the landfill will be used for commercial and general industrial purposes which will enhance the long-term productivity of the area.

Cumulative Impacts

The proposed action will not result in any cumulative impacts that are related to land use or zoning in the area.

PUBLIC FACILITIES AND SERVICES

Primary Impacts

There are no significant primary impacts related to public facilities that will result from the filling of the vertical expansion area at the landfill.

The only potential significant impact of the landfill on the Minnesota Valley National Wildlife Refuge and Recreation Area would be increased water quality degradation caused by leachate contamination. Analysis of the existing landfill conditions indicates that dilution in the river will be sufficient to reduce any significant threat of leachate pollution even during low flow conditions.

For a further discussion, see Surface Water Quality, Section III.

Direct or Indirect Effects that Cannot be Avoided

There are no significant direct or indirect effects relating to public facilities that will result from the expansion of the landfill.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of resources related to public facilities that will result from the expansion of the landfill.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed expansion of the landfill would have the short-term benefits of the secure disposal of an additional 5.0 million cubic yards of municipal refuse and thereby eliminate the need for alternative disposal methods.

Cumulative Impacts

The proposed action will not result in any cumulative impacts that are related to public facilities in the area.

TRANSPORTATION

Primary Impacts

The proposed expansion of the Freeway Sanitary Landfill will result in extending the use span of this landfill rather than to accommodate greater annual volumes of refuse. Also, the existing watershed boundaries of this landfill are not anticipated to change significantly as the result of the proposed action. Consequently, transportation-related impacts associated with the proposed action will reflect existing rather than new additional impacts. The existing impacts have been identified as a traffic operational deficiency at and either about the I-35W/113th Street interchange

Direct or Indirect Effects that Cannot be Avoided

The proposed action will extend the use of the established haul routes by approximately five years.

Irreversible and Irretrievable Commitment of Resources

Irreversible and irretrievable commitment of resources associated with the hauling of refuse to the Freeway Sanitary Landfill will be petroleum consumed for transport.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The five-year extended use of the established haul routes will have no significant impact on short-term uses of man's environment and the relationship between maintenance and enhancement of long-term productivity. (see Table V-1 for mitigative measures)

Cumulative Impacts

The five-year extended use of the designated haul routes resulting from the proposed action will have no significant cumulative impacts. (see Table V-1 for mitigative measures)

COLLECTION AND MANAGEMENT SYSTEM COSTS

Primary Impacts

Filling of the proposed expansion area will extend the life of the Freeway Sanitary Landfill by about three to six years. Area haulers that normally use this site can continue to do so for the additional time period. Area customers serviced by haulers using the landfill will continue to be charged collection fees based in part on the disposal charges set at Freeway. Disposal charges presently at the landfill are higher than surrounding competing landfills (see Section III, Socio-Economics, Pine Bend Sanitary Landfill Environmental Impact Statement).

Filling of the proposed expansion area will also extend the time frame for the need to develop new landfills in the Region (see Section VI, Alternatives Pine Bend Sanitary Landfill Environmental Impact Statement). Hennepin County (1979) found, for example, that it will cost between \$3.5 and \$4 million to develop a 120-acre parcel that could handle 500 tons of refuse per day. When legal, administrative and engineering expenses are added, landfill development costs could reach \$4.2 and \$5.6 million. Landfill development costs are reflected in disposal charges and ultimately in generator collection rates. Minimal development is necessary to use the Freeway expansion area; filling of this area will, therefore, help to maintain present collection rates in the Region by avoiding costs of developing new land disposal areas.

There are no adverse primary impacts on collection and management system costs that can be attributed to filling the proposed expansion area.

Direct or Indirect Effects that Cannot be Avoided

Filling of the proposed expansion area will extend the life of the Freeway Landfill and subsequently provide additional capacity for area haulers. This will, in turn, lessen the need and expense for new landfills and changes in routing and additional fuel costs for area haulers. Filling of the proposed expansion area will, therefore, help meet future regional land disposal capacity needs and help keep collection rates down.

There are no adverse direct or indirect effects on collection and management system costs that can be attributed to the proposed action.

Irreversible and Irretrievable Commitment of Resources

There are no irreversible or irretrievable commitment of resources with respect to collection and management system costs that can be attributed to the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

The proposed action will not result in any impacts on collection and management system costs that would adversely affect either short-term or long-term uses of the site for land disposal or the long-term productivity of the surrounding environment.

Cumulative Impacts

The most significant cumulative impact of continued disposal at Freeway as a result of using the expansion area, is the extension of the Metropolitan Area's landfill capacity. The expansion will add about 9 months of life to the metropolitan disposal system. Filling the expansion area will, therefore, lessen the need to develop new landfills sooner and help to maintain present land disposal charges and collection rates.

HISTORICAL/ARCHAEOLOGICAL

Primary Impacts

No historical or archaeological impacts are associated with the present site. The proposed action is contained within the perimeter of the landfill property. Therefore, no historical or archaeological impacts will be associated with the expansion of the present site.

Direct or Indirect Effects that Cannot be Avoided

The present site contains no historical or archaeological significance, therefore, no historical or archaeological impacts will occur due to the proposed action.

Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitment of resources with respect to historical and archaeological impacts of the facility will occur as a result of the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no historical and archaeological impacts associated with the proposed action that will adversely affect the maintenance and enhancement of the long-term productivity of the area.

Cumulative Impacts

No cumulative impacts relating to historical and archaeological significance are predicted.

AESTHETICS

Primary Impacts

Filling of the proposed expansion area will result in the landfill operating about three to six years longer. Nearby homes that look directly upon the landfill will be exposed to the operation of the facility for these additional years and any subsequent visual impacts. Such impacts will be greater than those already present since the final vertical elevation of the expansion will create an isolated mound.

Direct or Indirect Effects that Cannot Be Avoided

Visual impacts from operation of the landfill will occur for a longer time period as a result of the filling of the expansion area, a direct effect that cannot be avoided.

Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitment of resources with respect to visual impacts of the facility will occur as a result of the proposed action.

Relationship Between Local Short-Term Uses of Man's Environment and Maintenance and Enhancement of Long-Term Productivity

There are no significant aesthetic impacts associated with the proposed action that will adversely affect the maintenance and enhancement of the long-term productivity of the existing surrounding environment. As portions of the landfill reach final fill elevations they will receive final cover material and be seeded for vegetation purposes. This should help to lessen the adverse visual impacts associated with operation of the facility.

Cumulative Impacts

Cumulative impacts are possible for those homes that overlook both the Burnsville and Freeway landfills. Approving expansions to both landfills will expose the operation of both facilities to some area receptors for a longer time period.

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FREEWAY SANITARY LANDFILL EXPANSION

SECTION V

MITIGATION MEASURES TO REDUCE OR MINIMIZE SIGNIFICANT ADVERSE EFFECTS

METEOROLOGY/CLIMATOLOGY, AIR QUALITY AND NOISE

METEOROLOGY/CLIMATOLOGY

The activities associated with the construction, operation and closure of the proposed expansion areas will not produce any significant adverse effects on the existing climate. Consequently, no mitigative measures are necessary.

AIR QUALITY

As noted in Section IV, the construction, operation and closure of the proposed expansion area will result in minimal production of fugitive dust, odors, and methane gas. In addition, the construction of the screening berm will produce a minimal amount of fugitive dust.

Current operational procedures used at the existing landfill should be sufficient to handle most of the air emission problems associated with the proposed expansion areas. In addition, the surrounding topographic and land use features of the area should provide adequate protection from adverse impacts on local receptors.

It was found that there is a potential for adverse impacts from methane gas after closure of the landfill, if gas should accumulate in new structures on the property because of the additional gas production in the proposed expansion areas. It may be necessary, prior to closure of the facilities to install a gas monitoring system to evaluate any future requirements for on-site and perimeter gas control measures. Such a monitoring program will also help determine future use of the property and whether new structures should be placed on the property.

Odors emanating from the landfill have been noticed by residents directly across the river. The application of proper amounts of daily cover material are sufficient to deal with this.

The following are other mitigative measures that might be undertaken to further reduce potential impacts from air pollutants.

- Provision of dust control via surface paving
- Reduction of dust generation via prompt revegetation

NOISE

As noted in Section IV, the construction, operation, and closure of the proposed expansion area will not produce any adverse noise impacts. Consequently, no mitigative measures are necessary.

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WATER QUALITY

GROUND WATER QUALITY

Ground water monitoring since 1971 has shown some degradation of ground water immediately underneath the landfill. However, ultimate discharge of ground water is to the Minnesota River, which has not shown measurable contamination that can be attributed to Freeway Landfill.

A liner and leachate collection system could be installed under the proposed expansion area of the landfill, however, the benefits to the Minnesota River would most likely be minimal and the additional cost to the project would be prohibitive.

SURFACE WATER QUALITY

Surface water monitoring has shown seasonal degradation of water quality in the drainage ditch east of the landfill. Analysis of the impact of expansion on the surface water quality revealed no measurable change in leachate parameters.

A leachate treatment system could be installed at the end of the drainage ditch just before the river. However, the benefits to the Minnesota River would most likely be minimal and the additional cost to the project would be prohibitive.

A method of mitigating the surface toe seeps is to promote better surface runoff conditions and to minimize percolation. This procedure is already being implemented at the landfill and should continue.

LOCAL WATER SUPPLY QUALITY

There is little potential for contamination of local water supply due to the expansion. The two wells located within the area potentially influenced by leachate, U.S. Salt and Freeway landfill truck shed, were installed below the level where groundwater is influenced by leachate. Nonetheless, a stepped up monitoring program for these two wells is recommended as a mitigative measure. They should be sampled on an annual basis and results reported in conjunction with the landfill monitoring data.

Although development is prohibited within the area of potential leachate influence between the landfill and the Minnesota River due to floodway designation, no future wells should be allowed in the immediate vicinity to prevent any potential drawdown effect in the area of the landfill.

MITIGATION MEASURES TO REDUCE OR MINIMIZE
SIGNIFICANT ADVERSE IMPACTS

TERRESTRIAL AND AQUATIC ECOLOGY

CONSTRUCTION

The two major impacts associated with the construction phase of the vertical expansion and screening berm are sedimentation that would occur in surface water runoff and removal of vegetation. Sanitary landfilling is by its very nature a construction activity and these impacts would be difficult to avoid. The construction activities of the proposed actions should, however, avoid equipment encroachment on non-landfill acres.

OPERATION

Impacts associated with operation of the proposed vertical expansion area would include impacts on vegetation and wildlife as caused by surface runoff, leachate production and methane gas migration. A potential mitigative measure might include utilization of surface runoff controls to minimize direct surface runoff drainage into the wetland areas and to lessen infiltration at the site and subsequently reduce the rate of the production of leachate and methane gas (i.e., berms, ponding, routing of runoff away from wetland areas, proper cover placement, grading and seeding practices).

Freeway operations have recently been upgraded to include daily cover. This practice should be continued as a mitigating measure to reduce leaching potential from the existing fill area and the expansion. An additional potential mitigative measure might include utilization of a leachate treatment system at the end of the easterly drainage ditch before discharging to the river. Aquatic impacts due to proposed expansion should be negligible and therefore the benefit of this costly treatment system on aquatic ecology may not be noticeable.

CLOSURE AND POST-CLOSURE

Impacts associated with the final phases of landfill operation are essentially identical to those experienced during the operational phase. Additional mitigative measures which could be implemented include:

1. Utilization of a final cover consisting of two feet of clay overlain by six inches of sandy loam topsoil to promote vegetative growth. Additional effects relating to maintaining appropriate vegetative growth conditions such as liming, fertilization, watering, insect control could be considered.

2. Selection of a variety of plant species noted for potential adaptability to landfill conditions.

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SOCIO-ECONOMICS

LAND USE, ZONING

The activities associated with the construction, operation and closure of the proposed expansion area will not produce any significant adverse effects on the existing land use or zoning. The expansion will, however, delay use of the facility for other purposes. Under the new Waste Management Act of 1980, municipalities can now tax solid waste land disposal facilities. They are no longer exempt as pollution control facilities. Burnsville, therefore, can now realize the landfill as a source of revenue.

PUBLIC FACILITIES

The proposed action will have no impact on public facilities in the landfill area. No mitigative measures are, therefore, necessary.

TRANSPORTATION

Only one (i.e., Burnsville) of the five municipalities that are most directly affected from the hauling of refuse to the Freeway Sanitary Landfill has identified existing adverse effects that might be continued under the proposed action. These adverse effects and suggested mitigative measures are given in Table III- .

COLLECTION AND MANAGEMENT SYSTEM COSTS

The proposed action will have no adverse effects on collection and management system costs in the Metropolitan Area. No mitigative measures are, therefore, recommended.

HISTORICAL/ARCHAEOLOGICAL

Since the present site contains no historical or archaeological significance, the activities associated with the construction, operation and closure of the proposed expansion area cannot have any influence on historical or archaeological considerations. Therefore, no mitigative measures are necessary.

AESTHETICS

The proposed action will result in greater adverse visual impacts to off-site receptors than those that have occurred with previously filled areas of the landfill.

A suggested mitigative measure would be to seed portions of the landfill as soon as possible in order to facilitate vegetative growth. Screening, such as the planting of high growth shrubs should also be investigated.

Table V-1 IDENTIFIED ADVERSE EFFECTS AND MITIGATIVE
MEASURES RELATING TO THE HAULING OF REFUSE
TO FREEWAY SANITARY LANDFILL

<u>Identified Adverse Effect</u>	<u>Suggested Mitigative Measure</u>
Traffic operational deficiency at the I-35W/113th Street interchange causing a safety hazard for trucks entering the north traffic flow on I-35W	Recommend to the Minnesota Department of Transportation to review their study of the traffic operations and safety factors at the I-35W/113th Street interchange and develop, as appropriate, an interim plan to improve deficiencies and safety hazards at this interchange
Litter about the I-35W/113th Street interchange resulting from improperly covered haul trucks maneuvering the sharply curved south bound egress ramp	Appropriate citation for inadequately covered refuse truck

FREEWAY SANITARY LANDFILL

SECTION VI

ALTERNATIVES TO PROPOSED ACTION

BACKGROUND INFORMATION

The following alternatives analyses are based on estimated closing dates of the existing sanitary landfills derived by projecting the continuing use rates and remaining capacities. These projections must necessarily be based on a set of data and assumptions. Because of the number of variables involved in the Regional landfill system during the next 10 years, the resulting closing dates are predictions to be used for general planning purposes only and are subject to change.

Table VI-1 summarizes the base data for the Regional landfill system including the predicted closing dates. The following assumptions were used in this analysis:

1. Presently remaining and expansion volumes, as given in acre-feet as of January 1980 reflect the remaining air space volume only. Cubic yard conversions are based on the definition of acre-feet: 1613 cubic yards (CY) per acre-foot (AF).
2. Presently remaining volume for Burnsville Sanitary Landfill is based on the recent stipulation agreement with the Minnesota Pollution Control Agency. This agreement essentially trades side-slope space for vertical space allowing 700,000 CY (434 AF) to be used on top of the existing refuse. Added to the previously existing space of 600,000 CY (372 AF) brings the total existing volume of Burnsville Sanitary Landfill to 1.3 million CY (806 AF).
3. 1980 use rates are calculated by using the best available receiving rate data (County and MPCA recorded data and/or landfill operators) and then converting to acre-feet using the conversion constant of 672 tons received through the gate per acre-foot in place in the landfill.
4. Use rates are assumed to increase somewhere within a range of 0.0 to 1.3 percent per year. Reported closing dates reflect the median use rate increase of 0.65 percent per year.
5. The closing dates reflect projections based on the interrelated nature of solid waste flow within the Regional landfill system. When the first landfill closes, the landfill's last use rate (AF/Yr) is dispersed evenly between the remaining "neighboring" landfills depending on relative proximity.

Table VI-1

Base Data For Regional Landfill System

Landfill	(A) Presently Remaining Volume (As of 1/80)	(B) Expansion Volume	Total Available Volume (A + B)	1980 Use Rate
Pine Bend	5952	2790	8742	792
Freeway	951	1860	2811	158
Burnsville	806	2418	3224	237
Flying Cloud	1046	0	1046	607
Louisville	1500	496	1996	79
Dakhue	333	0	333	27
Woodlake	67	1550	1617	150
Anoka Municipal	786	0	786	340
Oak Grove	211	0	211	174
East Bethel	807	0	807	11
WDE	<u>245</u>	<u>0</u>	<u>245</u>	<u>40</u>
7-County Region Total	12,704	9,114	21,818	2,611

6. A subregional scenario was used to predict effects of other landfills' closing on Freeway Sanitary Landfill. Louisville, Flying Cloud, Burnsville and Pine Bend were determined to have the greatest impact on Freeway's use rate due to proximity and overlapping wastesheds. Therefore, the use rates of these neighboring landfills were dispersed among the remaining landfills when closed.

Results of this analysis are as follows. If all landfills, including Freeway, are granted expansions, then Freeway landfill will close in 1989. If Freeway landfill is not granted the expansion, it will close in late 1983, approximately six years earlier. Figure VI-1 represents this subregional system in reference to Freeway landfill. The shaded area illustrates different projected closing dates depending on whether neighboring landfill expansions are granted or not granted.

NO ACTION ALTERNATIVE

SOCIO-ECONOMIC IMPACTS

If the proposed expansion to Freeway Sanitary Landfill is not granted, three elements of the Regional solid waste management system would be affected directly: refuse haulers, neighboring landfills, and County and Regional government charged with siting new landfills. The general population served will be affected either directly or indirectly through secondary effects of changes in the solid waste management system. Finally, the City of Burnsville would also be affected by an earlier closing date.

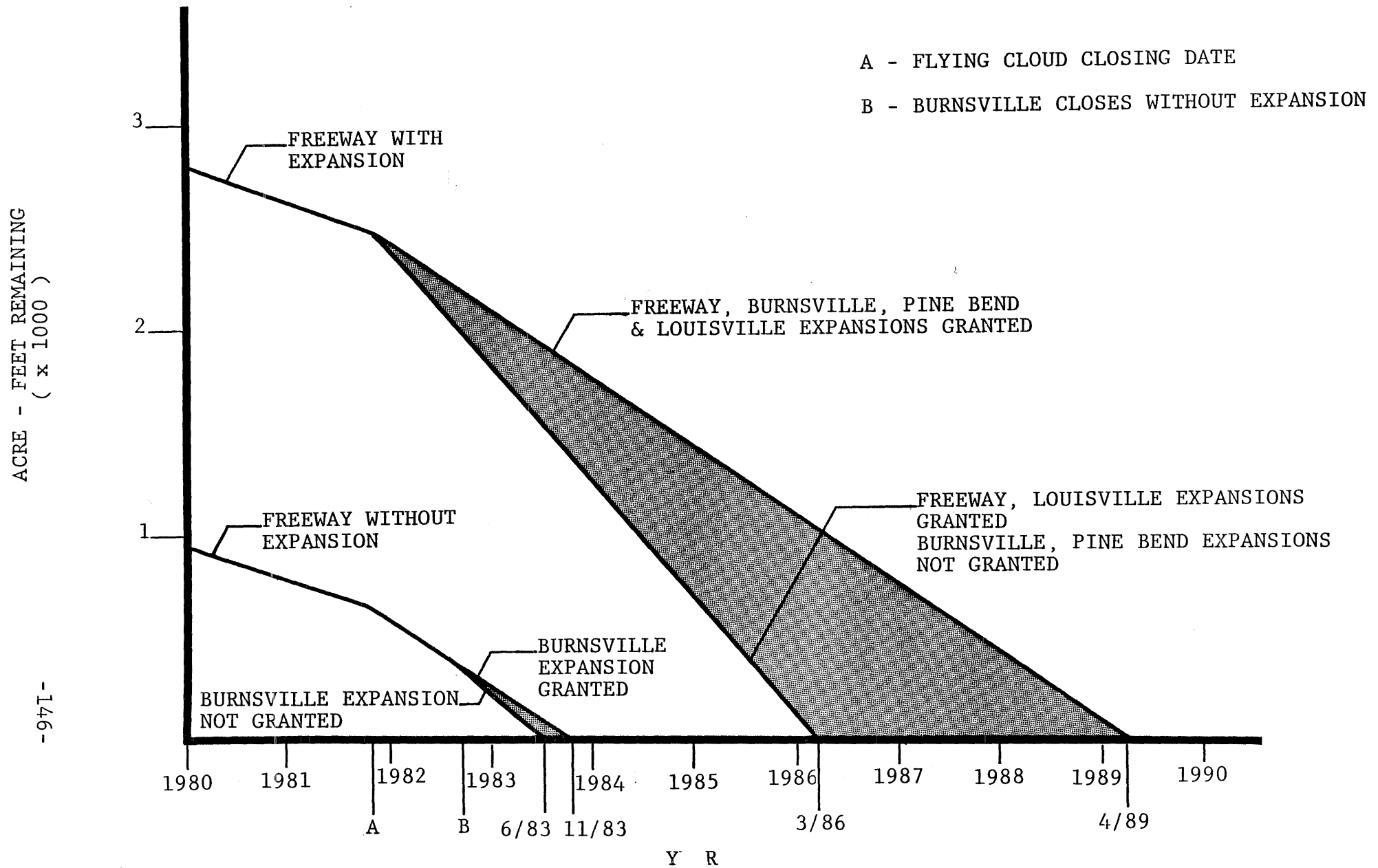
As noted earlier, if Freeway is not granted the expansion, it will close in mid or late 1983. The haulers using Freeway Sanitary Landfill will then have to dump their loads at other landfills which are still open. This may result in increased nonproductive driving time for some haulers. Both labor and fuel costs for these haulers may increase resulting in increased collection fees to the residents. Also new haul routes may have to be established resulting in increased wear and nuisance problems (e.g., litter, noise, fugitive dust, etc.).

The increased receiving rates at other landfills may result in increased operational expenses in order to handle the additional volume. This may result in higher disposal charges which may, in turn, result in higher collection fees to residents.

The proposed expansion represents 1860 acre-feet of new landfill capacity. If not granted, it is reasonable to consider this capacity as part of that required by any new landfill serving the area. Developing a new landfill involves three phases or elements of work. These are preliminary planning, siting and site preparation, and operation. Generally the first two phases include assessment of need, alternatives analysis, site inventory, site selection and

Figure VI-

FREEWAY DISPOSAL CAPACITY PROJECTION



acquisition, environmental impact statement, hearings, permit applications, and construction and site preparation. Operation is an immediate occurrence following the first two phases.

The first phase in the development of a new site will be landfill base preparation which will involve grubbing, excavation and overburden material, grading, and the emplacement of lining material. Leachate collection and treatment system costs will vary depending on site conditions. Additional costs may include sedimentation basins and drainage facilities. To prevent scavenging, vandalism, and unauthorized dumping, a 10-foot high heavy gauge chain-link fence is usually erected. Additional cost factors include the construction of an access road, buildings for site personnel and equipment storage, landfill equipment and monitoring facilities.

If the entire site using an example of (120 acres) is developed initially, the estimated total construction costs would be about \$3,500,000 to \$4,000,000. Contingencies, legal, administrative and engineering costs can increase this amount by 20 to 40 percent, depending upon the complexities of the project. Thus, total estimated construction cost would approximate \$4,200,000 to \$5,600,000 to fully develop the site. Annual operation and maintenance costs, cover material, and site closure are not included in the above example.

If the expansion is not granted, a new landfill facility will have to be sited at least nine months sooner. The planning, development and operation phases of landfill siting and construction for a new facility to serve the Region would have to be accelerated accordingly. The proposed expansion of Freeway Sanitary Landfill represents about four percent of the Region's landfill capacity needs without any expansions through the year 2000.

ENVIRONMENTAL IMPACTS

The expansion represents 1860 acre-feet of additional refuse material. This added quantity of refuse will increase the total leaching potential of Freeway Sanitary Landfill. The amount of leachate any landfill generates is a direct function of the amount of refuse buried (see Water Quality Section). If the expansion is not granted, the leaching potential would not be increased when considering volume of refuse only.

SITE SPECIFIC DESIGN ALTERNATIVES

SURFACE WATER RUNOFF CONTROL

The landfill boundaries remain fixed under the proposed vertical expansion by the Freeway Landfill owner, Richard B. McGowan Company. Final grades on the entire fill area are sloped to provide surface runoff from the higher final elevations of the landfill, but at the same time control of erosion on the surfaces is achieved by using less than maximum allowable slopes. Additional or alternative surface runoff controls to those in the proposed site development plans are not necessary.

LEACHATE CONTROL

A hydrogeologic investigation of the Freeway Landfill site revealed that percolation from the landfill in the form of leachate under natural conditions will not recharge the aquifers in the Jordan sandstone underlying the Shakopee-Oneota formation that is the bedrock beneath the landfill. The piezometric pressure levels in the Jordan and Shakopee-Oneota aquifers are great enough to exclude percolation from the landfill area; under natural conditions there is a northerly flow of ground water in the soil above bedrock that discharges into the Minnesota River. Any percolation that might be collecting in the quarry on the south boundary of landfill is pumped to the river. Also, there are no wells near the landfill which draw water from the surface soils.

A liner does not exist beneath the refuse deposited at the site since the landfill opened in 1971. Richard B. McGowan Company has not proposed a liner installation in conjunction with the current proposal to expand vertically. In view of the negligible effects observed upon the Minnesota River of the seepage that has occurred from the existing landfill and the minimal potential for increase in detrimental effects due to a vertical expansion only of the landfill, a requirement for leachate control by means of a liner would not be reasonable. Through proper operations, i.e. daily cover, runoff provision (maintaining proper drainage so as to reduce rainfall ponding and penetration) and vegetative cover on both intermediate and final slopes, the effects of leachate can be mitigated and no noticeable decrease in water quality will occur in the Minnesota River.

A leachate treatment system will vary depending on site conditions which influence flows and pollutant loadings. Capital costs for both collection and treatment facilities can vary considerably. For treatment of low strength to high strength pollutant loadings, costs have been estimated to vary between \$85,000 and \$600,000 respectively. The alternative to no liner and leachate control is continued monitoring of both ground water and surface water for possible effects during the active filling period and postmonitoring for a period following final closure of the landfill.

GAS CONTROL

The existing Freeway Sanitary Landfill has no special gas control system installed, nor does the proposal for vertical expansion contain a provision for such control. The landfill to date has had no problems with gas accumulation or landfill gas odors beyond the landfill site and no such problems are anticipated with the vertical expansion. The landfill's operational practices should minimize any gas hazard since the amount of water in contact with the buried refuse is kept to a minimum. A slow rate of decomposition will reduce the possibility of explosive concentrations being reached. Also, no occupied buildings are adjacent to the landfill which might be subjected to lateral movement of gas from within the landfilled refuse. Therefore, no new gas control alternatives would be deemed reasonable.

Freeway Sanitary Landfill has not proposed installation of a methane gas recovery system. Such a system, if deemed economically feasible, could provide an energy resource from a waste source and supply methane gas to industrial facilities located nearby for an appreciable period of time.

For discussion of the following sections pertaining to alternatives to the proposed expansion, refer to Draft Environmental Impact Statement on the Pine Bend Sanitary Landfill Expansion, April 29, 1980 (available upon request of the Metropolitan Council):

SITE SPECIFIC DESIGN ALTERNATIVES (continued): Compaction,
Shredding, Bailing
WASTE REDUCTION
ENERGY RECOVERY

MATERIALS RECOVERY

Encompassed within this analysis of alternatives to the proposed expansion is the following discussion of materials recovery which provides for material-specific alternatives to any land disposal facility. Materials recovery systems probably are the only reasonable and prudent alternatives to the proposed action that presently exist.

The following information is a summary of the more complete Materials Recovery Alternative Analysis which is available from the Metropolitan Council upon request.

Given the estimate that the Region currently recovers seven to eight percent of the total waste stream, it is possible this recovery rate could be increased to as high as 30 percent utilizing the following systems: residential source separation - 20 percent, corrugated recovery - 5 percent, and leaf composting - 5 percent. This could be accomplished through: government support of existing recycling programs through involvement in public education, staged development of municipal source separation programs to compliment garbage collection, increased picking programs at transfer stations and landfills, and new leaf pick-up and composting programs similar to Roseville's system.

The Metropolitan Council's and MPCA's preliminary cost-benefit analysis of increased materials recovery indicates that there would be a net economic savings to the community if recycling, source separation and composting programs were expanded. This analysis

included the total management costs such as: operating, capital transport, disposal and labor. In addition, the community would gain the following secondary benefits: conserved materials resources, conserved energy, increased public awareness of solid waste management problems and new jobs. However, the most important benefit may indeed be saved landfill space.

REFUSE TO ENERGY SCENARIOS

Based upon scenarios developed by the MICA (Metropolitan Inter County Association), refuse to energy facilities will come on line no earlier than mid-1985. Since Freeway's projected closing date without the expansion is mid or late 1983, there is essentially no possibility for refuse to energy facilities to utilize the refuse generated during that interim period of time.

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FREEWAY SANITARY LANDFILL EXPANSION

SECTION VII

THE IMPACT ON STATE GOVERNMENT OF ANY FEDERAL CONTROLS
ASSOCIATED WITH THE PROPOSED ACTION

Refer to the Pine Bend Sanitary Landfill expansion environmental impact statement for a discussion of the impact on state government of any federal controls associated with the proposed action.

FRS789

FREEWAY SANITARY LANDFILL EXPANSION

SECTION VIII

MULTISTATE RESPONSIBILITIES ASSOCIATED WITH THE PROPOSED ACTION

GENERAL STATEMENT

The Freeway Sanitary Landfill and the proposed expansion and construction areas lie well within Minnesota borders, and because of this, there are no formal multistate responsibilities associated with implications, as discussed below.

ENERGY

The fuel consumed in filling the proposed expansion area will come from outside the state since Minnesota is an importer of energy products. Current energy requirements to operate the landfill would continue with implementation of the proposed actions.

WATER QUALITY

All leachate seepage entering the ground water system will eventually reach the Minnesota River and impact it accordingly. The Minnesota River is an interstate water body used as a water supply, fishery and for recreation by other states. As previously shown, the impact of leachate seepage into the river from the landfill, and that resulting from filling the proposed expansion area, will be negligible. There would, therefore, be no impact on the quality of the river in other states. However, the cumulative impacts of leachate from landfills and other sources of pollution in the Metropolitan Area will have a significant impact on the quality of the river in other states.

FWS789

FREEWAY SANITARY LANDFILL EXPANSION

SECTION IX

IMPACTS ON COUNTY PLANNING

Refer to the Pine Bend Sanitary Landfill expansion environmental impact statement for a discussion on county solid waste planning.

FWS789

FREEWAY SANITARY LANDFILL EXPANSION

SECTION X

IMPACTS ON REGIONAL PLAN

METROPOLITAN SOLID WASTE PLAN

COMPLIANCE WITH REGIONAL PLAN

The following discussion concerns the proposed action's compliance with the policy framework and pertinent review criteria contained in the Council's regional solid waste policy plan.

Policy Framework

The Council's solid waste plan states that the siting and development of new landfills and increasing the capacity of existing sites must begin soon to meet the Region's disposal needs. The proposed filling of the expansion area at the Burnsville Landfill is certainly consistent with this objective. The proposal, however, must be balanced against the availability of present or future waste recovery or reduction methods for the Region's solid waste stream. The extent to which these technologies and reduce waste that would be going to the Burnsvillesite is largely unknown at this time. Further work is necessary, which will be accomplished over the next couple of years as required by the new Metropolitan Solid Waste Act of 1980.

For a further discussion on the Metropolitan Council's Solid Waste Policy Plan and the new Metropolitan Solid Waste Act of 1980, refer to the Pine Bend Sanitary Landfill environmental impact statement.

Review Criteria

Criterion 2c -- This criterion states that the development of proposed solid waste management facilities should be compatible with the Region's growth forecasts, the need to replace existing facilities and county schedules for implementing new waste facilities.

The proposed expansion of the Freeway Landfill will add to the life of the metropolitan land disposal system. The proposed expansion is consistent with the Council's determination that the siting of new landfills and expansion of existing landfills needs to be undertaken soon. However, the seven metropolitan counties are in the process of developing their solid waste master plans. These plans, along with the work required under the new Metropolitan Solid Waste Act, will provide development schedules for new land disposal, recovery and waste reduction facilities in the Region. Until this work is completed, it is difficult to determine the compatibility of the proposed expansion with other major planning efforts as required by this criterion.

Criterion 4b -- This criterion states that sites should be accessible year round by highways that have adequate capacity. In addition, this criterion states that roads used for hauling must meet safety standards of the governmental units having jurisdiction over them and that access to the site should not depend on the use of local and collector streets through residential areas.

Access to the Freeway Landfill is good.

Solid waste is brought to the disposal site by commercial haulers or private individuals along the roads shown in Figure II-1. The primary haul route is I-35W with access to the landfill from 113th Street South. Access to the landfill site is provided by an all weather, blacktopped entrance road.

Access to the landfill will not change with implementation of the expansion.

Access to the landfill does not depend on the use of local and collector streets through residential areas.

Criterion 4d -- This criterion states that, where possible, sites should be visually compatible with adjacent property or development. This criterion further states that residential and other nonindustrial land uses are considered compatible only if there are barriers to reduce noise and obscure public view.

The Freeway Landfill, including the expansion area, is compatible with the adjacent land uses in the Area. The property surrounding the landfill is zoned for general industrial uses (see Section III, Socio-Economics).

Filling of the proposed expansion area will result in the landfill operating 4-6 years longer. A few nearby homes (in the Bloomington area) that look directly upon the landfill will be exposed to the operation of the facility for these additional years and any subsequent visual impacts. Such impacts will be greater than those already present since the final vertical elevation of the expansions will create an isolated mound virtually level with the opposing bluff in Bloomington.

Filling of the expansion area will make the site more visible from I-35W. There is presently limited view of the site from I-35W

Criterion 5a -- This criterion states that the site selection process for land disposal facilities should include an evaluation of the site's capacity to assimilate waste and its constituents.

Ground water monitoring has shown some degradation of ground water immediately underneath the landfill. However, ultimate discharge of ground water is to the Minnesota River, which has not shown measureable contamination that can be attributed to the landfill. Dilution within the river appears sufficient to mitigate any potential adverse impacts from leachate produced by the landfill.

Criterion 5 -- This criterion provides that applicants should ensure that environmental monitoring will be conducted when the facility is operating, and should include evaluations of air and water quality.

Five piezometers have been installed to monitor possible impacts by the landfill including subsequent surface water impacts (see Figure II-6 for locations). The monitoring plan includes quarterly sampling of four surface stations and the five ground water wells for the following parameters: COD (filtered and total), BOD (filtered and total), chloride, specific conductance, pH, copper and total chromium. This monitoring system will remain in operation during and subsequent to the filling of the landfill including the proposed expansion.

Operation of the landfill has not resulted in any reported air quality problems at the facility itself or the surrounding area. There appears to be adequate measures to contain fugitive dust and other emissions generated by operations of the landfill (see Air Quality, Section III). Environmental monitoring for air quality related problems doesn't appear necessary at the site.

Criterion 5g -- This criterion states that the grounds of solid waste facilities should be landscaped wherever possible. The criterion further states that those areas where waste is dumped or salvaged should be screened from public view and routine measures should be instituted to control dust, blowing litter, odors and other potential nuisances.

The landfill has been cited a number of times by the MPCA for litter violations. Moreover, odors from the landfill have been noticed by residents across the river on the opposing bluff. The landfill has had a history of violating daily cover requirements which could be contributing to the odor problems.

Litter control consists of having attendants picking up paper and other debris which may be scattered on the site. Litter control fences are also used to prevent wind-blown material from leaving the site.

Refer to Criterion 4d for a discussion on visual impacts.

Criterion 6c -- This criterion states that proposed solid waste management facilities should have controlled access to prevent entry or unauthorized disposal during nonoperational hours.

Security at the site is provided by an attendant who is on duty during the operating hours of the landfill. The attendant, limits access to the site and provides directions for unloading vehicles. In addition, an employee of the landfill lives in a house-trailer located at the site's entrance. This employee provides security during the nonoperating hours of the landfill.

The landfill, however, is not fenced and off-road access is possible.

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FRREF

Appendix I

LEGAL DESCRIPTION OF FREEWAY LANDFILL

South 400 feet of Government Lot 7 in Section 28, Township 27, Range 24, except the West 450 feet thereof, subject to an easement for road purposes of a track of land 2 rods in width, the north line of said track being parallel to and 400 feet north of the south line of said lot 7.

Government Lot 7, except that part line both north of road and west of the East 780 feet thereof, and also except the South 400 feet line east of the West 450 feet thereof, and except that part taken for highway purposes, all in Section 28, Township 27, Range 24.

Southeast Quarter of the Southeast Quarter (S.E. 1/4 of S.E. 1/4) of Section 28, Township 27, Range 24, according to Government survey.

Southwest Quarter of Southeast Quarter (S.W. 1/4 of S.E. 1/4) of Section 28, Township 27, Range 24, according to Government survey.

LEGFW

"Appendix II"
Chronology of Significant Events
Inspections - Violations
Freeway Sanitary Landfill

FREEWAY LANDFILL CHRONOLOGY

- July 19, 1968 - Freeway is operating as dump
- June 17, 1969 - Conditional use permit granted by the Village of Burnsville to operate a sanitary landfill
- June 18, 1969 - Letter from Russ Streefland, attorney representing Kraemer concerning the Freeway landfill
- July 7, 1969 - Letter from David Durenberger requesting an investigation into the site of the Freeway landfill
- July 14, 1969 - Letter from the Lower Minnesota River Watershed District requesting McGowan obtain a permit from them to operate a landfill in a floodplain.
- August 7, 1969 - Site investigated by MPCA staff. No enforcement action at this time until solid waste regulations become law.
- September 24, 1969 - Permit to construct dike and operate a landfill issued by the Lower Minnesota River Watershed District.
- September 8, 1970 - Prior to this date, McGowan applied for an MPCA sanitary landfill permit
- February 11, 1970 - Letter from MPCA denying the permit application re:
 - fill area in a floodplain
 - surface water protection and diversion inadequate
 - ground water protection inadequate
 - fill area within 1,000 feet of I-35
 - approach road sometimes flooded
 - the availability of adequate cover material is not substantiated
 - no water monitoring plan provided
 - several other reasons
- April 19, 1971 - Letter from Dakota County Commissioners expressing some surprise MPCA is considering permitting landfills in a floodplain.
- June 3, 1971 - Letter from the Burnsville Environmental Quality Council approving the Freeway and Burnsville landfills.
- June 8, 1971 - State Attorney General opinion on the Freeway and Burnsville landfills. Recommended the Freeway permit be denied.
 - the landfill is in violation of the Village of Burnsville ordinance on several points
 - the landfill would violate solid waste regulations 4, 5

Freeway Landfill Chronology
page 2

- June 18, 1971 - Letter from Special Assistant to the Attorney General recommending an interim permit for the Freeway and Burns-ville landfills to expire October 31, 1971.
- October 14, 1971 - Solid waste permit #57 was issued to the Freeway Landfill. A variance was given concerning the distance to municipal wells.
- November 16, 1971 - Letter from the Agency to McGowan outlining some of the agreed upon actions he would be taking:
--extend dike
--provide monitoring wells
--construct toxic and hazardous waste facilities
--monthly reports
- December 31, 1971 - This date was set by the county to have all nonconforming dumps closed.
- February 8, 1972 - Violation--working face too large
- February 18, 1972 - Fire on site
- March 30, 1972 - Staff memo stating that the Freeway Landfill is probably the best operated sanitary landfill in the state.
- April 27, 1972 - Inspection; some litter problems
- June 17, 1972 - Inspection; working face too large and some erosion is taking place.
- October 6, 1972 - Violation--wood dump area burning
--working area too large
--litter
--erosion
--lack of cover on demo area
- November 28, 1972 - Violation--daily cover
--working face too large
- March 13, 1972 - Violation--daily cover
--working face too large
- April 24, 1973 - Violation--daily cover
--litter
--working face too large
--filling with refuse too close to the water table
- June 6, 1973 - Violation--cover
--working face too large

August 10, 1973 - Violation--operation on the edge of I-35 drainage stream
refuse piled 5 feet high

August 28, 1973 - Letter from the Burnsville Environmental Advisory Council
states that the landfill is dumping in a wetland and
directly into the stream next to I-35

September 6, 1973 - Violation--daily cover
--working face too large.
--erosion
--refuse deposited too close to the stream

September 12, 1973 - MPCA letter to the Department of Natural Resources requesting
clarification of the stream on the Freeway Landfill. It
appears the stream was overlooked when the permit was prepared.

October 30, 1973 - Violation--one big mess; resembles an old dump
--daily cover
--very large working face
--old fill area has refuse exposed
--all the demo material placed within 25 feet of
the stream has not been removed
--litter

February 11, 1974 - Staff report. Filling in wetland is permitted. Need
culvert pipe to drain off excess water.

February 1, 1974 - Letter from the Burnsville Environmental Advisory Council
criticising the filling in the wetland.

March 3, 1974 - Violation--daily cover
--salvaging

May 28, 1974 - Violation--litter
--cover

June 25, 1974 - Letter from the U.S. Fish & Wildlife Service protesting the
filling in of the wetland and stream. They contend McGowan
needs Corps 404 permit.

July 12, 1974 - Violation--clean fill in wetlands should be covered with
clean earth
--litter

July 31, 1974 - MPCA letter to McGowan requesting tardy monitoring reports

August 8, 1974 - Meeting with the Corps of Engineers regarding need for a
404 permit

October 4, 1974 - Dakota County letter reporting sewage being dumped at Freeway

Freeway Landfill Chronology

page 4

- October 7, 1974 - Violation--daily cover
--final cover
--litter
--"same as usual"
- January 15, 1975 - Letter from U.S. Fish & Wildlife Service requesting need
for prompt action. Wetland is almost completely filled in.
- February 26, 1975 - Violation--litter
--ponding water
--dumping of snow
- March 13, 1975 - Inspection with U.S. Fish & Wildlife Service. Fish & Wildlife
Service feels the landfill is in violation of Sect. 13 Rivers
and Harbors Act and Section 404 of the Federal Water Pollution
Control Act.

The Fish & Wildlife Service was told by the MPCA at the
August 1974 meeting that the Agency would not take any
action to limit the filling in the wetland.
- March 31, 1975 - Violation--litter
--daily cover
--ground water monitoring reports not submitted.
- April 9, 1975 - MPCA staff memo concerning the filling in of the wetland
and stream
- May 23, 1975 - Letter from U.S. Fish & Wildlife Service protesting the
filling of wetlands
- May 29, 1975 - Site investigation with U.S. Fish & Wildlife Service, DNR
to determine if MPCA or DNR could take action against
McGowan for filling in the wetland. Determined wetland
was of little value. Take no action. In regard to the
pumping of water out of the wetland, the DNR feels no permit
is needed.
- June 13, 1975 - Violation--litter
--ground water needs to be resampled.
- July 2, 1975 - MPCA response to U.S. Fish & Wildlife Service letter of
May 23, 1975. The filling of the wetland was permitted
prior to September 1973 when the solid waste regulation
prohibiting wetland filling was adopted. Therefore, the
new regulations do not have jurisdiction over the Freeway
Landfill.
- July 30, 1975 - Violation--ground water monitoring reports overdue
--salvaging

page 5

August 8, 1976

- MPCA memo concerning leachate draining into the stream on the east side of the landfill
 - leachate discharge is 20,000 gpd
 - recommend a stipulation agreement
 - sampling data
 - require McGowan to submit plans and specifications for correcting the problem

Freeway Landfill Chronology
page 6

- September 8, 1976 - Letter from Barr Engineering summarizing the geology and ground water characteristics at the Freeway site.
- December 10, 1976 - MPCA letter to Barr Engineering requesting that they demonstrate the water quality standards in the Minnesota River are not violated.
- January 12, 1977 - Violation--litter
--leachate
- February 7, 1977 - MPCA letter to McGowan concerning the leachate generation and operational concerns
- February 1, 1977 - Violation--litter
--demo
--plan compliance
--excavation down to bedrock
- February 3, 1977 - Meeting with McGowan. Several topics discussed. Suggest a stipulation agreement be developed. Mr. McGowan did not agree with the stream classification.
- April 15, 1977 - Violation--terminal cover
--litter control
- May 4, 1977 - MPCA memo; reviewing proposed revised monitoring program
- May 9, 1977 - Violation--litter
--demolition
--leachate discharge
--stop the excavation of peat ahead of the fill area
- July 1, 1977 - MPCA letter to McGowan transmitting draft stipulation agreement and indicating a need to evaluate the impact of the landfill on the area ground water.
- June 11, 1977 - Violation--working face too large
--leachate generator
--plan compliance
- August 4, 1977 - Violation--working face too large
--no water monitoring system
--leachate continues to drain
- September 2, 1977 - Letter to MPCA submitting the proposed ground and surface water monitoring program
- September 26, 1977 - Violation--working face too large
--ponding water on several locations

Freeway Landfill Chronology

page 7

- October 21, 1977 - Violation--operation of two fill faces
--litter
--leachate
- January 3, 1978 - Violation--excavating to the bedrock
--hazardous waste
- August 29, 1978 - Violation--daily cover
--terminal cover
--vegetation
--surface drainage
- September 13, 1978 - Permit modification. Revised water monitoring plan approved
- January 2, 1979 - Dakota County inspection. Violations
--daily cover
--working face too large
- April 26, 1979 - Violation--litter
--daily cover
- May 4, 1979 - Violation--litter
--demolition
--daily cover
- June 21, 1979 - Violation--working face too large
--daily cover
--intermediate cover
- August 1, 1979 - Violation--working face too large
--demolition
--final cover
- July 25, 1979 - Staff memo to Jay Heffern concerning proposed enforcement
action to be taken against the Freeway Landfill for
continued violations of the daily cover requirement.
- September 10, 1979 - Violation--daily cover
--surface water drainage; ponding

M E T R O P O L I T A N C O U N C I L
Suite 300 Metro Square Building, St. Paul, Minnesota 55101

M E M O R A N D U M

January 13, 1981

TO: Physical Development Committee

FROM: Environmental Planning (Paul Smith)

SUBJECT: Setting of Public Meeting on the Freeway Landfill Expansion
Supplement to the Draft Environmental Impact Statement (EIS)
Metropolitan Council District No. 15
Metropolitan Council Referral File No. 7819-1

Attached is a supplement to the draft EIS on the Freeway Sanitary Landfill expansion. In August 1980, the Minnesota Environmental Quality Board (EQB) granted the Metropolitan Council an extension of time to complete the EIS on the Freeway Sanitary Landfill expansion. The extension of time was necessary to await the results of a report being prepared for the City of Burnsville on its water supply well field expansion program. The City's well field is located about 3500 feet south of the Landfill. The Council felt the City's report would provide further definition on the groundwater hydrology in the vicinity of the Landfill and any impacts that might occur to the City's well field as a result of the Landfill's expansion.

The supplement to the EIS describes the results of the City's water supply well field testing program. Groundwater characteristics in the vicinity of the well field and Landfill are defined and the impact on the aquifer under various pumping conditions is determined. The supplemental EIS states that the potential exists for the Landfill to adversely impact the City's well field.

The supplemental EIS was prepared pursuant to EQB regulations (MEQB21-MEQB41). The Council is required to hold an informational meeting on the document to receive public comment 30 to 45 days after filing of the supplemental EIS with the EQB. Upon closure of the informational meeting record (20 days after the meeting), the Council will have 30 days to prepare and file with EQB the final EIS on the project.

RECOMMENDATIONS

1. That the Metropolitan Council file the supplemental Environmental Impact Statement on the Freeway Sanitary Landfill expansion with the Minnesota Environmental Quality Board.
2. That the Metropolitan Council set February 26 as a public meeting date to receive public comments on the supplemental EIS.

2 copies

SUPPLEMENT TO
DRAFT ENVIRONMENTAL IMPACT STATEMENT
FREEWAY SANITARY LANDFILL EXPANSION
BURNSVILLE, MINNESOTA

January 20, 1981

Metropolitan Council
Suite 300 Metro Square Building
St. Paul, Minnesota 55101

INTRODUCTION

In August 1980, the Minnesota Environmental Quality Board granted the Metropolitan Council an extension of time to complete the environmental impact statement (EIS) on the Freeway Sanitary Landfill expansion. The extension of time was necessary to await the results of a report being prepared for the City of Burnsville on its water supply well field expansion. The City's well field is located about a 3500 feet south of the Landfill. The Council felt the City's report would provide further definition on the groundwater hydrology in the vicinity of the Landfill and any impacts that might occur to the groundwater and City's well field as a result of the Landfill's expansion.

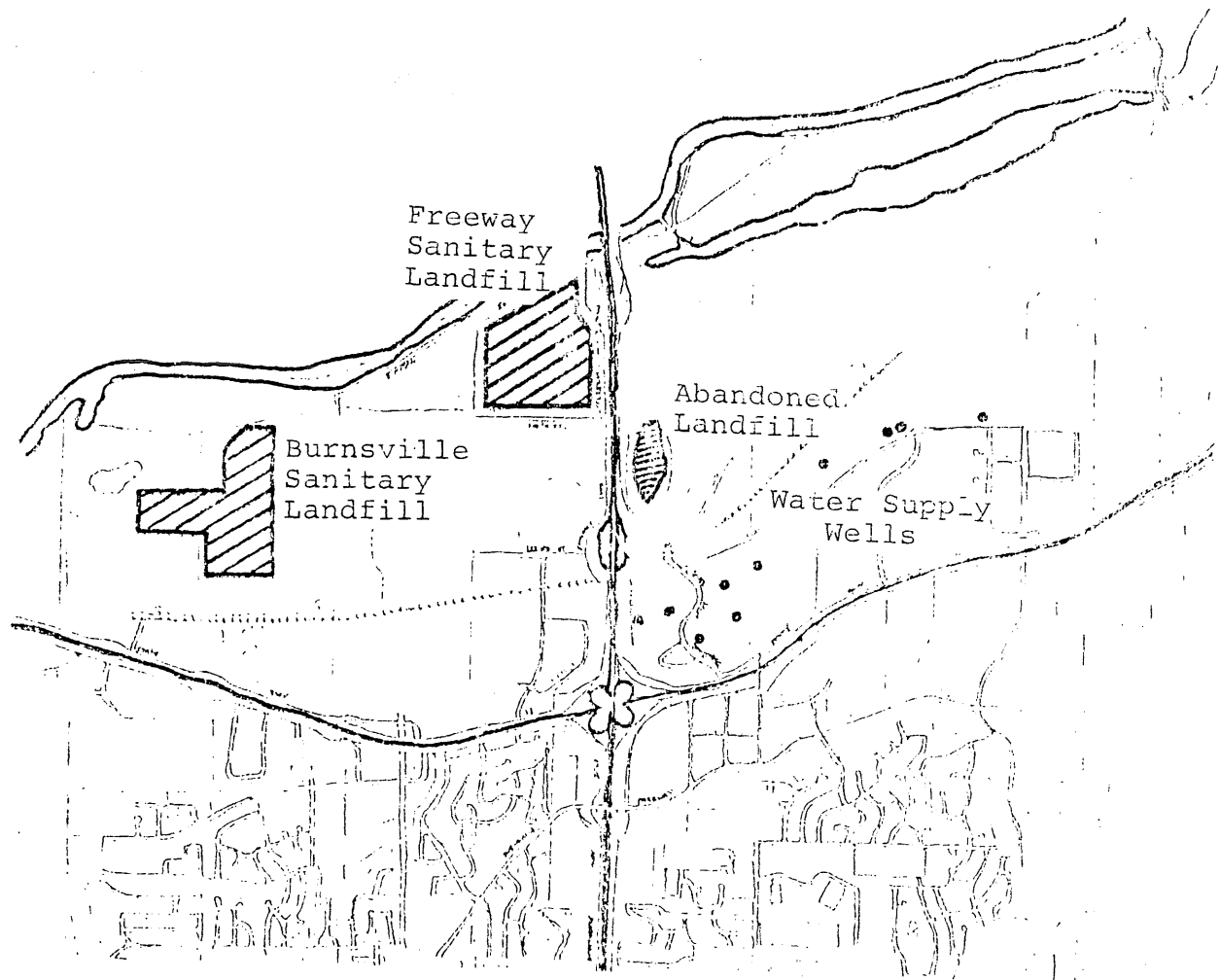
The City's report on its water supply well field expansion was completed in December 1980. The following analyses of the City's report will supplement the draft EIS on the Landfill expansion. The analyses will be contained in the groundwater sections of the final EIS.

WELL FIELD TESTING PROGRAM

Well field testing procedures, starting in March 1980, were conducted as part of Burnsville's continuing municipal water well development program. The well field testing program was undertaken in response to conclusions presented in a report regarding groundwater investigations in 1978 which identified a condition that posed a potential contamination threat to the Jordan aquifer in the well field area. According to the 1978 report, observed interference water level fluctuations indicated the possibility of groundwater gradient reversals extending beneath the Minnesota River floodplain.

The proximity of the City's water supply well field to the Landfill is shown in Figure 1. As can be seen, the Landfill is about 3,500 feet north of the well field. In addition, Figure 1 shows the location of the Burnsville Sanitary Landfill and an abandoned landfill north and slightly west of the well field. The immediate location of the abandoned landfill to the well field was the major reason for the City to undertake the 1980 study. The possibility of leachate from this landfill descending to the Jordan aquifer during periods of pumping at the wells that produce the gradient reversal represented the most immediate potential threat.

The implementation of the well field testing procedures required as a basic minimum, one observation well in Jordan sandstone and one observation well in the Shakopee dolomite. Accordingly, the existing Jordan aquifer well located at the former site of the City's sewage treatment facility was modified for water level instrumentation and a new well was constructed in the Shakopee dolomite approximately 48 feet south of the Jordan aquifer well.



Burnsville's Water Supply Well Field

Figure 1

Water samples were collected weekly starting on July 1, 1980 and continuous water level recorders were installed at the Jordan and Shakopee observation wells on July 17, 1980. Pumping tests were then run at the City's water supply wells number 2, 3, 4, 6, 7, 8 and 10 during the month of August (see Figure 2). The tests consisted of pumping an individual well for two hours while the other wells remained off. The closest wells to the pumping well were used as observation wells. Water level fluctuations were also recorded at the Jordan and Shakopee observation wells.

HYDROLOGY

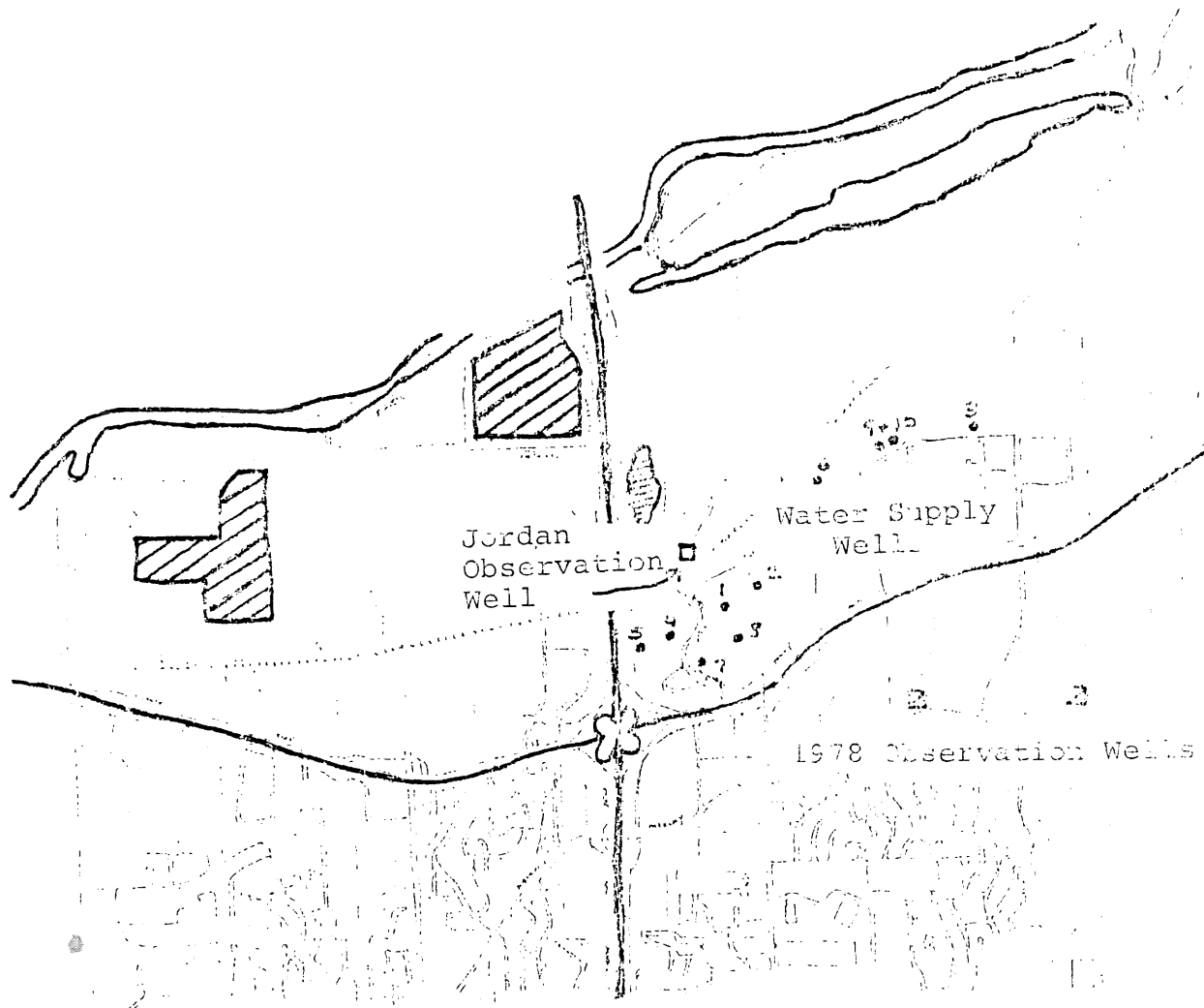
In evaluating an aquifer that is selected as a source of water supply, the recharge and discharge relationship with underlying and overlying aquifers must be considered. Under natural conditions the water in the Jordan sandstone was in a state of equilibrium. Although the water level fluctuated from season to season and year to year in response to changes in recharge and discharge, over long periods of time the average discharge was equal to the average recharge and the fluctuation occurred through a relatively narrow zone.

Prior to the development of groundwater supplies or other works of man that disturbed the natural flow of groundwater, recharge to the Jordan aquifer occurred mainly beneath the upland areas remote from the major stream valleys and discharge occurred through the overlying geologic units to the major streams and lakes located in the floodplains. At Burnsville, the natural groundwater discharge was concentrated in the Minnesota River Valley and ultimately, the groundwater left the area as stream flow or evapotranspiration.

A potentiometric surface map based on available water levels in Jordan wells is shown on Figure 3.

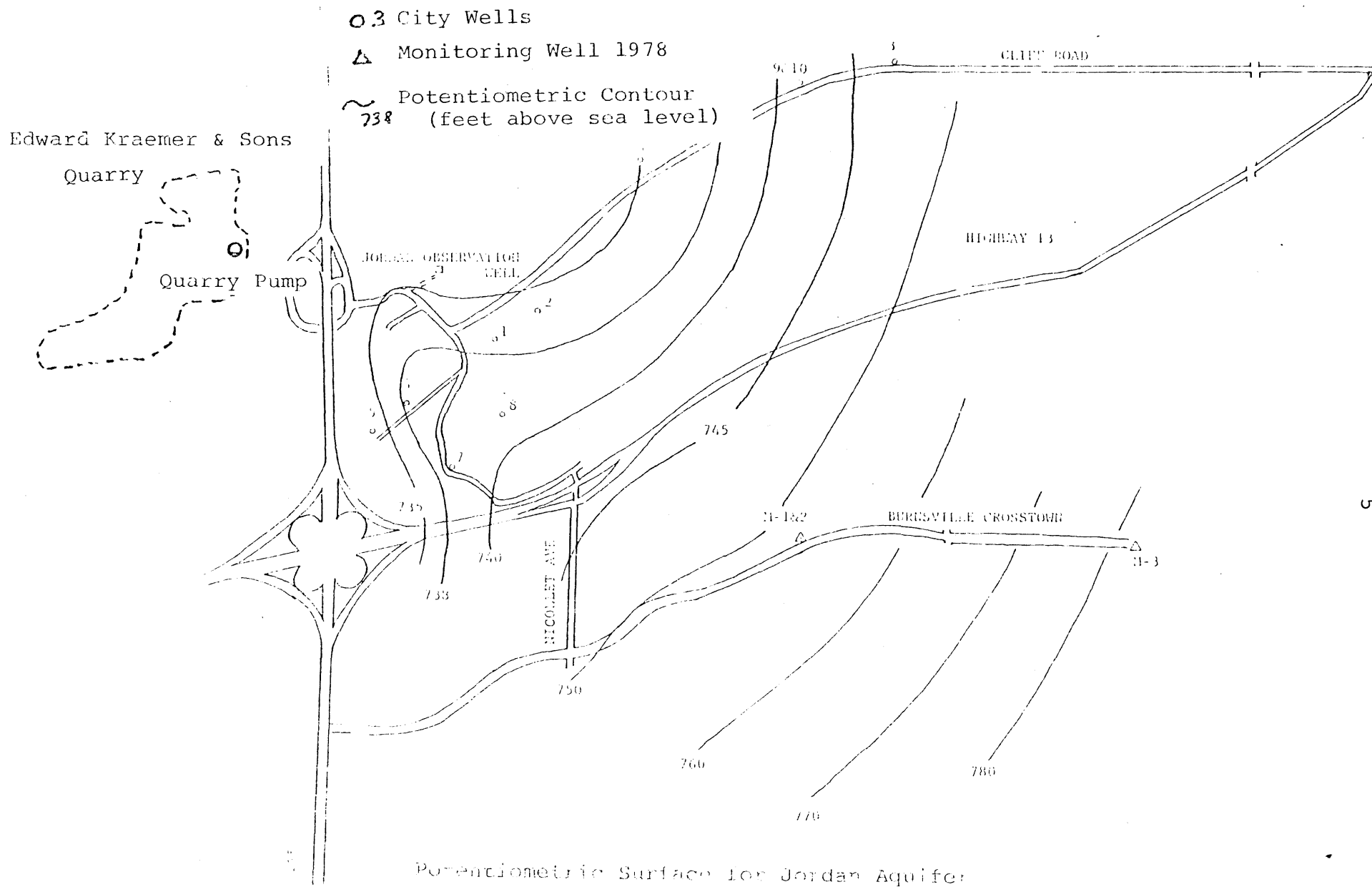
The installation of wells in the Jordan aquifer and development of a quarry in the overlying Shakopee-Oneota dolomites approximately 3,000 feet west (see Figure 3) of the observation wells tends to modify the natural equilibrium and distort the flow patterns within each unit as well as the groundwater transfer between the units. Dewatering operations at the quarry, which is in an area of natural groundwater discharge, created a cone of depression, increased the vertical gradient from the Jordan aquifer and consequently also increased the transfer of water from the Jordan. In contrast, the new wells open only to the Jordan aquifer, tend to reduce the vertical gradient in the areas of natural discharge and in heavily pumped areas cause a transfer of water from the dolomite to the sandstone.

The geologic cross sections shown on Figures 4 and 5 represent the stratigraphy of the Burnsville area and indicate the general direction of groundwater flow. In a natural condition the hydraulic gradient is from the south to the north, flowing towards the river. Under the influence of pumping of the city wells, this gradient is reversed in the area north of the well field, such that groundwater moves to the south towards the well field. Along with the reversal of the groundwater flow there is leakage from the Shakopee dolomite into the underlying Jordan sandstone.



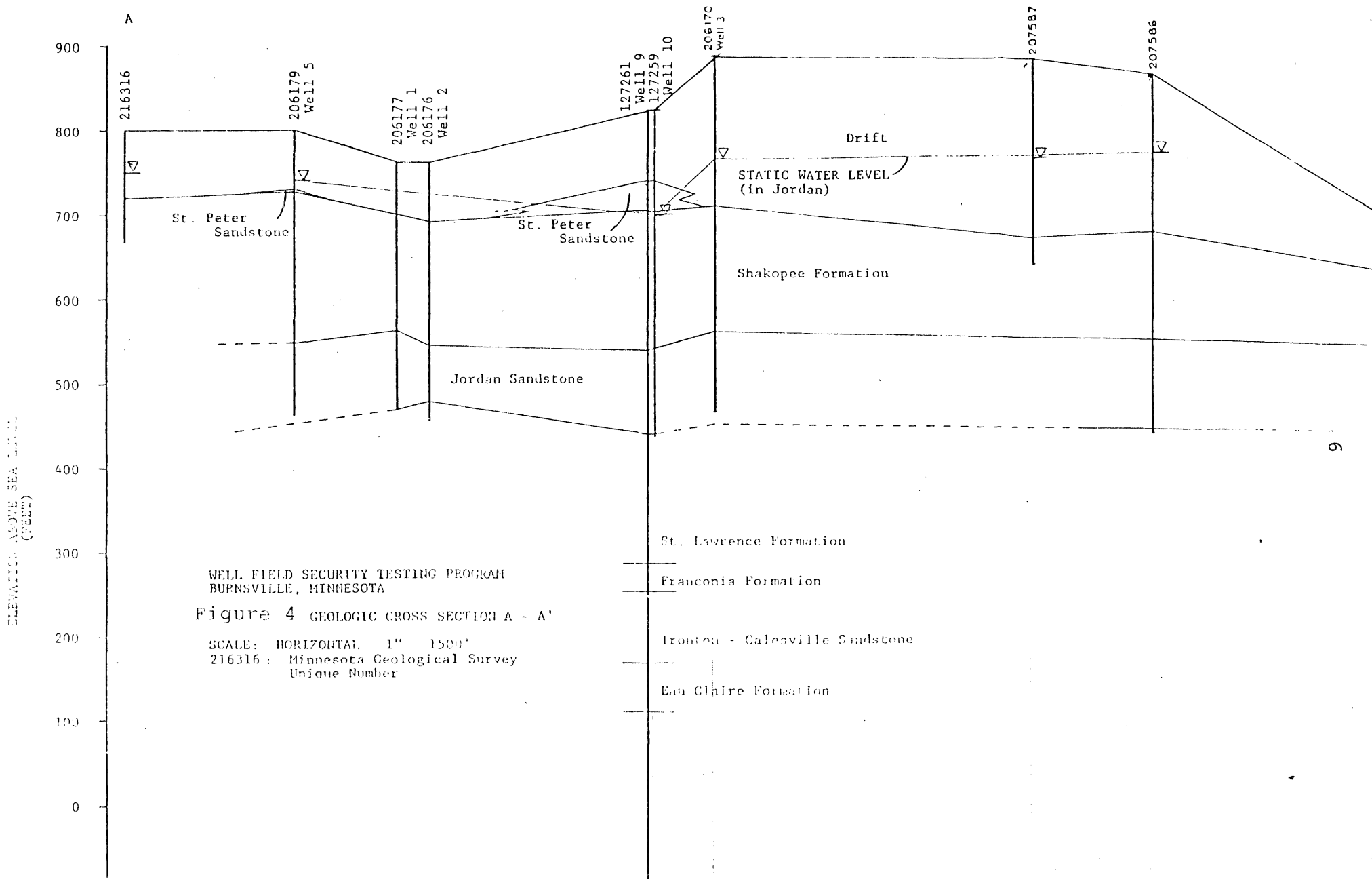
Well Field Testing Program

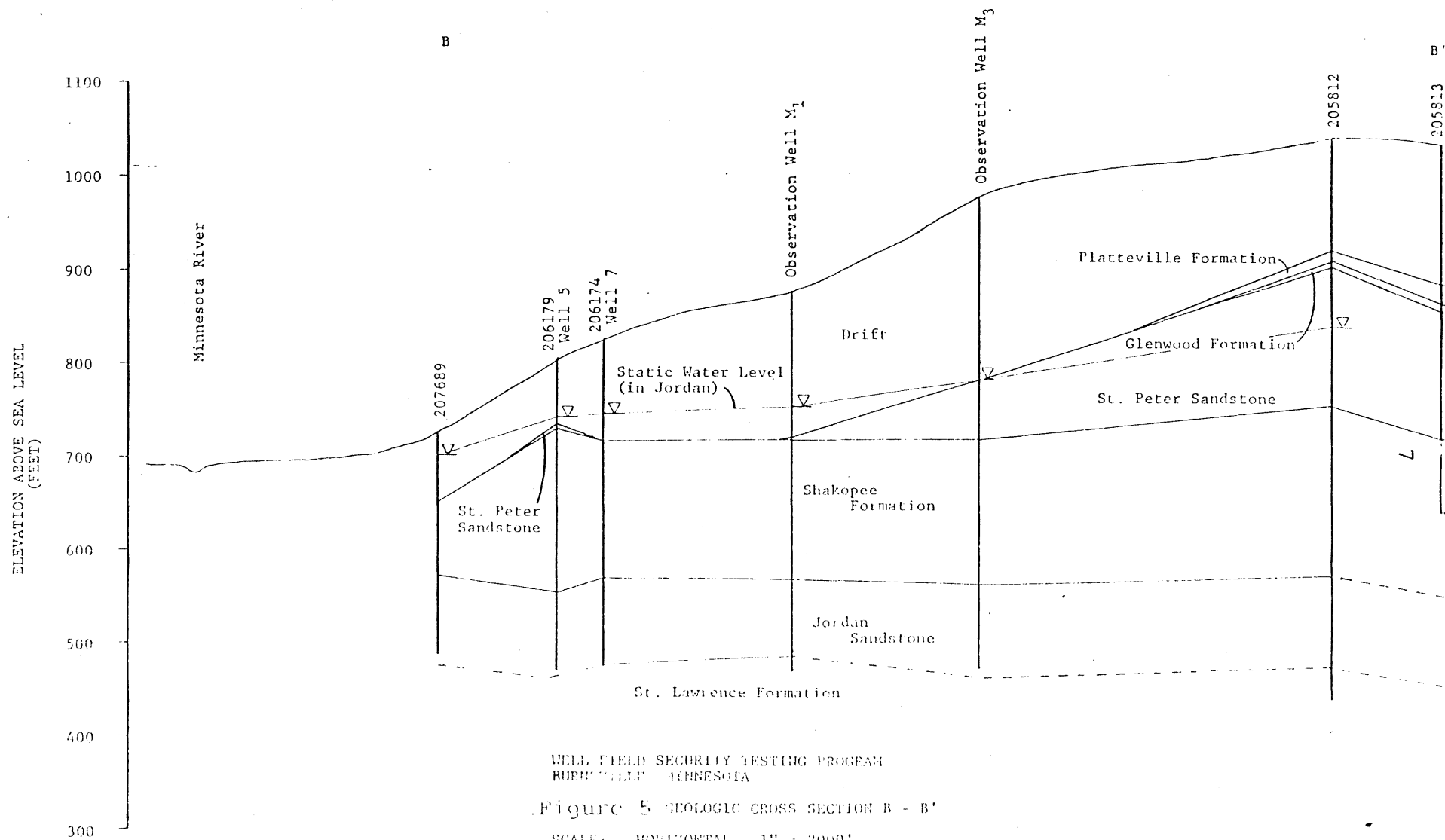
Figure 2



Prepared by Bruce Liesch Associates for City of Burnsville

Figure 3





WELL FIELD SECURITY TESTING PROGRAM
RUBENVILLE, MINNESOTA

Figure 5 GEOLOGIC CROSS SECTION B - B'

SCALE: HORIZONTAL 1" = 2000'

207689 Minnesota Geological Survey
Unique Number

This reversal of the groundwater flow takes place during part of the pumping cycle and during part of the recovery cycle. Reversal of flow is known to be noncontinuous because after the pumping of all the city wells, the Jordan observation well recovers to the point where it is discharging at the surface while the Shakopee well has a water level 8 to 9 feet below the surface. This indicates that the Jordan is leaking into the overlying Shakopee and flow into the Jordan from above cannot take place.

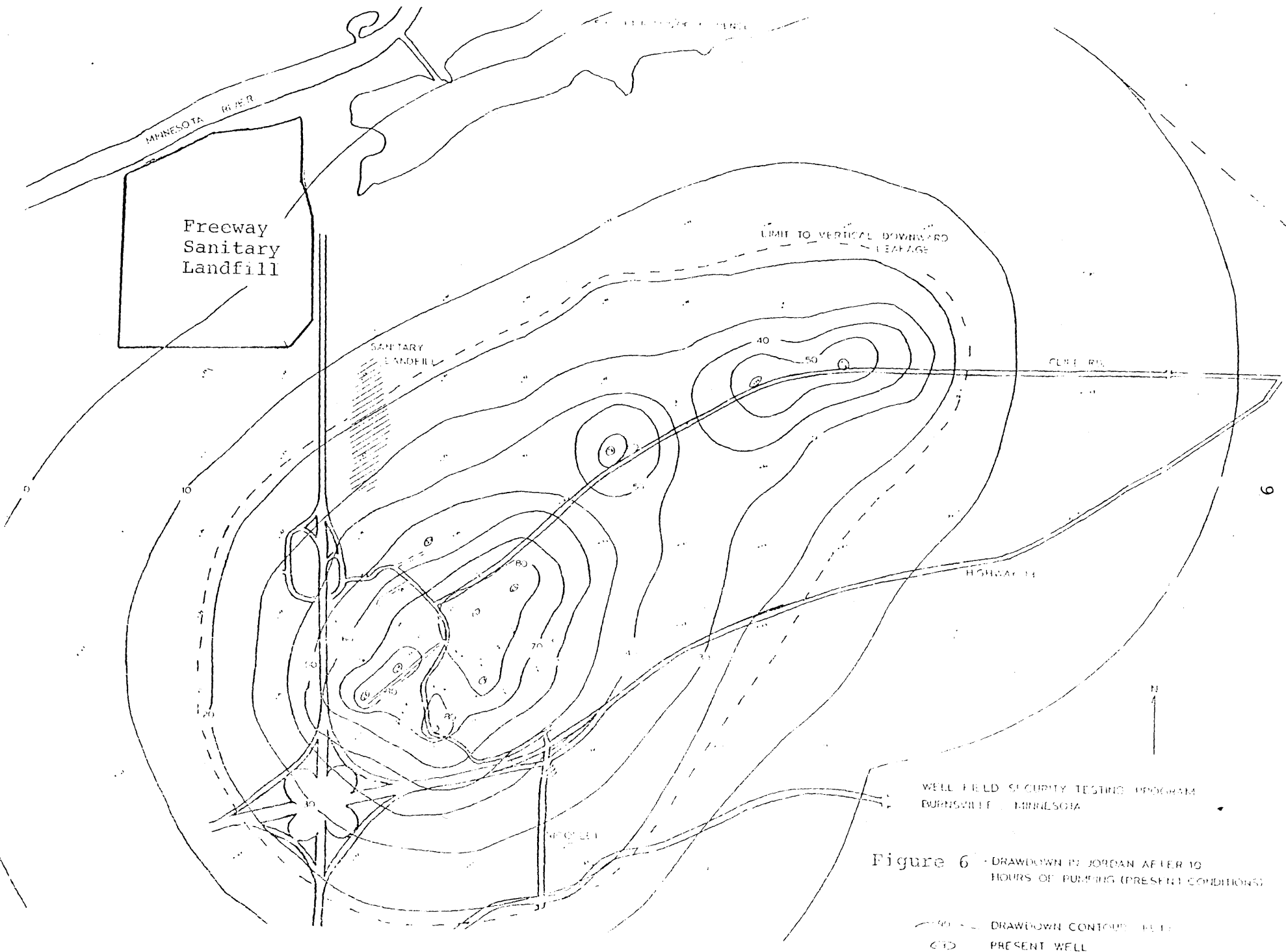
PUMPING TEST ANALYSIS

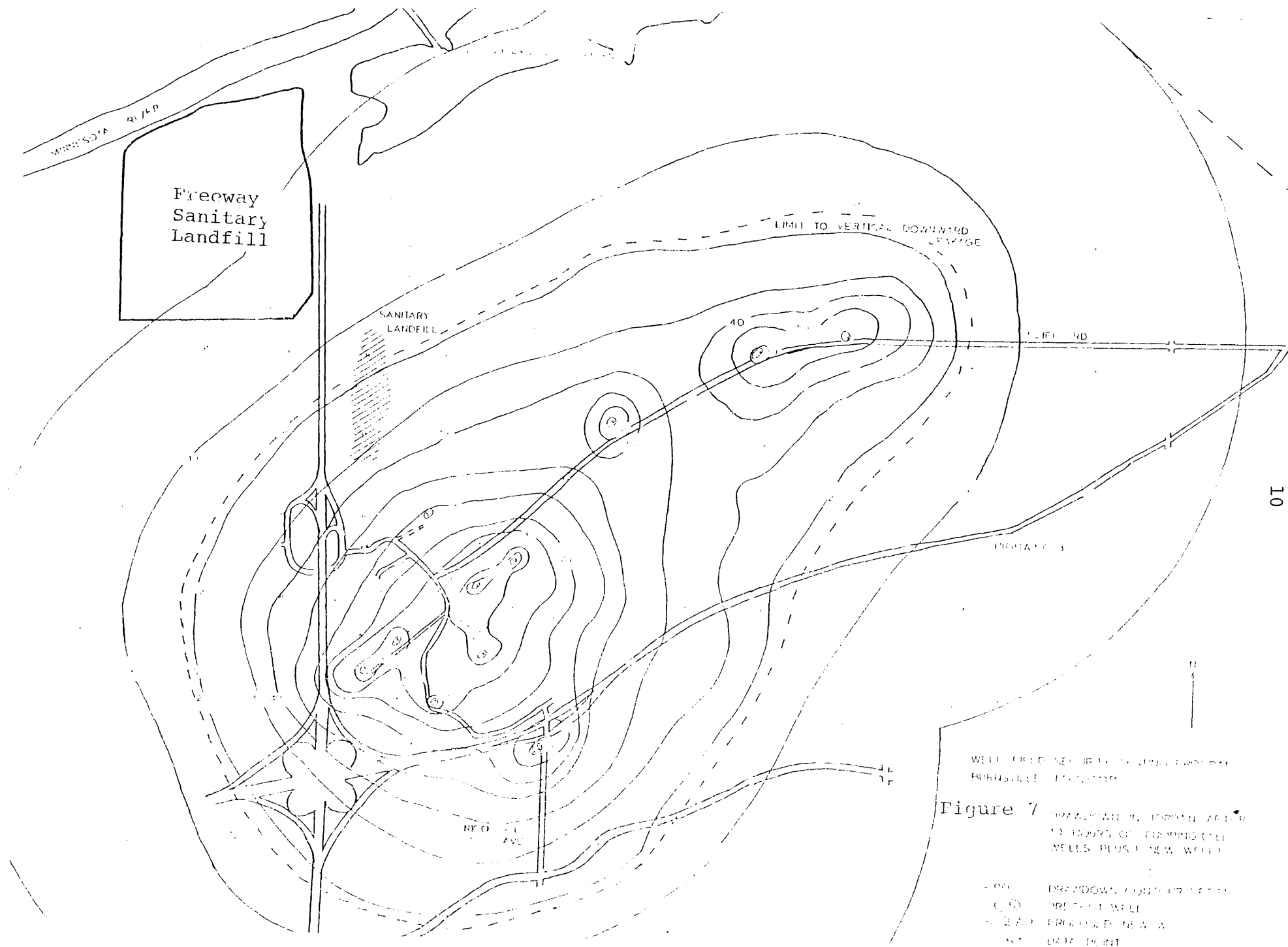
During the testing procedure at each well, drawdown and recovery water levels were measured at the pumped well, at nearby municipal production wells and at the Jordan and Shakopee observation wells. The data were plotted and analyzed using the time-drawdown, time-recovery Theis non-equilibrium method modified by Jacob, and by distance-drawn equilibrium methods.

Upon completion of the analysis of the pumping data, a mathematical model, based on distance-drawdown curves, was developed to simulate the reaction of the aquifer and its potentiometric surface to varying pumping rates and well field configurations. This allowed a study of the reaction of the aquifer to the location and pumping of new wells in various configurations. As a calibration control for the model, a pumping test was run October 13 and 14, 1980. This test consisted of pumping all the wells except 6, and observing the drawdown in the wells throughout the 9.5 hours of pumping. Water levels were measured before the test to determine the trend caused by recovery from antecedent pumping and to determine the approximate projected water level in the flowing Jordan observation well.

The computed drawdowns derived from the mathematical model and the actual drawdowns observed in the October 13 and 14 pumping test were in very close agreement, especially in the observation wells. This indicates that the model, based on the distance-drawdown curves, along with the assumptions are representative of the hydraulic conditions in the Burnsville well field area. It should be pointed out, however, that the model is theoretical in nature and simulated the relation of the aquifer and its potentiometric surface based on observations of the City's well field under varying pumping conditions. Additional observation wells north of the City's well field would help to further define hydrologic characteristics in the vicinity of the Freeway Landfill.

Drawdown maps were compiled using the aquifer mathematical model to observe the reaction to various well configurations. The first drawdown map, Figure 6, represents the drawdown associated with pumping all the present city wells at 1200 gpm for 10 hours, at which point equilibrium was reached. An additional well was then added at the intersection of Nicollet and Highway 13 (SW corner) and a drawdown map developed to study the change in the Jordan water levels, Figure 7. The proposed new well was assumed to be located in a segment of the aquifer represented by the model in the vicinity of well 8. With this new well pumping, additional drawdown observed at the Jordan observation well would be 2.6 feet after 10 hours of pumping.





In a worst-case scenario the new well could follow the distance-drawdown curve for well 2 and cause 4.3 feet of drawdown at the Jordan observation well at equilibrium.

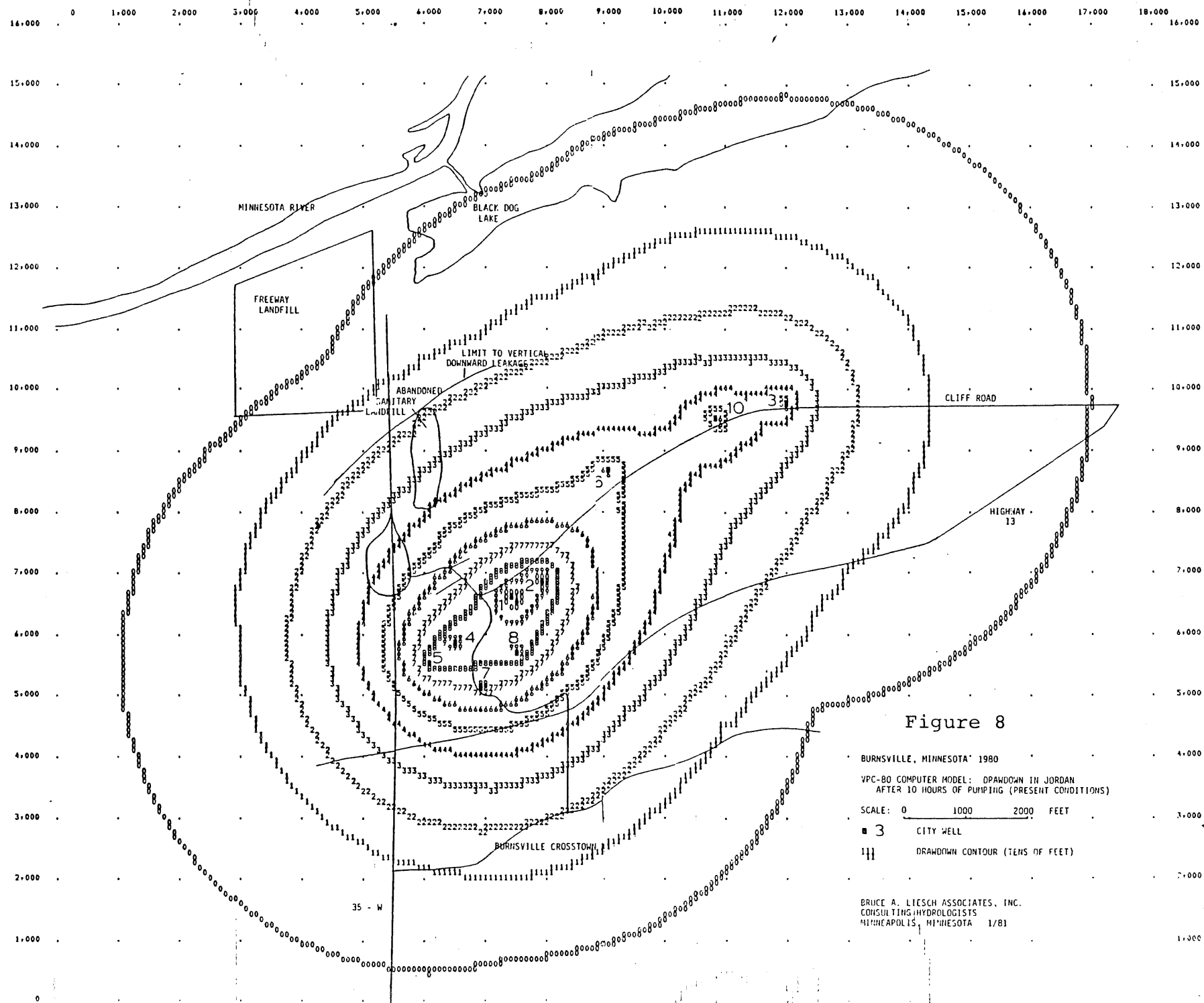
A major concern in Burnsville is the possible contamination of the water supply from leachate at the abandoned landfill site north of the well field. Upon analysis of the drawdown maps of Figures 6 and 7, it appears that no appreciable change is observed in the Jordan water surface by the addition of a well at the intersection of Nicollet and Highway 13. The distance between the new well and the southern-most extent of the landfill is approximately 4,100 feet. At this distance the new well would cause a maximum increase in drawdown under the landfill of 1.2 to 1.9 feet, dependent on the assumed distance-drawdown relationships. At a point approximately three-quarters of the way through the landfill there would be no drawdown change caused by the new well.

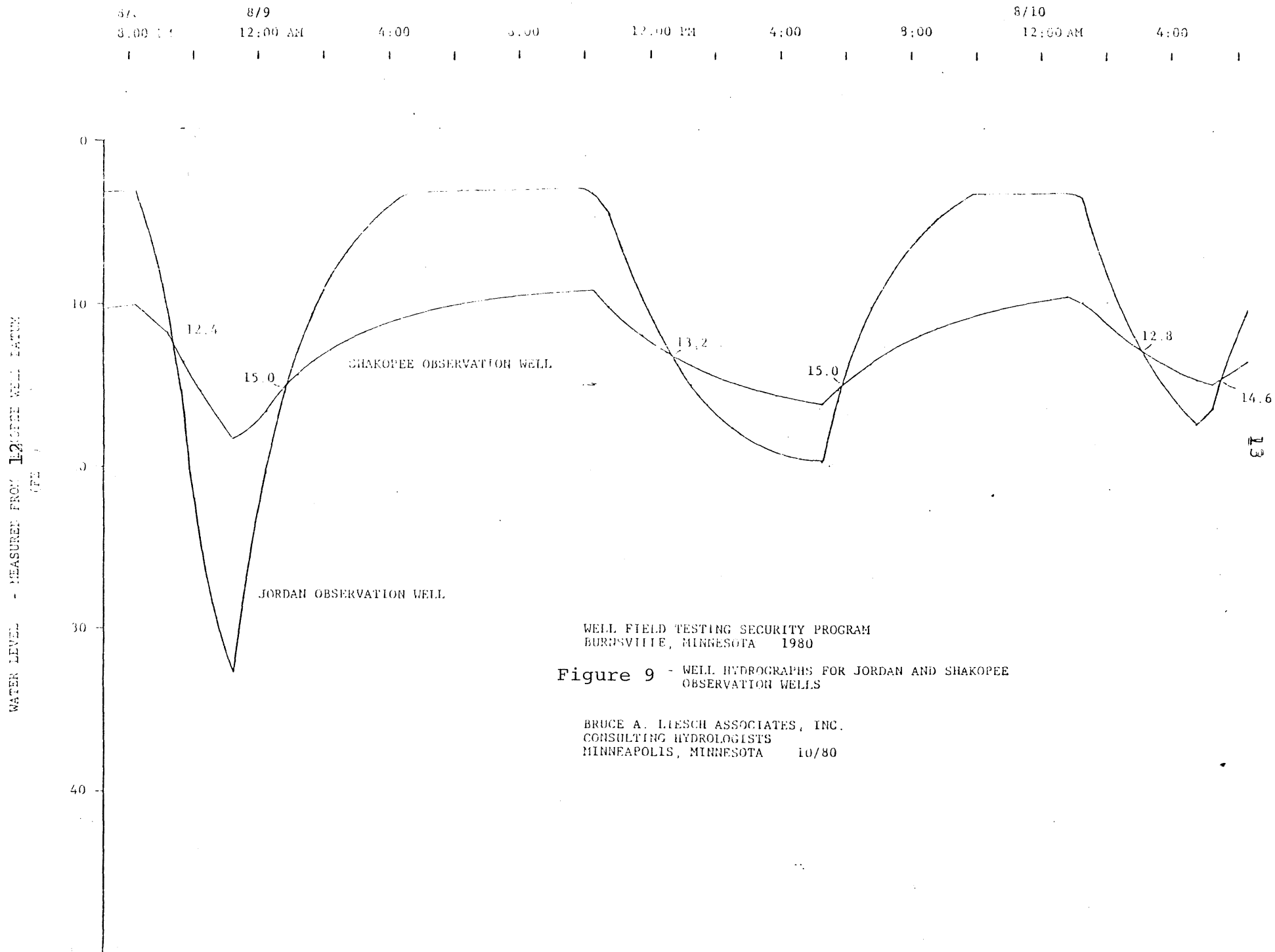
Hydrographs of the Shakopee and Jordan observation wells under the conditions of all wells pumping are shown in Figures 8 and 9. The intersections of the hydrographs indicate points where flow direction between the two formations is reversed. By extrapolating the Jordan observation well recovery curve to a static level, the drawdown in the Jordan at which leakage begins to occur can be determined. During the drawdown and recovery cycle, leakage between formations is reversed at a drawdown of between 14 and 17 feet. A line of leakage is assumed to be between the 10- and 20-foot drawdown contour lines in Figures 6 and 7. Under both well configurations studied, three fourths of the abandoned landfill is in an area of vertical leakage from the Shakopee dolomite into the Jordan sandstone during part of the pumping cycle. The Freeway Landfill is about 1000 feet northeast of this vertical leakage line.

The drawdown contours in Figure 6 were further defined in Figure 8 by the City's consultant using a computer model. Figure 8 shows the drawdown contours with pumping all of the present city wells at 1200 gpm for 10 hours. The vertical leakage line is now about 300 feet from the Landfill.

The hydrograph of Figures 9 and 10 gives some idea as to the length of time leakage from the Shakopee into the Jordan takes place. To determine how long leakage occurs under the abandoned landfill site, these water level curves have to be modified. Figure 10 shows the modification of the drawdown trends, indicating the water levels in the formations underlying the abandoned landfill.

According to Figure 8, the abandoned landfill's southern most extent is overlying an area which has 40 feet of drawdown associated with steady state pumping and a northern-most extent associated with 20 feet of drawdown at steady state. Figure 11 shows that leakage starts at the Jordan and Shakopee observation wells 15 minutes after pumping begins but does not start at the beginning of the landfill until the pumps have been going for 150 minutes. Figure 11 also indicates that at 18 feet of drawdown or less, there is no leakage from the Shakopee into the Jordan. The 18-foot drawdown contour line shown in Figures 6, 7 and 8 represents the limit of vertical leakage from the Shakopee to the Jordan at steady state conditions. Since





DATE

10/13

10/14

12:00 PM

2:00

4:00

6:00

8:00

10:00

12:00 AM

2:00

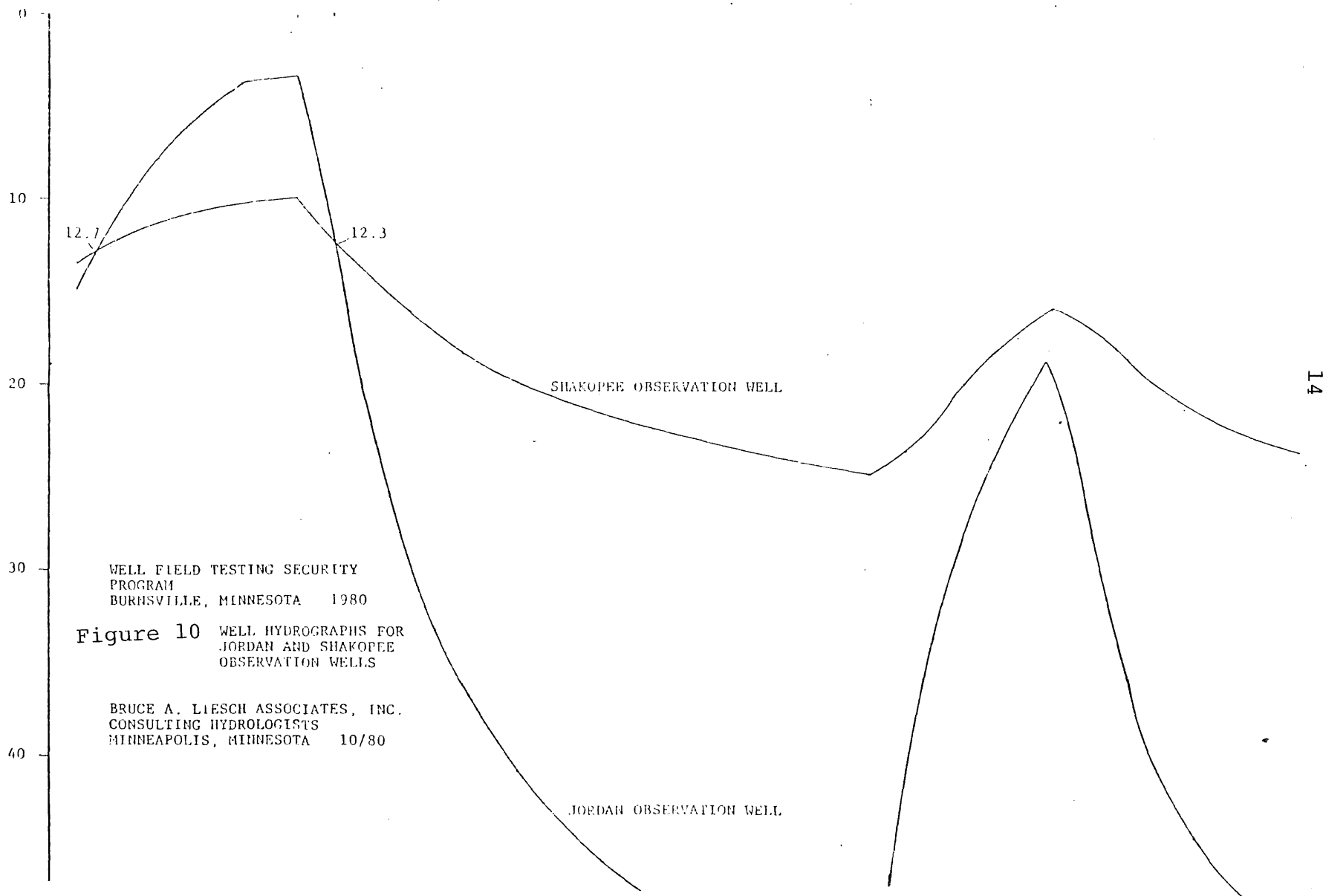
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WATER LEVEL - MEASURED FROM SHAKOPEE WELL DATUM
(FEET)



TIME - MINUTES

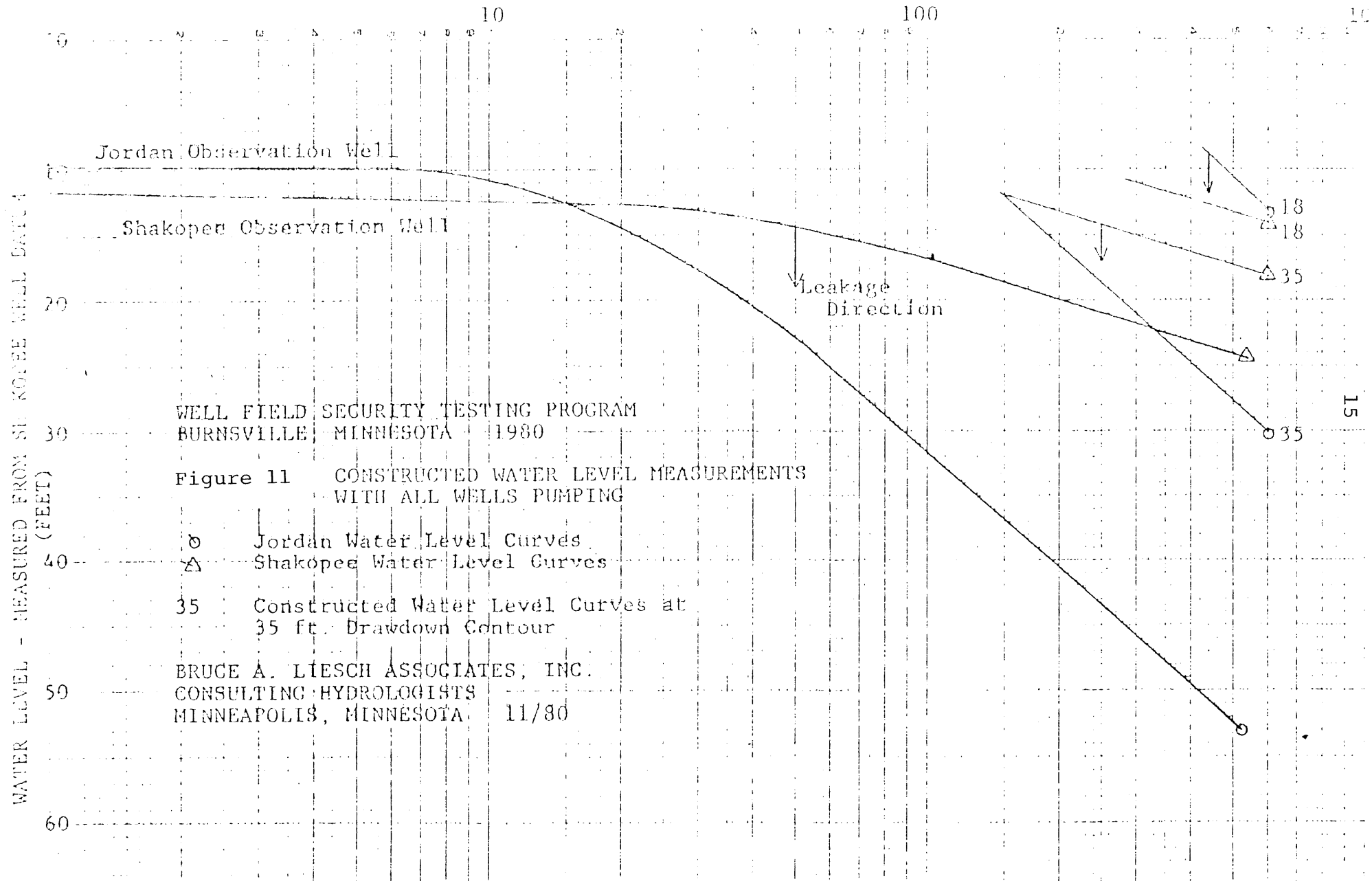


TABLE 1 - Analysis of Leakage Direction Measured at the Jordan and Shakopee Observation Wells 7/22-7/28, 1980.

Date July 1980	Flow Into Jordan		Flow Into Shakopee		Total Time	
	Start	Stop	Start	Stop	Hrs.	Min.
22	1:10P	5:20P			4	10
22			5:20P	6:40P	1	20
22-23	6:40P	4:30A			9	50
23			4:30A	10:20A	5	50
23	10:20A	4:40P			6	20
23			4:40P	5:00P		20
23-24	5:00P	8:50A			15	50
24			8:50A	10:20A	1	30
24-25	10:20A	5:00A			18	40
25			5:00A	6:30A	1	30
25	6:30A	11:00A			4	30
25			11:00A	2:30P	3	30
25	2:30P	7:20P			4	50
25			7:20P	10:40P	3	20
25-26	10:40P	3:00A			4	20
26			3:00A	11:30A	8	30
26	11:30A	3:40P			4	10
26			3:40P	5:00P	1	20
26-27	5:00P	12:00A			7	0
27			12:00A	9:30A	9	30
27-28	9:30A	11:00A			25	30

the pumps are seldom run long enough to attain a steady state condition, the drawdown under the abandoned landfill and the leakage associated with the drawdown is almost always less than predicted.

An analysis was conducted to determine the length of time that groundwater leaked from the Shakopee dolomite into the Jordan sandstone during the period of maximum pumpage. Table 1 shows the results of the analysis, indicating that the leakage from above occurs over a much longer time period than the natural flow from the Jordan to the Shakopee. At one point there are 25.5 hours of leakage over three pumping cycles in which the water level in the Jordan is below the water level in the Shakopee at the observation wells.

In contrast, hydrographs from two and one-half weeks later, Figure 9, indicate that the upward flow from the Jordan into the Shakopee occurs over much longer periods of time than reversed flow. During the pumping of August 9, flow was reversed for a period of five hours, followed by a period of upward flow of nine hours. Previous to the five hours of reversal, the flow was from the Jordan to the Shakopee over a 12-hour period. Figure 10 indicates an extended period of leakage into the Jordan during the middle of October. This was caused by extended pumping to fill a storage reservoir and does not represent a normal pumping period for October.

This analysis indicates that only over a short period of time during the year does leakage into the Jordan exceed the natural condition of leakage direction from the Jordan into the Shakopee.

HYDROLOGIC INVESTIGATION WEST OF THE BURNSVILLE WELL FIELD

A 10-hour pumping test was run by the City's consultant on December 29, 1980 to determine the effect the City's wells would have on drawdown in a Jordan well on the Kraemer and Sons quarry property west of the City's well field. The test consisted of pumping city wells 1, 2, 4, 5, 7 and 8 and observing drawdown in the Jordan well on the Kraemer quarry property as well as drawdown in city wells 3 and 6 and in the Shakopee and Jordan observation wells.

The results of the pumping test represent the actual drawdown expected during the peak pumping periods of the City's well field. The results were compared to the theoretical drawdown computed from the mathematical model developed for the Burnsville area and the conclusions drawn.

The water levels observed at the quarry well indicate a deep cone of depression in the Jordan aquifer caused by pumping from the quarry. The cone of depression beneath the quarry acts as a barrier sink to the movement of groundwater in the Shakopee-Oneota-Jordan aquifer system. The measured interference water level drawdown at the quarry well caused by the Burnsville Jordan wells pumping at a maximum rate for 10 hours was 1.35 feet. In contrast, the mathematical model indicated an interference drawdown of 17 feet. The lack of agreement between the actual observed interference conditions and the mathematical model may be attributed to a) a higher effective coefficient of transmissivity in the area of the quarry than has been assumed for the model, b) an increase in the coefficient of storage caused by

partial dewatering of the Shakopee dolomite and partial transition from artesian to water table condition, c) higher leakage rates from the Shakopee to the Jordan in the intervening area between the well field and the quarry, d) a combination of all the factors a, b and c. A higher coefficient of transmissivity and higher leakage rates would be natural physical characteristics of the units. The increase in the coefficients of storage that would accompany a transition to partial water table conditions would be induced by the deep cone of depression in equilibrium beneath the quarry. A cessation of pumping at the quarry would cause a trend toward natural conditions and the protective effects of the barrier sink would be diminished or eliminated.

CONCLUSIONS

1. The mathematical model developed for the Burnsville well field is representative of the actual aquifer conditions and can be used to model varying well field configurations of future proposed wells.
2. The mathematical model is theoretical in nature. Additional observation wells north of the City's well field would help to further define hydrologic characteristics in the vicinity of the Freeway Sanitary Landfill. In the vicinity of the Jordan and Shakopee observation wells the flow direction is reversed at a drawdown of between 14 and 17 feet where upon flow is from the Shakopee into the Jordan. The Freeway Sanitary Landfill is about 300 feet northwest of this vertical leakage line.
3. Because of the Freeway Landfill's close proximity to the vertical leakage line and the theoretical basis under which this line was determined, the potential exists for the City's water supply well field to be adversely impacted by contaminants from the landfill.
4. Under current pumping conditions and only during short periods of peak demand, the combined cones of depression in the Burnsville well field produce a net transfer of groundwater from the Shakopee-Oneota dolomites to the Jordan sandstone within the area encompassed by the dashed line between the 10-foot and 20-foot drawdown contours shown in Figure 8.
5. Only during short periods in the summer does the length of time of flow from the Shakopee dolomite into the Jordan sandstone exceed the length of time of flow from the Jordan sandstone into the Shakopee dolomite.
6. The potential for short-term groundwater contamination in a limited area adjacent to the abandoned landfill appears to be more a function of the duration of the pumping periods at the existing municipal wells rather than additional wells pumping at more remote sites to the south and east.

7. The potential for long-term, widespread contamination of the Jordan aquifer would be greatly enhanced by the extended pumping periods at the existing municipal wells resulting from an increase in the water requirements rather than by orderly expansion of new wells to the south and east.
8. During steady state conditions, the water pumped from the Jordan is replaced by groundwater leakage through the Shakopee-Oneota descending from the overlying geologic units. To avoid contamination it would be preferred that the replacement water be derived largely from the St. Peter sandstone and glacial drift deposits south of the well field rather than from the valley alluvium.

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