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EIS770942F

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY

REGION 5
230 S. DEARBORN ST.
CHICAGO, ILLINOIS 60604

MAY 1977

ENVIRONMENTAL IMPACT STATEMENT

FINAL

Organic Solids Reuse Plan

Madison Metropolitan Sewerage District,
Dane County, Wisconsin

EIS770942F

FINAL ENVIRONMENTAL IMPACT STATEMENT

ORGANIC SOLIDS REUSE PLAN

PROPOSED BY

THE MADISON METROPOLITAN SEWERAGE DISTRICT

Prepared By The

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION V

CHICAGO, ILLINOIS

APPROVED BY:

GEORGE R. ALEXANDER, JR.
REGIONAL ADMINISTRATOR

MAY 1977

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( ) Draft

(X) Final

U. S. Environmental Protection Agency Region V, Chicago

1. (X) Administrative Action

( ) Legislative Action

2. Description of the Action

The analysis of alternatives indicates that the sludge management needs of the Madison Metropolitan Sewerage District service area would most adequately be met by abandoning the present system of lagoon disposal of liquid anaerobically digested sludge and adopting a system of land disposal of liquid anaerobically digested sludge on privately-owned agricultural land. The program would involve marketing the sludge to farmers at their request.

3. Environmental Impact

a. Water

The abandonment of lagoon disposal of sludge at Nine Springs sewage treatment plant will eliminate the threat of lagoon dike failure and resultant toxic spills of the lagoon contents into Nine Springs Creek and the adjacent wetlands. As long as the proposed land disposal program is strictly managed and operated as planned, there will be no significant effect on water quality and quantity.

b. Air Quality

As long as the precautions related to sludge hauling and application which have been outlined in the facilities plan and environmental assessment are taken, potential odor problems will be minimized. Significant odor-producing sludge treatment processes will be abandoned or modified by this plan so that odor problems will be minimized. Dust generated from construction of solids treatment and handling facilities will cause a temporary change in ambient conditions.

c. Land Use

The only significant effect on land use which is expected to result from the proposed plan is the beneficial one which is the eventual return of the abandoned sludge lagoons to a wetland condition.

d. Soils and Biota

The soil fertilizer value of the sludge will improve the fertility of the soils on which sludge is applied while reducing the quantities of expensive commercial fertilizers which must be used. Possible impacts on the soils and plant and animal life of the study area could result from the build-up of materials contained in the sludge to levels which may be toxic to normal life functions. This potential effect will be minimized because MMSD's plan proposes to limit annual application rates and total allowable loadings to levels which would provide for protection of the soils and plant and animal life of the area while at the same time obtaining the maximum soil amendment value to be gained from land application of the sludge.

Cadmium levels and the ratio of cadmium to zinc in MMSD sludge are higher than the United States Department of Agriculture would recommend for sludge being applied to privately-owned land. MMSD's conservative application rates and their proposed cadmium source control program should minimize the potential for build-up of cadmium to toxic levels.

e. General Concern

Since the potential adverse impacts of MMSD's proposed organic solids reuse plan can be minimized or avoided only if MMSD's proposed management and marketing programs are strictly carried out, it is imperative that MMSD strictly adhere to their plan.

4. Alternatives Considered

a) Lagoon Abandonment Alternatives

Treatment plant sludge
  continue discharge to existing lagoons
  or discontinue discharge and build new lagoons
Lagoon sludge
  remove and apply to farmland
  or leave in lagoons
Lagoon supernatant
  remove and return to treatment plant
  or leave in lagoons
Lagoons dikes
  stabilize and maintain
  leave as they are

b) Ultimate Disposal Alternatives

1) Land application of dewatered sludge;
2) Land application of liquid digested sludge;
3) Land application of compost;
4) Landfill of sludge/milled refuse mixture;
5) Landfill of digested sludge;
6) Subsurface placement of sludge;
7) Incinerate raw sludge;
8) Incinerate digested sludge;
9) Lagoon storage - NO ACTION ALTERNATIVE.

c) Transportation Method Alternatives

1) Rail transport;
2) Truck transport;
3) Pipeline transport.

d) Application Method Alternatives

1) Sprinkler gun;
2) Subsurface injection;
3) Truck or tractor drawn spreader.

e) Sludge Reuse Program Alternatives

1) Sludge supplied by MMSD at farmer's request;
2) MMSD leases privately-owned land for sludge application;
3) Combination of 1) and 2).

5. Irreversible and Irretrievable Commitment of Resources

By the implementation of the proposed actions the only irreversible and irretrievable commitment of resources would be for the capital, labor and energy used in the construction of the facilities and the operation and maintenance costs of the entire program.

6. Federal, State, and Local Agencies and Individuals who Commented on the Draft EIS for this Project

Federal

United States Department of Agriculture
Soil Conservation Service
United States Department of Interior

State

Wisconsin Department of Natural Resources
State Historical Society of Wisconsin

Local

Dane County Regional Planning Commission
Holtzman Company

7. Dates

Statement made available to:	Draft	Final
The Council on Environmental Quality	October 1976	May 1977
The Public	October 1976	May 1977

CHAPTER 1
BACKGROUND

A. Existing Water Quality Facilities and Agencies

The Madison Metropolitan Sewerage District (MMSD) which was organized under Wisconsin Statutes in 1930 is a metropolitan sewerage district with the responsibility for the transmission, treatment and discharge of wastewaters from the City of Madison, Wisconsin and its surrounding areas. The MMSD presently serves a total of three cities, five villages and twenty-six municipal customers located within ten townships. The MMSD includes approximately 142 square miles and is located entirely within Dane County.

The 36.5 MGD of wastewaters currently generated within the District receives secondary treatment at the Nine Springs Sewage Treatment Plant which is located on the southern edge of the City of Madison.

B. Existing Problem

1. Background

On December 31, 1975, MMSD was awarded a Step 1 Grant (Grant No. C550826-01,-02) from this agency to prepare a facilities plan which would meet the requirements of Wisconsin Pollutant Discharge Permit No. WI-0025411. The facilities plan was to include documentation to determine the cost-effective construction of advanced waste treatment facilities and disposal of the effluent, and handling and disposal of sludge from the treatment facilities.

In July 1975 the facilities planning effort was segmented into two portions, 1) advanced waste treatment and effluent discharge (Grant No. C550826-01) and solids 2) handling and disposal (Grant No. C550826-02). This segmentation was done because of the need to expedite the solids handling portion of the study.

This EIS covers only the segment of MMSD's overall facilities planning effort concerned with solids handling and disposal. Advanced waste treatment and effluent discharge issues will be considered in a separate EIS.

When the draft EIS for this project was distributed for comment, it was accompanied by a second volume which was comprised of MMSD's facilities plan and environmental assessment for the project. This second volume has not been revised as part of the Final EIS. Comments related to it have been addressed in Chapter 7 of the Final EIS. If additional copies of the volume with MMSD's plan and assessment are required, they can be obtained from Region V, Planning Branch, EIS Preparation Section.

2. History of the Sludge Disposal Program

Since the Nine Springs Wastewater Treatment Plant was put into operation in the early 1930's the problem of disposing of the sludge produced during wastewater treatment has been present. From the 1930's until 1942, the sludge produced was dried on sand beds and utilized as a fertilizer for lawns, gardens, and flower beds. Small amounts were ground and bagged. With the outbreak of World War II the manpower required to operate and maintain this system was no longer available.

In 1942, Lagoon 1 was constructed and the sludge produced at the plant was diverted to it for storage. This lagoon has been in continuous use since that time. As the capacity of the original lagoon was reached, a second lagoon (Lagoon 2) was constructed immediately to the east of Lagoon 1 in 1968. The total lagoon area is approximately 145 acres.

In April 1970, portions of the dike of Lagoon 2 failed, allowing lagoon supernatant to flow into Nine Springs Creek and then into the Yahara River just upstream of Lake Waubesa. An additional dike failure occurred in November 1973, but spillage was negligible at that time. As a result of the first failure, MMSD paid $20,000 in damages and entered into an agreement with WDNR stipulating that an alternative method of sludge disposal was to be implemented by MMSD as soon as practicable.

A number of studies were then initiated which investigated the alternatives for sludge disposal and the stability of the lagoon dikes. A major finding of these reports (Warzyn Engineering and Service Co., Inc., 1970; CH2M-Hill Engineers, Inc., 1975) concluded that the dikes of Lagoon 2 were quite unstable and were subject to probable failures in the future. Other reports (Greeley and Hansen Engineers, 1971; Roy F. Weston, Inc., 1974) evaluated and concluded that sludge reduction and disposal methods such as incineration, heat treating, mechanical dewatering and landfilling were either economically or technically not feasible. The staff of MMSD prepared an addendum to the Weston report evaluating other sludge handling and disposal alternatives not considered in the Weston Report. For a number of reasons, including the physical and chemical characteristics of the MMSD sludge and high energy requirements, these methods were eliminated from further consideration. The recommended method of sludge disposal was land application of the sludge to utilize its nutrient value as a fertilizer substitute.

The sludge disposal portion of the facilities plan has evaluated the various methods presently available to implement a land application program. Consideration was given to the factors necessary to develop site location and management, environmental factors and program costs. In addition, various methods of sludge treatment have also been considered. Also, several lagoon abandonment options were evaluated. The proposed plan will have the positive benefits of being an effective economical sludge disposal method which realizes the natural resource value of sludge by recycling the nutrients, water, and organic matter which it contains. Compared to some other disposal methods such as landfilling and incineration the proposed plan has added benefits such as minimizing air pollution. Also the range of potential uses of the land application area after use for sludge disposal will not be permanently affected as in some other methods. Other benefits of MMSD's proposed plan include the elimination of lagoon-dike failure which resulted in toxic spills into Nine Springs Creek and adjacent wetlands. The expansion and modification of the sludge treatment facilities will eliminate odor problems which some of the processes have previously contributed to.

3. Proposed Solution

MMSD proposes to abandon the present program of lagoon disposal of liquid anaerobically digested sludge and to pursue a program of land application of liquid anaerobically digested sludge to privately-owned agricultural land. The program involves marketing the sludge to farmers for its fertilizer and soil amendment value at their request. The total present-worth cost of the organic solids reuse program is $14,949,000. The applicant is requesting $3,833,000 in Federal and $256,000 in state grants to fund the project. MMSD's portion of the cost is expected to be approximately $10,860,000 which represent the operation and maintenance costs and their share of the construction costs. The Federal and state grant amounts cited above are tentative in that it remains to be determined by Region V, USEPA and the State of Wisconsin which costs are actually grant eligible.

CHAPTER 2
EXISTING ENVIRONMENT

A. Natural Environment

1. Atmosphere (Climate)

Chapter 6 of the facilities plan and Section 2 of the environmental assessment present an adequate summary of climatological conditions in the study area. Some additional information is provided to supplement these sections. The main source of this supplemental information is the environmental inventory for the project prepared by the applicant and its consultants.

Temperature, Precipitation, Snowfall, Winds

Table 2-1 is presented to provide a summary of temperature, precipitation, snowfall and winds data for Madison, Wisconsin.

Severe Climatological Events

No additional information is necessary.

2. Land

Topography

Section 2.03 of the assessment is an adequate summary of topography. The following information has been extracted from the environmental inventory for the plan to supplement the discussion of drainage basins.

> "There are numerous lakes and wetland areas found in central and eastern Dane and Rock Counties (WDNR, 1970, 1976). The Yahara River flows generally southwestward to the Rock River, closely following its pre-glacial course. Partial damming of the river valley with moraine left by the receding glaciers has resulted in the formation of the Madison Lakes (Mendota, Monona, Wingra, Waubesa, and Kegonsa). There are numerous wetland areas adjacent to the Yahara River.
>
> "The Rock River also closely follows its pre-glacial course, flowing generally southward from its headwaters in Dodge County through Jefferson and Rock Counties. The two major impoundments on the Rock River, Lakes Koshkonong and Sinissippi were formerly marsh areas which have been turned into shallow lakes by the placement of dams across the river channel.

Geology

Section 6.1 of the facilities plan and Section 2.04 of the environmental assessment provide an adequate discussion of the geology of the project area and how the geology influences surface and ground water resources.

TABLE 2-1

CLIMATOLOGICAL DATA[1]
MADISON WISCONSIN

	Temperature (°F)[2]			Precipitation (in)[3]			Snowfall (in)[4]		Winds (mph)[5]		
	Max	Min	Mean	Max	Min	Mean	Max	Mean	Prevailing	Max	Mean
January	54	-30	16.8	2.45	0.19	1.25	21.9	8.9	WNW	68	10.5
February	56	-23	20.3	2.77	0.08	0.95	16.1	6.5	WNW	57	10.7
March	78	-29	30.2	5.04	0.38	1.93	25.4	9.8	NW	70	11.4
April	87	9	45.3	7.11	0.96	2.66	17.4	1.7	NW	73	11.7
May	91	20	56.0	6.26	0.98	3.41	0.7	T	S	77	10.5
June	95	31	65.8	8.15	0.81	4.33	0.0	0.0	S	59	9.2
July	98	36	70.1	10.30	1.38	3.81	0.0	0.0	S	72	8.2
August	95	36	68.7	7.47	0.70	3.05	0.0	0.0	S	47	8.1
September	90	25	59.7	9.51	0.49	3.36	T	T	S	52	8.8
October	90	15	49.4	5.55	0.06	2.16	0.9	0.1	S	73	9.6
November	76	1	34.7	3.94	0.34	1.87	8.9	2.8	S	56	10.8
December	62	-22	21.9	3.64	0.25	1.47	20.8	9.9	W	65	10.2
Year			44.9			30.25		39.7			10.0

[1]Taken from "Local Climatological Data - Annual Summary with Comparative Data, 1974 - Madison, Wisconsin"; National Oceanic and Atmospheric Administration

[2]Period of record, 15 years

[3]Period of record, 35 years

[4]Period of record, 26 years

[5]Period of record, prevailing direction - 14 years; speed - 28 years

(Extracted from Environmental Inventory for MMSD's Comprehensive Facilities Plan.)

Soils

Sections 6.3 and 6.5 and Figure 6-4 (general soil map) of the facilities plan and Section 2.05 and Table 2-2 of the environmental assessment present sufficient information related to soils. Section 6.3 discusses soils from the standpoint of suitability for sludge application. Figure 6-4, Section 6.5, Section 2.05 and Table 2-2 provide a display and discussion of the location and characteristics of various soil types. The information presented is of necessity of a general nature. More detailed soils series data would be required for detailed agricultural management or construction design work when specific project sites are under consideration.

Wetlands and Water/Land Interfaces

Section 2.10 B of the environmental assessment presents a summary of wetlands in the study area. The environmental inventory for the study lists 16 priority, No. 1, 19 priority No. 2, and 12 priority No. 3 wetland areas in Dane County and their location and importance. However, the acreage of each area is not listed. Figure 6-4 in the facilities plan shows the general location of wetlands within the study area. The various wetland priority types are not distinguished on the figure. The wetlands shown on the figure fall primarily within the areas designated as "few of the soils suitable for application" or secondarily within the areas designated as "some soils suitable for sludge application".

Of the Priority No. 2 wetlands listed in the inventory there is one area which would potentially be impacted on by this project since it is within the vicinity of the Nine Springs Sewage treatment plant site. Priority No. 2 wetlands were those which were considered to have a biologically good rating with other values. The Priority No. 2 wetlands listed is Upper Mud Lake in Blooming Grove Township, Sections 28, 29, 30, 32. This wetland is considered to have value for diverse vegetation, animal life, bird life, recreation, and watershed protection. There is also a Priority No. 3 wetlands area which could potentially be affected by the project. Priority No. 3 wetlands were those which were considered to have a biologically fair rating or poor biological rating with other values. The Priority No. 3 wetlands listed is Nine Springs wetlands in Blooming Grove Township, Sections 31 and 32 and Fitchburg Township, Sections 12, 3, and 10. This wetland is considered to have value for diverse vegetation and watershed protection.

A further discussion of these wetlands is included in subsequent sections of Chapter 2.

Related to flood hazards, the environmental setting description, Section 2.03 and Table 2-3 include flow value data, however, no discussion is presented on flood hazard areas. Section 2.06 of the environmental inventory for the facilities plan does indicate that in respect to flooding in the lower Rock River basin (includes Yahara River basin):

"Flood flows are relatively low due to the small relief of the basin, as well as the storage capacity provided by the many lakes, reservoirs and wetlands. Flooding in headwater areas is generally limited to low-lying agricultural or undeveloped land adjoining waterways, although some springtime flooding of low-lying residences near the Madison Lake and Lake Koshkonong does occur. Substantive flood potential does exist in the cities of Janesville and Beloit where commercial and residential construction has taken place on the floodplain."

3. Water

Water Quantity and Location

Section 6 of the facilities plan and Section 2.06 of the environmental assessment provide an adequate discussion of ground water resources.

The discussion of surface water quantity in Section 2.06 of the environmental assessment is sufficient.

Water Quality

Section 6 of the facilities plan and Section 2.06 of the environmental assessment present sufficient information on groundwater quality. Section 2.6 and Table 2-4 of the environmental assessment adequately summarize surface water quality conditions. Additional monitoring information is included in backup appendices to the facilities plan. They have not been included because of their voluminous nature. As a point of clarification, Table 2-4 presents two sets of monitoring data. The 1955-1958 data was for a period prior to MMSD's diversion of their effluent into Badfish Creek. The 1972-1975 data is post-diversion.

4. Natural Vegetation and Wildlife

Habitat

Section 2.07 I of the environmental assessment is a summary of existing vegetation in the study area. Some clarification and supplementation of this section is necessary. Additional species information is included in backup appendices to the facilities plan.

One plant species which possibly occurs within the study area has been included as a proposed endangered species on the proposed list of "Endangered and Threatened Plant Species of the United States" published in the Federal Register on June 16, 1976. Lespedeza leptostachya (bushclover) is expected to occur on dry prairies in the study area.

Related to the discussions of aquatic vegetation some clarification is required. The discussion refers to an Appendix D which was described as including the results of an algal survey of Badfish Creek. This appendix was not, however, attached to the environmental assessment. The survey referred to was a survey of fish and algae of the Badfish Creek (main stem and and Rutland Branch) and Yahara River conducted in 1975 by John Magnuson and Gary Herbst from the University of Wisconsin. From their survey of fish and algae they concluded that:

1) in relation to Badfish Creek a) Badfish Creek is most severely polluted upstream of Cooksville, b) limited recovery occurs in the lower regions of the stream, c) water quality of Badfish Creek is inferior to both the Rutland Branch and the Yahara River;

2) the fish found in the Yahara River appear unaffected by Badfish Creek;

3) diatom species abundance and diversity in the Yahara River is reduced downstream of the mouth of Badfish Creek (indicating therefore, that the algal flora of the Yahara River is influenced by the Badfish Creek);

4) the Rutland Branch (of the Badfish Creek) is a pristine stream;

5) further detailed investigations of the fish fauna are warranted.

One area of special concern which could potentially be affected by this project either positively or negatively is Nine Springs Creek and adjacent wetlands which are in proximity to the Nine Springs Sewage Treatment Plant with its sludge lagoons. In 1970 and 1973 sludge lagoon dike failures occurred which resulted in toxic spills of lagoon contents into Nine Springs Creek and then into the Yahara River. As can be seen on Figure 2-1 the creek has been channelized in the vicinity of the lagoons. It flows around the south and east perimeters of the sludge lagoons and then through the wetlands out to the Yahara River. the plant cover mapping shown on Figure 2-2 was done in 1973 by the Wisconsin Department of Natural Resources as part of a study of the Upper Mud Lake wetlands. The wetlands cover about 800-900 acres and can be described as a sedge meadow. The area has been ditched. It is shrubby at one end with cattails at the other. The vegetation consists of diverse sedges, cattails, and other species. See Figure 2-2 for more detailed species information. Wildlife is prevalent and consists of a variety of shore birds, nesting birds, and small mammals. The area beyond the perimeter of the sedge meadow consists of Lake Waubesa and farmland while more intense development lies to the west. Wildlife is still prevalent in the surrounding agricultural land, more so than in the developing areas bordering the plant site to the west.

Wildlife

Section 2.07 of the environmental assessment summarizes wildlife in the study area. Additional backup information is included in the environmental inventory to the facilities plan. However that information is voluminous in nature and has therefore not been reproduced in this report. Section 2.07 is adequate with some clarification and supplementation. Section 2.07 F refers to Appendix E and Section 2.07 G refers to Appendix D. Those appendices were not attached to the environmental assessment. However, they are included as backup information to the comprehensive facilities plan.

The investigation of the macroinvertebrate found of Badfish Creek referred to in Section 2.07 F of the environmental assessment was completed by William L. Hilsenhoff and Thomas S. Karl of the Department of Entomology, University of Wisconsin, Madison in 1975. Their conclusions were that:

1. Effluent from the Madison Metropolitan Sewerage District's treatment plant has severely altered the macroinvertebrate fauna of Badfish Creek. This fauna in 1975 was characteristic of that which is normally found in moderately large streams severely polluted by organic wastes.

2. Faunal alteration was caused by a greatly increased volume of water flowing through the stream and by increased nutrient and BOD loads. The BOD creates a depression of dissolved oxygen levels, especially in the summer, which severely restricts the macroinvertebrate fauna that can exist in Badfish Creek. The increased nutrient loads that promote abnormal amounts of plant growth and abnormally high concentrations of certain ions may also be contributing factors in limiting the fauna.

3. Faunal alteration is most severe in the upstream areas of Badfish Creek, with some indications of recovery in downstream sections.

4. The macroinvertebrate fauna of the Yahara River was distinctly altered by waters from Badfish Creek during spring and early summer of 1975, but in late summer and fall alteration of the fauna was insignificant.

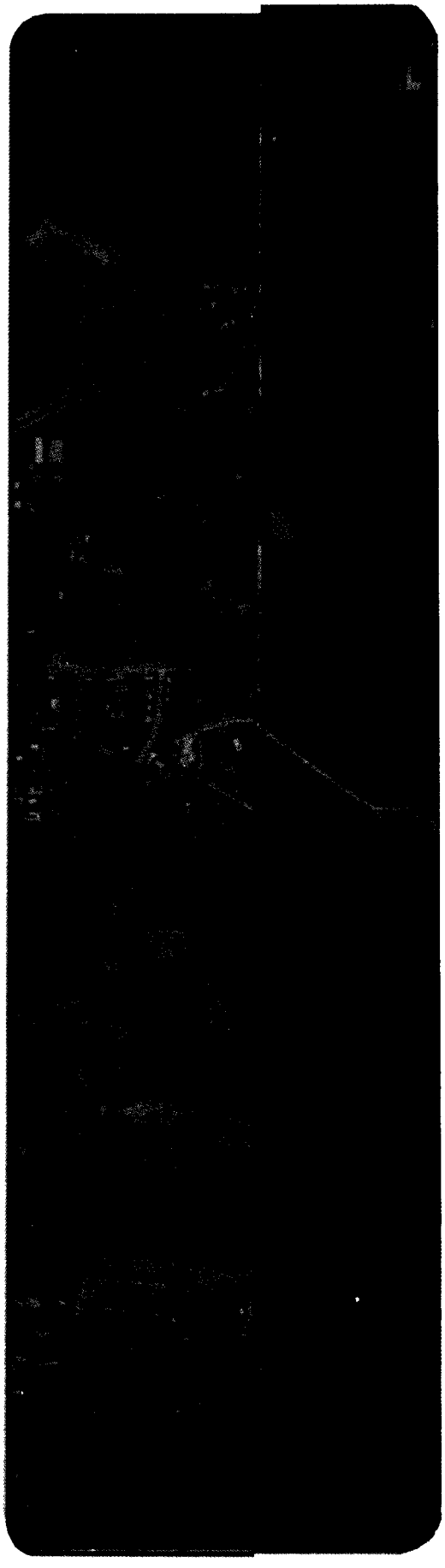


FIGURE 2-1

*BASE MAP OF THE NINE SPRINGS SEWAGE TREATMENT PLANT AREA

racted from Volume II of Madison Metropolitan
erage District's Facilities Plan and Adapted
Use in this Report.

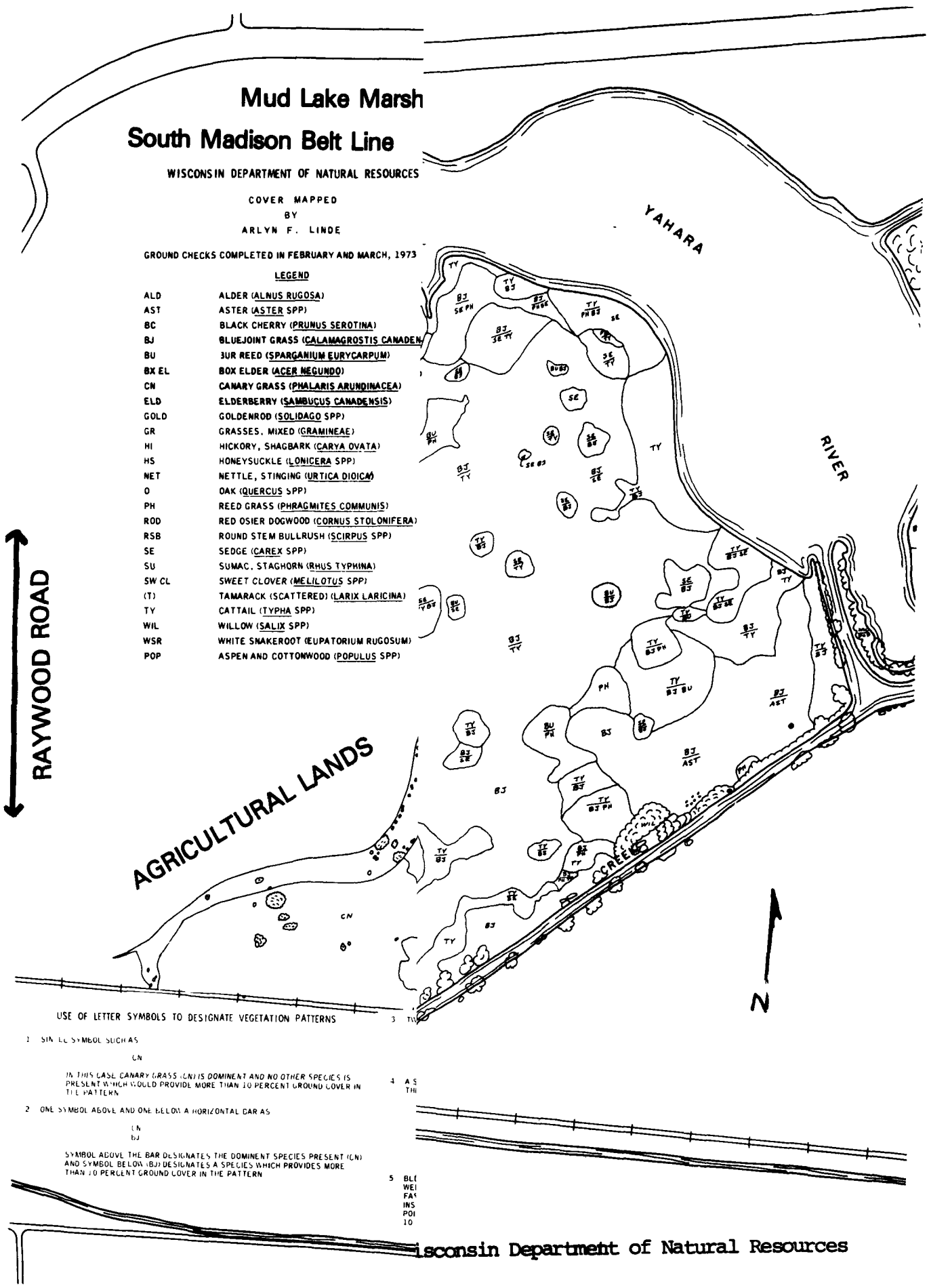
Mud Lake Marsh

South Madison Belt Line

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

COVER MAPPED
BY
ARLYN F. LINDE

GROUND CHECKS COMPLETED IN FEBRUARY AND MARCH, 1973



LEGEND

ALD	ALDER (ALNUS RUGOSA)
AST	ASTER (ASTER SPP)
BC	BLACK CHERRY (PRUNUS SEROTINA)
BJ	BLUEJOINT GRASS (CALAMAGROSTIS CANADEN
BU	BUR REED (SPARGANIUM EURYCARPUM)
BX EL	BOX ELDER (ACER NEGUNDO)
CN	CANARY GRASS (PHALARIS ARUNDINACEA)
ELD	ELDERBERRY (SAMBUCUS CANADENSIS)
GOLD	GOLDENROD (SOLIDAGO SPP)
GR	GRASSES, MIXED (GRAMINEAE)
HI	HICKORY, SHAGBARK (CARYA OVATA)
HS	HONEYSUCKLE (LONICERA SPP)
NET	NETTLE, STINGING (URTICA DIOICA)
O	OAK (QUERCUS SPP)
PH	REED GRASS (PHRAGMITES COMMUNIS)
ROD	RED OSIER DOGWOOD (CORNUS STOLONIFERA)
RSB	ROUND STEM BULLRUSH (SCIRPUS SPP)
SE	SEDGE (CAREX SPP)
SU	SUMAC, STAGHORN (RHUS TYPHINA)
SW CL	SWEET CLOVER (MELILOTUS SPP)
(T)	TAMARACK (SCATTERED) (LARIX LARICINA)
TY	CATTAIL (TYPHA SPP)
WIL	WILLOW (SALIX SPP)
WSR	WHITE SNAKEROOT (EUPATORIUM RUGOSUM)
POP	ASPEN AND COTTONWOOD (POPULUS SPP)

USE OF LETTER SYMBOLS TO DESIGNATE VEGETATION PATTERNS

1 SINGLE SYMBOL SUCH AS

CN

IN THIS CASE, CANARY GRASS (CN) IS DOMINENT AND NO OTHER SPECIES IS PRESENT WHICH WOULD PROVIDE MORE THAN 10 PERCENT GROUND COVER IN THE PATTERN

2 ONE SYMBOL ABOVE AND ONE BELOW A HORIZONTAL BAR AS

CN
BJ

SYMBOL ABOVE THE BAR DESIGNATES THE DOMINENT SPECIES PRESENT (CN) AND SYMBOL BELOW (BJ) DESIGNATES A SPECIES WHICH PROVIDES MORE THAN 10 PERCENT GROUND COVER IN THE PATTERN

3 TY

4 A S
THI

5 BL
WE
FA
INS
PO
10

Wisconsin Department of Natural Resources

Table 2-6 in the environmental assessment is taken after "Surface Water Resources of Dane County", 1961, WDNR, "Surface Water Resources of Rock County", 1970, WDNR and "Wisconsin Mapped Lakes", Clarkson Map Company. More recent sampling was completed for Badfish Creek and the Yahara River in 1975 by John Magnuson and Gary Herbst from the University of Wisconsin. That survey showed additional species existing in the Yahara River such as bluegill, crappie, and white bass. Their Badfish Creek survey data show some trout and bluegills living there in addition to those shown on the table. Refer back to the section on habitat for a discussion of the general conclusions of their study.

Nine Springs Creek in the vicinity of the Nine Springs Sewage Treatment sludge lagoons is channnelized. Fish sampling data for Nine Springs Creek close to Nine Springs Sewage Treatment Plant is not available. However, the Department of Natural Resources conducted a fish sampling program upstream of Nine Springs Sewage Treatment Plant in the summer and fall of 1972 and 1973 using shocker gear pulled up the creek. The 29 species of fish sampled there should represent some of the fishes from the Yahara River and up through the wetland areas around the treatment plant since the fish move freely up the creek from the river. A list of the fish species sampled at the upstream location can be found in Appendix D.

5. Sensitive Natural Areas

Section 2.10 of the environmental assessment summarizes sensitive natural areas. As indicated in this section there are many sensitive natural areas and areas of scientific interest within the project area which should be given special consideration when planning any specific project action. Tables 2-2 and 2-3 have been extracted from the environmental inventory for the study and are included here to provide additional information on sensitive areas which should be protected.

Of these areas listed on Tables 2-2 and 2-3 there is only one site which could potentially be impacted by this project. It is listed as Upper Mud Lake wetlands. The lagoons of Nine Springs Sewage Treatment Plant are located on the easterly edge of an extensive grass-sedge marsh area known as Nine Springs Marsh and portions of which are referred to as Upper Mud Lake wetlands. These wetlands occupy 800-900 acres and lie within Blooming Grove Township, Sections 28, 29, 30, 31 and 32.

B. Man-made Environment

1. Air

Air Quality

Section 2.08 of the environmental assessment is an adequate discussion of air quality.

Noise

There has been no discussion of noise levels in the project area in the environmental assessment. In 1970, the Madison Standard Metropolitan Statistical Area (SMSA) had registrations of 494 motor vehicles per 1000 population and 16 motor cycles per 1000 population. A recent USEPA publication used this index of vehicle registration as an index of noise population with the Madison SMSA ranking 19th and 37th lowest, respectively, for these two categories among 83 SMSA's with population between 200,000 and 500,000. In both cases Madison ranked in the quieter half of those towns of its size surveyed. This kind of an analysis could be somewhat misleading considering the study area includes both urban and rural areas which would by their nature have different noise sources and levels. However, no better information is available.

TABLE 2-2

DANE COUNTY
NATURAL AREAS AND FEATURES OF SCIENTIFIC INTEREST[1]

	Area Name	Acres	General Description, Geology, Comments
	Springfield Township		
1.	Missouri Tavern Prairie	5	Prairie remnant on land unfit to cultivate - good number species
2.	South of Waunakee Marsh Wild Life Area[2]		
3.	Mainholz Woods	20	Oak hickory woods Bot. No. 1079 - Form A
	Deerfield Township		
4.	Barn Swallow Colony		Barn Swallow colony on barn exterior - long history use.
	Blooming Grove Township		
5.	Mc Farland Quarry	20	Limestone quarry collection area for calcite and chert nodules
6.	Upper Mud Lake		Cattail marsh, aquatics, waterfowl
	Madison Township		
7.	Second Point Woods[2]	10	Red oak woods
8.	Greene Prairie & Oak Openings[2]	70	Sandy soil prairie, different gradients, restored from farmland.
9.	Curtis Prairie[2]	60	Silt loam prairie, different gradients, restored from farmland.

TABLE 2-2 (cont.)

	Area Name	Acres	General Description, Geology, Comments
10.	Wingra Fen	25	
11.	Wingra Marsh	70	Emergent vegetation, sedge meadows.
12.	Gardner Marsh	100	Emergent vegetation, sedge meadows.
13.	Noe Oak Woods	30	Black and White Oaks on silt loam, butternut trees.
14.	Gallistel	35	Oak Woods underplanted.
15.	Wingra Woods	45	Different gradients of Oaks. Indian effigy mounds.
	Middleton Township		
16.	Johnstown Terminal Moraine		Cut in prominent terminal moraine wooded small park, private
17.	Pheasant Branch Creek, Woods		Bot. 4032, 4046, 4020 creek cut through lake terraces. Bottom land Forest
18.	Middleton-Black Earth RR Prairie[2]		Along RR between Black Earth and Middleton Managed by Game Management
	Cross Plains Township		
19.	Camel's Back Hill West of Johnstown Moraine		Sandstone-limestone contact in roadcut, just east of terminal moraine
20.	Norway Pine Bluff	30	Sandstone outcrop with Norway Pine, birch, red oak.
21.	Festge Springs[2]		Springs into Black Earth Creek
	Vermont Township		
22.	Talinum Hill	3	Sandstone outcrop, prairie on steep hill, small area, good quality - A-frame development

TABLE 2-2 (cont.)

	Area Name	Acres	General Description, Geology, Comments
	Fitchburg Township		
23.	Vroman Woods	26	Red oak, cherry, hardwoods, for sale 1969
24.	Dunn's Marsh		Pond, marsh, best bird area in county
25.	Nine Springs Creek	80	Springs formerly grazed
	Christiana		
26.	Hanson Prairie	3	Dry to dry mesic, small prairie. Needs management. Good quality. Best dry prairie in eastern Dane County.
	Albion		
27.	Albion Oak Opening near Saunders Creek	20	Grazed but well known oak opening, oaks, scenic.
	Dunkirk		
28.	Sundby Quarry		Best outwash gravel pit in eastern Dane County.
29.	Grass Lake	70	Deep marsh, habitat for a variety of birds.
	Oregon		
30.	Story Creek[2]		Story Creek - ½ mile fair trout stream
	Roxbury		
31.	Carlson Cedar Forest	20	Steep SW-facing slope covered with low juniper and red cedars, few prairie species (see also Cactus Rock to west).

TABLE 2-2 (cont.)

	Area Name	Acres	General Description, Geology, Comments
	Mazomanie		
32.	Mazomanie Mesic Prairie[2]	6	Rich mesic prairie with scattered black oaks - easy access.
	Black Earth Township		
33.	Lark Sparrow Site	10	Small, shallow sand blow, scattered black oak pastured - not botanically significant.
34.	Black Earth Prairie[2]	5	Rich low to mesic prairie, between County F and Fensenfeld Road
35.	Black Earth Road Cut		A complete section of the Cambrian Formation worms stone fossiles - in area of dendritic drainage pattern-scattered red cedars on "goat pastures".
	Berry Township		
36.	Marx Prairie	35	South-facing hill, thin black soil over limestone, zeric forest, cedar glade, prairie.
37.	Ketelboeter Oak Opening and Prairie	10	Prairie on steep bluff many open grown burr oaks with red oaks, aspen.
	Dunn Township		
38.	Hook Lake		Tamarack bog, marsh.
39.	Mud Lake		Large cattail sedge marsh.
40.	Lower Waubesa Wetlands	129	Diversified wetland area, waterfowl and marsh bird habitat.

[1]State of Wisconsin Scientific Areas Preservation Council - 1969

[2]These areas are not numbered on the Plan since they are a part of other proposals

(Extracted from Environmental Inventory for MMSD's Comprehensive Facilities Plan)

TABLE 2-2 (cont.)

	Area Name	Acres	General Description, Geology, Comments
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[1]State of Wisconsin Scientific Areas Preservation Council - 1969

[2]These areas are not numbered on the Plan since they are a part of other proposals

(Extracted from Environmental Inventory for MMSD's Comprehensive Facilities Plan)

TABLE 2-3

ROCK COUNTY

NATURAL AREAS AND FEATURES OF SCIENTIFIC INTEREST[1]

	Area Name	Acres[2]	General Description
	Union Township		
1.	Brooklyn Prairie	+	Mesic, good condition
2.	Union Bog	10	Open bog, excellent condition
	Porter Township		
3.	Kessler Road Prairie	+	Wet-M. + Mesic, excellent condition
4.	Gibbs Lake		Marsh, Shrub Carr
5.	Gibbs Marsh	20	Cattail Marsh, Shrub Carr
6.	Kessler Road Prairie	+	Fen (dry), good condition
	Fulton Township		
7.	Mill Pond Bottoms		Lowland, fair condition
8.	Fulton Bottoms	10	Lowland, fair condition
	Milton Township		
9.	Milton Prairie	10	Dry-mesic, good condition[3]
10.	Camp Wakowpa	40	Dry-mesic Oak Woods, good condition
11.	Thiebeau Marsh	150	Cattail Marsh excellent condition
12.	Grass Lake	30	Cattail Marsh, excellent condition
13.	Storrs Lake	80	Grassy Cattail Marsh, fair condition
14.	Otter Creek Springs	+	Springs, excellent condition

TABLE 2-3 (cont.)

	Area Name	Acres	General Description
15.	Bingham Fen	+	Fen
16.	Newville Carr		Shrub-Carr
17.	Bingham Fen	+	Shrub-Carr, good condition
	Janesville Township		
18.	Janesville Nature Prairie		Dry-Mesic and Oak Savannah, good condition
19.	Janesville Prairie	+	Mesic
20.	Riverside Park	+	Mesic Oak
21.	Janesville Nature Preserve	40	Dry-Mesic Oak Savannah, good condition
22.	Fox Woods	10	Dry-Mesic Oak, good condition
23.	Riverside Park	+	Shaded Cliff

Source:

[1]State of Wisconsin Scientific Areas Preservation Council
[2]Acreage of areas under 10 acres or along railroads indicated by +
[3]Areas in imminent danger of destruction

(Extracted from Environmental Inventory for MMSD's Comprehensive Facilities Plan)

Odor

The environmental assessment does not present an adequate picture of potential odor problems created by the proposed project and how they should be mitigated. Since the majority of the project area is agricultural land, it would be expected that the types of odor sources in these areas would be typical of agricultural areas. In addition, Nine Springs Sewage Treatment Plant has been reported as an odor source to the Wisconsin Department of Natural Resources; however, no action orders have been issued to MMSD. Processes such as the trickling filters and grit dump in the lagoon were significant odor producers in the past. The potential for odor problems would be minimized or eliminated by implementation of the facilities plan proposed by MMSD since these processes will be abandoned or modified as part of the plan.

2. Land Use

Existing Land Uses

Section 6.1 and 6.5 and Figure 6.5 of the facilities plan and Section 2.09 and Table 2-10 of the environmental assessment present a general summary of existing land uses. Figure 6.5 shows the types of areas which have uses incompatible with an agricultural reuse plan and should therefore be avoided. Some correction and supplementation of these sections is needed.

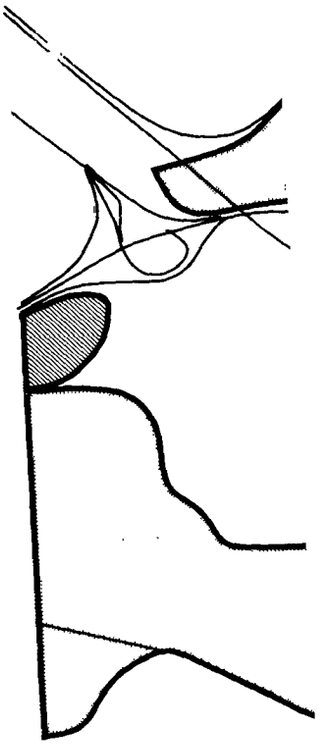
Two corrections of the text of Section 2.09 of the assessment should be noted. The figure 345,715 given for the population in the MMSD planning area in the year 2000 should be 299,643. The figure 2,040 acres given for the amount of additional acres of land for development (commercial, residential, and manufacturing) demanded by the year 2000 should be changed to 4,049 acres of additional land. (Personal communication with O'Brien and Gere Engineers staff).

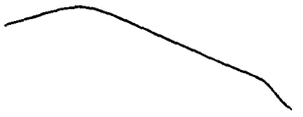
Land use around the existing plant and sludge lagoon site was one item not discussed in the environmental assessment. It should have been at least briefly considered in this portion of the plan since this plan proposes a modification of the existing sludge lagoon use and expansion of sludge treatment facilities. The following information was taken from a portion of the advanced waste treatment and discharge segment of the facilities plan related to plant siting.

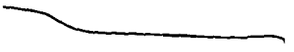
> "The plant site is bound on the northeast, east, and southeast by undeveloped property. (Refer to Figures 2-1, and 2-3). On the east side is a wetland, in public ownership, of 800-900 acres. (Refer to Figures 2-4 and 2-5). Industrially-zoned property to the northeast can be expected to develop in the future, while land to the east and southeast has limited development potential. Property immediately south of the plant is a mobile home subdivision. The area farther south and to the southeast is under cultivation. An undeveloped parcel of land lies immediately west of the plant, with an apartment complex and residential subdivisions beyond to the west. Land to the northwest is undeveloped, and an industrial complex lies to the north."

> "Zoning ordinances are administered by the respective jurisdictions within the vicinity of the plant and sludge lagoons; the City of Madison, the City of Monona, and Dane County. Land adjoining the treatment plant on the north is zoned industrial; the lands to the west are zoned manufacturing, agricultural, conservancy, and residential. The areas to the east and south of the plant are zoned manufacturing, agricultural and planned residential development." Refer to Figure 2-6.

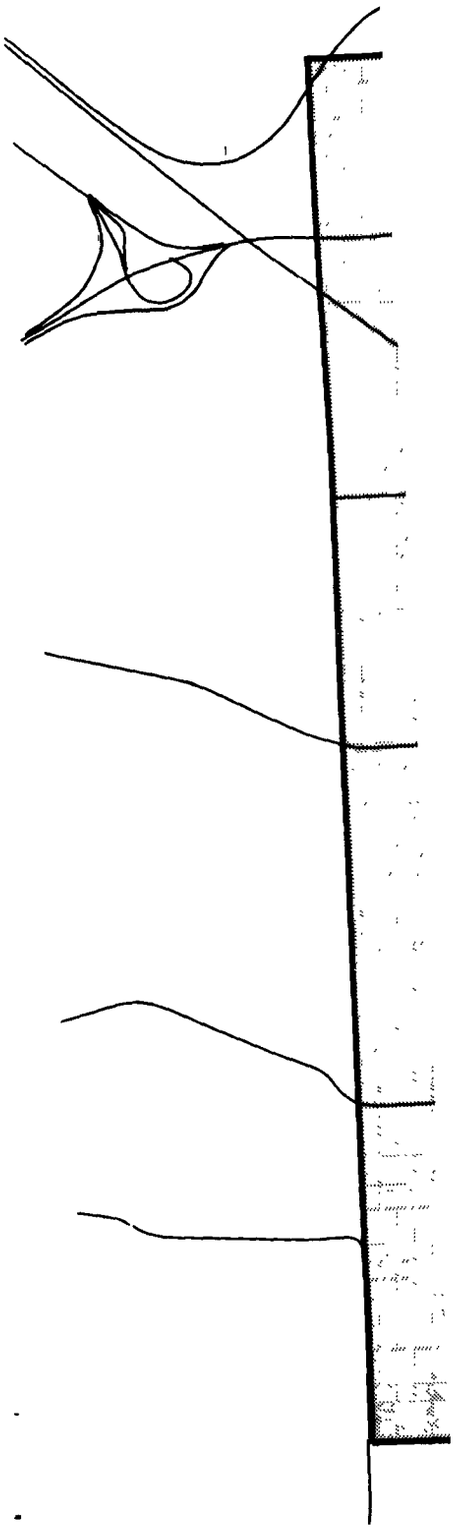
Lake Mon

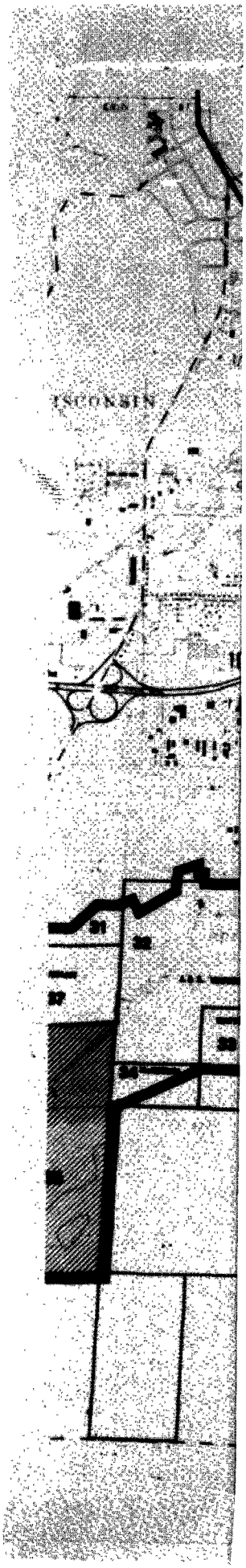






Lake Monona

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"Existing zoning is compatible with the present operation of the Nine Springs plant, but a mix of uses, including residential, has developed near the plant. Any nearby residential development can be considered a potential source of opposition to the further expansion of the plant."

Proposed Land Uses and Development Trends

The facilities plan and environmental assessment include only a minimal amount of discussion of proposed land uses and development trends for either the plan area in general or for the vicinity of the treatment plant and sludge lagoons specifically. To provide a better picture of future land use and development trends for the general study area the following information was extracted from the environmental inventory for the study.

"Definite statements cannot be made regarding future land use trends. The lack of strong, uniform land use planning implementation programs (personal communication, Mary Louise Symon, Dane County Board Chairman), and uncertain factors such as future birth rates and economic development, prohibit a clear estimation of future land use requirements. There is also no assurance that the trends noted in the past decade are indicative of long range land use patterns. However, based on the data available for the 1964 to 1973 period, some general land use trends seem apparent.

"Agricultural land use will probably continue to decline for a number of reasons. Increased production per acre of farm land will probably require that less land will be needed to produce the crops needed to feed increased future populations. Also, present economic conditions have led to a decreasing number of farms in operation.

"Dane County farms have decreased only slightly from 3,950 in 1972 to 3,940 in 1973, while the total land area has remained constant at 660,600 acres (Wisconsin Legislative Bureau, 1975).

"These figures all indicate a steady decline in both the total number of farms in operation and in the total number of acres devoted to agricultural practices on a state wide basis. Dane and Rock Counties do not seem to be affected as greatly.

"Population increases will require that additional lands be developed for housing, commercial establishments, services, utilities, etc. It is also anticipated that increased demand for recreation facilities will result in an increase of acreage devoted to this purpose."

One of the assumptions made by Dane County Regional Planning Commission in preparing their forecasts for area socioeconomic development is that an increasing proportion of future population increases will be located outside the Central Madison) Urban Services Area.

Related to land use plans and zoning for the area in proximity to the Nine Springs treatment plant (including sludge lagoons) some potential for conflicts appear to exist. As stated in a portion of the comprehensive facilities plan related to plant siting:

".... At the present time, existing zoning does not represent any serious conflicts with maintenance, operation and possible expansion of the treatment plant. Zones considered incompatible are fully developed, i.e., R-1 (the apartment complex) and PRD (the mobile home subdivision).

"There is reason for concern, however, when the comprehensive land use plan (Refer to Figures 2-7 and 2-8) is compared to existing zoning. Existing zoning does not totally reflect proposed land use patterns in the area, and the land use plan is the guiding reference in approving zone changes. Under the proposed plan, areas to the southwest, south, and southeast currently zoned agricultural could conceivably be altered to permit low-density or medium-density residential development. This would result in further encroachment of residential devlopment around the plant."

3. Water quality and quantity

Problem

Section 2.06 discusses surface and groundwater quality and quantity considerations. General reference is made to the types of pollution sources (point and nonpoint) affecting the area. Specific reference is made to the municipal point source discharges. However, no reference is made to industrial discharges. In the general area considered for sludge application the environmental inventory for the study shows eleven industrial point sources of pollution. These industries, the receiving waters into which they discharge, and the quantity and quality of their discharges are listed on Table 2-4 extracted from the environmental inventory for the study.

The most critical water quality problem most directly applicable to this organic solids reuse study is related to the storage lagoon problems which MMSD has experienced at Nine Springs sewage treatment plant. Those problems are summarized in Section 1.2 of the facilities plan and Section 1.04 E of the environmental assessment.

Uses

The discussion of water uses in Section 2.06 of the environmental assessment is sufficient for the level of detail of this report. Additional information is available in backup appendices to the comprehensive facilities plan.

Management

Sections 2.06 and 2.12 of the environmental assessmental adequately summarize water management programs in force in the study area.

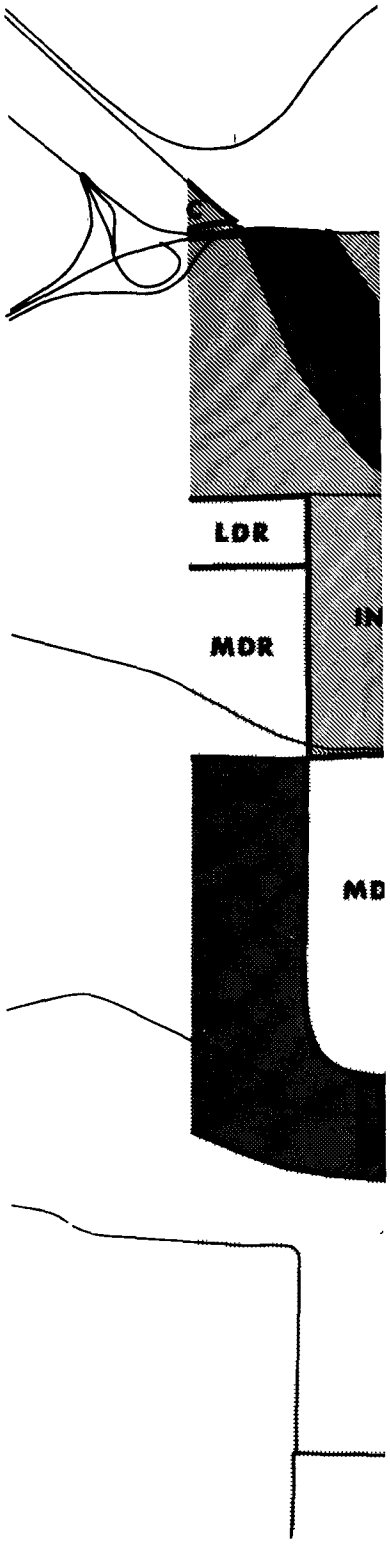
4. Summary of Sensitive Man-made Resources

Historical and Archeological Sites

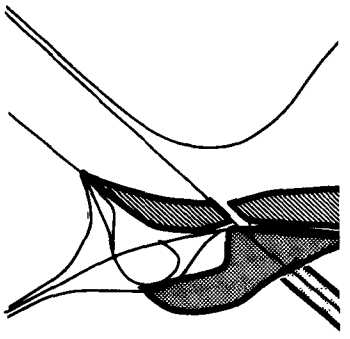
Section 2.16 of the environmental assessment is an adequate discussion of historical and archeological sites.

In a letter of comment on the draft EIS (letter included in Appendix A) the State Historic Preservation Officer indicated that there are no sites listed on the National Register of Historic Places that would be affected by this project. Also, there are no known sites of archeological, architectural, or historical significance in the project area that would be eligible for inclusion on the National Register of Historic Places.

Lake Monona



Lake Monona



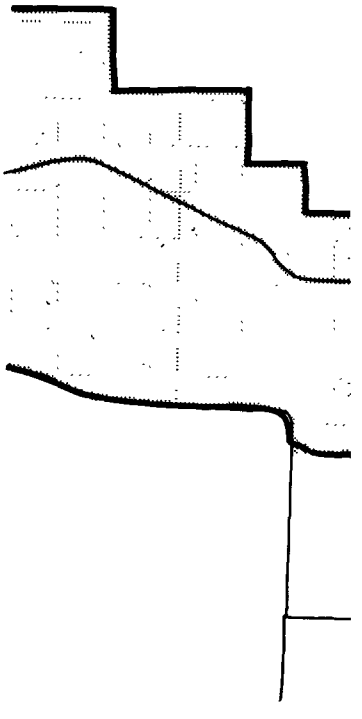


TABLE 2-4

INDUSTRIAL POINT SOURCES OF POLLUTION,[a]
LOWER ROCK RIVER BASIN

	Industry	Receiving Waters	Flowrate, MGD		Peak Contamination, mg/l		
			Peak	Average	BOD_5	TKN	SS
1.	Madison Gas and Electric Co., Madison	Lake Monona to Yahara River, to Rock River	177.8	88.1	5.0	0.02	0.24
2.	Oscar Mayer and Co., Madison	Yahara River, to Rock River	3.4	2.0	6.0	4.0	87.0
3.	Chicago, Milwaukee, St. Paul and Pacific Railroad, Madison	Lake Monona to Yahara River to Rock River	0.04	0.001	75.0	0.07	21.0
4.	ARS - Sprague Dawley Farm, Madison	Nine Springs Cr., to Yahara River, to Rock River	--	0.01	0.0	2.4	27.0
5.	Webcrafters, Madison	Yahara River to Rock River	0.20	0.18	0.6	4.1	6.0
6.	Bowman All Star Dairy, Madison	Nine Springs Cr., to Yahara River, to Rock River	0.01	0.005	2.4	0.8	2.0
7.	Schoep's Ice Cream Company, Madison	Yahara River, to Rock River	0.003	0.003	8.1	0.2	7.0
8.	Madison Newspapers, Inc., Madison	Lake Monona, to Yahara River to Rock River	0.05	0.01	5.0	0.16	21.0
9.	Giddings and Lewis Foundaries, Madison	Yahara River, to Rock River		0.24	8.0	1.48	249.0
10.	Graber Company, Middleton	Graber Pond	0.10	0.09	6.0	1.26	0.0
11.	Milwaukee Cheese Company, Waunakee	Six Mile Cr., to Yahara River, to Rock River	0.005	0.004	0.0	0.2	0.0
12.	Del Monte Corp., Arlington	Goose Lake	0.41	0.19	30.0	0.0	35.0
13.	Goodyear Tire and Rubber Co. Sun Prairie	Koshkonong Cr., to Rock River	0.08	0.05	7.0	0.0	9.0

TABLE 2-4 (cont'd.)

	Industry	Receiving Waters	Flowrate, MGD		Peak Contamination, mg/l		
			Peak	Average	BOD_5	TKN	SS
14.	Oconomowoc Canning Company, Sun Prairie	Koshkonong Cr., to Rock River	0.08	0.04	315	1.4	86.0
15.	Uniroyal, Inc. Stoughton	Yahara River, to Rock River	0.64	0.57	1.0	0.0	0.0
16.	General Motors, Janesville	Rock River	0.64	0.56	49.8	5.3	12.4
17.	Armstrong Chemical, Janesville	Rock River	0.04	0.04	5.5	6.4	10.0
18.	Park Pen Plant, Janesville	Rock River	2.40	1.09	9.0	3.9	0.4
19.	Parker Pen Offices, Janesville	Rock River	0.11	0.10	1.8	1.75	0.2
20.	Beloit Box Board, Beloit	Rock River	0.17	0.12	751	4.2	171
21.	Colt Industries, Beloit	Rock River	2.40	2.08	6.0	0.34	12.0
22.	Beatrice Foods Co., Beloit	Rock River	0.26	0.11	11.0	0.20	2.1
23.	George A. Hormel and Co., Beloit	Spring Br. to Rock River	0.08	0.06	28.8	0.0	0.2
24.	Larsen Co., Fort Atkinson	Rock River	0.49	0.39	80.0	80.0	210
25.	Jones Dairy Farm, Plant No. 1, Fort Atkinson	Rock River	0.64	0.56	49.8	5.3	12.4
26.	Jones Dairy Farm, Plant No. 2, Fort Atkinson	Rock River	0.05	0.05	12.9	2.3	34.0
27.	Thomas Industries, Fort Atkinson	Rock River	0.56	0.56	0.0	3.11	66.0
28.	Godfrey Company, Cold Spring	Spring Cr. to Bark River, to Rock River	0.003	0.002	60.0	8.6	51.0

TABLE 2-4 (cont'd.)

Industry	Receiving Waters	Flowrate, MGD		Peak Contamination, mg/l		
		Peak	Average	BOD_5	TKN	SS
29. Alpha Cast, Inc., Whitewater	Whitewater Cr., to Rock River	0.098	0.096	38.19	5.0	0.8
30. Bunker Rams Corp., Delevan	Swan Cr., to Turtle Cr., to Rock River	0.009	0.004	1.0	0.0	2.0
31. Triangle Pipe and Tube Co., Footville	Bass Cr., to Rock River	0.17	0.17	0.0	0.3	0.0

[a] Source: NR101 Files, Surveillance Section, Wisconsin Department of Natural Resources.

Recreation and Open Space Areas

The discussion of recreational areas and activities in Section 2.13 of the environmental assessment is an adequate summary of these subjects for the general project area. However, some additional discussion of recreation and open space areas in the vicinity of the Nine Springs Sewage Treatment Plant site and its sludge lagoons is necessary.

The Nine Springs Sewage Treatment Plant and surrounding areas falls within the Nine Springs Creek Corridor of the "E-way" system proposed by Dane County Regional Planning Commission. The basic framework for the "E-way" system consists of public roads, streets, walkways, and open space systems. These connected corridors enclose the city in an environmental loop which highlights its prominent educational, ecological, and environmental characteristics. The corridor widens in the area around Nine Springs Sewage Treatment Plant to include the undeveloped land and the adjacent wetlands a unique feature in the area. As can be seen on Figure 2-5, a large portion of land immediately to the south and east of the treatment plant and sludge lagoons is in public ownership. This land is being held for recreation and open space use. The public agencies owning land include the State of Wisconsin, Dane County, and MMSD. A portion of the area to the north of the sludge lagoons is designated as open space (see Figure 2-7) in the land use plan. The area is currently undeveloped. However, it is in private ownership. As shown on Figures 2-5 and 2-8 it is included as part of the E-way corridor system.

Agricultural Land

Chapter 6 (Section 6.1 and 6.4) of the facilities plan and the previous discussion of land use in this chapter together provide sufficient information on the agricultural economy and trends in agriculture in the study area.

Energy Resources

Energy uses by MMSD are adequately discussed in Section 2.14 of the environmental assessment. Other present or projected electrical power, natural gas and heating oil needs in the study area were not identified. "The Upper Mississippi River Comprehensive Basin Study" published in 1970 predicts a substantial increase in energy requirements in the basin between 1970 and the year 2000. The figures cited for Power Supply Area 13 which includes Dane County show that energy requirements will increase from 9,690 million kwh in 1970 to 50,560 million kwh in the year 2000. While these predictions may have changed somewhat since 1970, it can be expected that there will be an increasing demand for energy as the population increases.

CHAPTER 3
ALTERNATIVES TO THE PROPOSED PROJECT

Summary of Alternatives

Major alternatives evaluated:

Lagoon Abandonment Alternatives

Treatment plant sludge
  continue discharge to existing lagoons
  or discontinue discharge and build new lagoons
Lagoon sludge
  remove and apply to farmland
  or leave in lagoons
Lagoon supernatant
  remove and return to treatment plant
  or leave in lagoons
Lagoons dikes
  stabilize and maintain
  leave as they are

Ultimate Disposal Alternatives

Land application of dewatered sludge
Land application of liquid digested sludge
Land application of compost
Landfill of sludge/milled refuse mixture
Landfill of digested sludge
Subsurface placement of sludge
Incinerate raw sludge
Incinerate digested sludge
Lagoon storage - NO ACTION ALTERNATIVE

Transportation Method Alternatives

Rail transport
Truck transport
Pipeline transport

Application Method Alternatives

Sprinkler gun
Subsurface injection
Truck or tractor drawn spreader

Sludge Reuse Program Alternatives

Sludge supplied by MMSD at farmer's request
MMSD leases privately-owned land for sludge application
Combination of above alternatives

EPA Review of the Plan and Environmental Assessment

The organic solids reuse plan and the environmental assessment are accurate as far as they go in their presentation of how Madison Metropolitan Sewerage District systematically evaluated the various alternatives and arrived at their

proposed plan. However, some supplementation and clarification of what is presented in these two reports is required to allow the public to fully understand how various alternatives were eliminated from consideration. In some cases these reports compare the alternatives on the basis of economics when in reality MMSD and its consultants took other factors into account in addition to monetary costs. There is some additional information related to various alternatives which has not been considered in eliminating certain alternatives. Sludge treatment alternatives were discussed only briefly in the facilities plan, and environmental assessment. Instead of repeating what has been presented in the facilities plan and environmental assessment, this section will reference the sections of the facilities plan and environmental assessment which provide the information necessary to understanding how alternatives were evaluated and eliminated and supplement, clarify, or summarize this information where necessary.

The proposed plan includes a proposed lagoon abandonment program as well as a proposed plan for future sludge handling and disposal. Therefore, the alternatives discussion is broken up into those two categories.

A. Lagoon Abandonment Program Alternatives

Sections 1.2 and 1.3 of the facilities plan and Sections 1.04 and 1.05 of the environmental assessment give an adequate history of sludge lagoon problems at Nine Springs Sewage Treatment Plant. They show why MMSD was forced to cease their previous program of lagoon disposal of sludge and adopt a course of action to stop the threat of lagoon dike failure.

Chapter 5 of the facilities plan adequately discusses how the various alternative lagoon abandonment options were evaluated in selecting the proposed plan. Appendix B, Tables B-1 - B-4 of the facilities plan compare costs for the various alternatives.

It appears that MMSD has systematically and adequately considered all reasonable and feasible alternatives to lagoon abandonment and lagoon sludge disposal.

B. Future Sludge Handling and Disposal Alternatives

This category includes the alternative methods of treating, transporting and disposing of sludge produced by MMSD in the future.

As indicated in Sections 2.1 - 2.4 of the facilities plan and Section 3.01 of the environmental assessment, MMSD has had several studies done related to sludge treating, transport, and disposal. The results of the reports are summarized in the above-referenced sections. From the information presented in these sections it would appear that feasible alternatives were screened solely on the basis of monetary costs. Although monetary cost was certainly the overriding concern in the screening of alternatives, the various reports did include consideration of other factors in the screening process. The following discussion of the various reports is meant to supplement and evaluate what has been presented in the referenced sections of the facilities plan and environmental assessment.

1. Greeley and Hansen Reports

The discussion presented in Section 2.1 of the facilities plan and Section 3.01 of the environmental assessment is accurate. The alternatives include consideration of handling and disposal of sludge. It should be realized that alternatives A-D assume 25-mile truck transport of sludge and alternative E (liquid sludge application) assumes 25-mile pipeline or rail transport. The current proposed plan includes immediate truck and potential future pipeline

transport of liquid sludge. It would appear that on the basis of monetary costs no comparisons could be made of the proposed immediate plan of truck transport of liquid sludge with the alternatives in the Greeley and Hansen report since the assumed modes and distance of transport presented vary. However, Appendix B to the facilities plan compares the costs for various modes of transport so that comparisons can be drawn.

2. Weston Report

This report was discussed in Section 2.2 of the facilities plan and Section 3.01 of the environmental assessment. These sections present an adequate discussion of how lagoon disposal, land application of dried sludge, incineration of sludge and subsurface placement or trenching were eliminated from consideration on the basis of monetary costs. However, the discussion of how the three remaining alternatives (land application of liquid sludge, sanitary landfill of a sludge-milled refuse mixture and land application of compost) were compared only includes information on monetary costs. The Weston report had also compared these three alternatives on a non-monetary basis. Some additional factors considered related to these alternatives were:

Land application of sludge - In addition to the cheaper dollar cost of this alternative the report gave a shorter implementation time and retrieval of the fertilizer value of sludge as advantages. This alternative requires lagooning over the winter months. The report also indicated that virus survival, odor, heavy metals and runoff could be problems. However, with adequate control they are surmountable difficulties.

Sanitary landfill of sludge-milled refuse mixture - With this alternative the report indicated that sludge dewatering would be required and would probably provide a centrifuge effluent return of unacceptable quality. Cover material would probably be required in this alternative. The availability of a reliable source of milled refuse was considered questionable.

Land application of compost - According to the Weston report, some of the advantages of composting are: 1) Composting would return a valuable resource to the soil; and 2) Composting the Nine Springs sludge with wood chips or milled refuse would present additional dewatering benefits considering the poor dewatering characteristics of the sludge. After consideration of mechanical composting as an alternative, the Weston report concluded that it would be difficult or impossible to achieve the optimum moisture content which would promote effective growth of the aerobic organisms necessary to achieve composting. In addition, it was felt that the effluent from the centrifuge dewatering system could potentially impact on the balance of the treatment system. Open windrow composting such as has been tested at Beltsville, Maryland was also considered in the Weston report. It was felt that this type of composting could only be accomplished during summer months because of the low nighttime temperatures common to winter in Madison. It would be difficult to achieve an acceptable dewatered state as with mechanical composting. The problems with centrate quality affecting treatment balance would also be the same. A negative concern related to?aKmposting in general was the doubt of finding reliable sources of wood chips or milled refuse.

The Weston report was prepared based on initial test results at Beltsville, Maryland. More recent experiences by the United States Department of Agriculture at Beltsville and subsequent experiences at Bangor, Maine vary from the discussion of windrow composting presented in the Weston report. The experience at Bangor,

Maine (personal communication, USDA Laboratory, Bangor, Maine) has been that adequate windrow composting can be achieved year-round with proper controls. Also, the costs associated with composting would be lower than those cited in the Weston report. The cost of composting is less than the $140/dry ton cited in the Weston report. Estimated cost figures cited in a paper by Epstein and Wilson related to the sludge composting project at Beltsville, Maryland are $30/dry ton at a 40/dry ton/day plant receiving dewatered sludge. Personal communication with Dan Kowaseco, USDA Beltsville, Maryland indicated that the estimated cost would be in the range of $30-$60/ dry ton. This estimated cost does not include haul costs or any revenue resulting from sale of the product. This would still be higher than Madison's proposed plan. The Weston report also indicated that the highest practical and economical level of solids which could be attained at Nine Springs STP was around 12% and that this was below the level necessary to achieve composting. In recent tests at Beltsville, Maryland composting has been achieved using sludges with as low as 5% solids. The results of the tests have not yet, however, been published. (Personal communication, Dan Kowaseco, USDA, Beltsville, Maryland).

The Weston report did not consider additional benefits of composting which have been experienced at Beltsville, Maryland. These include better kill-off of pathogens and fewer potential odor problems. The recent experiences at Beltsville have shown that composting can produce a soil amendment product which could either be sold to offset the processing cost or used with the municipality for a variety of purposes, decreasing the amount of inorganic fertilizers which would otherwise be purchased.

Related to the composting alternative for MMSD it would appear that certain problems discussed in the Weston report such as finding a reliable source of wood chips and finding a market for the product would still offset the benefits to be gained from using composting. If the proposed farm market for liquid sludge does not develop as anticipated, it may be possible to reconsider composting as an alternative backup program.

Sludge treatment alternatives considered in the Weston report - The selection of sludge treatment alternatives was based on the need to produce sludges of a quality which would be suitable for the alternative methods of suitable ultimate disposal. Various combinations of processes were considered for each of the major sludge handling systems (Sanitary Landfill System, Land Application of Compost System and Land Application of Liquid Sludge System). The proposed system of land application of liquid sludge incorporated the process of blending of primary and secondary sludges, gravity thickening, and anaerobic digestion.

3. MMSD Addendum

Section 2.3 of the facilities plan and Section 3.01 of the environmental assessment discuss this report. The report analyzed several sludge treatment and disposal alternatives on the basis of costs and environmental impacts. The system proposed in the report as most cost-effective includes thickening and anaerobic digestion followed by pipeline transport and land application of liquid sludge. The evaluation of how three of the alternative systems were eliminated in a preliminary screening was adequately discussed. However, the evaluation of the four remaining alternatives was not sufficiently detailed. The following evaluation of these alternatives was excerpted from the MMSD Addendum to supplement the information in the facilities plan and environmental assessment. The final selected land application system varies somewhat from the Alternative 2A presented here in that the final system is more conservative and eliminates most of the disadvantages discussed for Alternative 2A. The costs of the four alternatives considered in the final screening in MMSD's Addendum is presented in Appendix B.

Alternative 1A - Land Trenching of Dewatered Sludge

Advantages

This option does not require digestion of the sludge. Elimination of a unit operation eliminates operational and control problems associated with that unit operation. The operation would be continuous, without the need for lengthy sludge storage which has the potential for odor problems. There would be very little visible evidence of sludge disposal at the final disposal site. A relatively small land area would be required to handle the sludge in this manner. If a farm were purchased by MMSD for the purpose of trench disposal, the farmer could continue to work the undisturbed property with minimal interference due to the sludge disposal. Odor problems at the disposal site would be minimal.

Implementation time for this system would be short and primarily dependent on the delivery time for the dewatering equipment. The final disposal site could be switched easily because of the small area required per year and the fact that the dewatered sludge would be transported by truck.

Disadvantages

The main disadvantage of the trenching option is the inability to predict whether the land used for disposal would be stable enough to be brought back into useful crop production. The dewatered sludge at 16% solids content is still pliable and may not readily lose enough of its remaining moisture to the surrounding earth or the atmosphere to stabilize. If the dewatered sludge would not stabilize, productive land may be lost.

A site with suitable geological characteristics would have to be found to prevent uncontrolled discharge of pollutants to the surrounding groundwater. The trenches might have to be lined with an impermeable membrane prior to sludge placement or drain tiles might be required to catch any downward movement of leachate. This leachate may have to be treated, probably by spraying it back on productive land.

The sludge dewatering step would produce a recycle stream which must enter the secondary treatment system. The recycle stream would use some plant capacity and may also have a harmful effect on the effluent discharged from the secondary plant. The 1990 loading from this recycle stream would equal 3.5 per cent of the anticipated 1990 BOD load, 3.9 per cent of the anticipated 1990 suspended solids load and 3.3 per cent of the anticipated 1990 ammonia nitrogen load in the secondary treatment plant. The suspended solids in the recycle stream would be very fine in nature and may accumulate in the secondary treatment system. Chemicals which may become increasingly expensive and hard to get must be used for conditioning prior to dewatering.

Elimination of the digestion step would eliminate production of methane gas now used to heat buildings and run specific equipment at the treatment plant.

Another disadvantage of this option would be the loss of the fertilizer value in the sludge because of the manner of disposition. The nutrients in the sludge may be discharged to the groundwater as a pollutant rather than recovered as a resource. Frozen ground may make winter trenching difficult.

Alternative 2A - Land Application of Liquid Sludge

Advantages

This disposal option utilizes the high fertilizer value in the sludge. Crop uptake of the nutrients would turn a problem into a benefit. Very little land would be permanently taken out of useful crop production. The same site could be continually used with no loss in aesthetic or economic value during or beyond the design period.

The implementation time of this system could be short relative to the other alternatives. With this system, it would also be easy to slowly reduce the sludge volume in the existing lagoon if this action were necessary. There would be limited expansion necessary at the existing Nine Springs Treatment Works. No recycle stream, with the associated problem of BOD , SS and NH-N removal, would be returned to the secondary treatment plant. There would be no dependence on chemicals for sludge conditioning or no worry about fines buildup in the secondary treatment system.

Disadvantages

The major disadvantage associated with this option is the expected difficulty in locating and purchasing or leasing the large land areas required for controlled successful land irrigation of sludge. If the land were not purchased or leased, there would be difficulty in coordination with local farmers for land use.

The necessity for a temporary sludge storage lagoon could lead to an odor problem if proper controls were not maintained. The land application of sludge may result in a musty odor which could be offensive to some individuals. A buffer area would have to be provided around the land used for storage and application. Possible virus survival is also of concern. With increased digestion capacity, more complete digestion should minimize the potential odor and virus problems.

Aeration of the lagoons would help prevent odors. The sludge lagoon would be storing sludge primarily during the winter months when odors are not normally a problem. In summer the lagoons would be used as a transfer point and would not hold large volumes of sludge, therefore minimizing potential odor problems. New efforts directed at reducing odor problems would have to be implemented.

For this option it may also be necessary to line the final disposal site with drain tiles, collect the leached water and return it to the surface for crop irrigation. Careful control of runoff would be necessary along with adjacent stream monitoring.

Laying a pipeline to a specific point severely limits the location of the final disposal site. The permanence of a pipeline, along with the time and money associated with construction of a such a line, tend to make this option inflexible. It would be difficult to justify abandoning or severely altering this system once it was operational.

The entire application and cropping procedures would require agricultural management expertise which would have to be acquired by MMSD.

Alternative 3A - Landfilling of Sludge/Milled Refuse Mixture

Advantages

This alternative would take advantage of the expertise available in the operation of traditional sanitary landfill operations. It would utilize the absorptive capacity of existing refuse to act as a dewatering agent for the sludge. It would be necessary to dewater the sludge but not to a high degree.

Site control could be insured from experience gained in the solid waste handling field. There should be no odor problem associated with this operation if proper cover techniques were used.

The land requirements would not be excessive. There would also be minimal sludge storage requirements which could result in potential odor problems. Also, with this option, it would be easy to reduce the volume of sludge in the existing lagoons by gradual inclusion in the mixing process if more milled solid waste were to become available.

Disadvantages

Land utilized as the final disposal site could be recovered as cropland or for some other use but, may have some limitations. Once the landfill has been placed and the original site filled, a new site must be located.

The necessity of dewatering produces a recycle stream which must be treated and may have a harmful effect on the effluent from the secondary treatment plant. The 1990 loading from this recycle stream would equal 1.0 per cent of the anticipated 1990 BOD load, 1.5 per cent of the anticipated 1990 suspended solids load and 13.5 per cent of the anticipated 1990 ammonia nitrogen load in the secondary treatment plant. The suspended solids in the

recycle stream would be very fine in nature and may accumulate in the secondary treatment system. Chemicals which may become increasingly expensive and hard to get must be used for conditioning prior to dewatering.

This option involves rehandling the sludge several times, once before mixing and once after mixing. Again, the fertilizer value associated with the sludge is lost in the landfill.

This option is dependent on obtaining a certain quantity of milled refuse from the City. If that refuse were not available or very high in moisture content, sludge disposal would be impaired.

This option limits the potential resource recovery from the milled refuse unless it were used in a compost operation. Sludge/milled refuse in a landfill would generate leachate which would have to be collected and treated. The nutrients associated with the sludge would be a potential groundwater pollutant.

Alternative 3B - Land Application of Dewatered Sludge

Advantages

The major advantage of this option is the use of the fertilizer value associated with the sludge. Nutrient uptake would be accomplished by crop production. No land would be taken out of farm use. The same site could be used in future years with no physical or economic loss.

No storage lagoons are necessary. The sludge could be stockpiled on the land on which it would be eventually spread. Odor problems associated with the dewatered completely digested sludge should be minimal. Spreading of the sludge could probably be accomplished with normal farm equipment. The necessary nutrient loading could be provided with one pass over the land.

Disadvantages

Hauling the dewatered sludge to rural farmland may result in some objection from the local residents. The same large amounts of purchased or leased land is required as in the liquid sludge application alternative. If the land were not purchased or leased, coordination with the local farmers might be difficult. Virus survival may again be a question not to be overlooked.

The sticky character of the dewatered sludge due to the polymer addition may make it very difficult to spread or plow under evenly. These problems would result in poor acceptance by farmers. This problem might possibly be reduced by lowering the polymer dose to the centrifuge such that the centrate stream character degrades but the sludge cake solids content does not appreciably change. The centrate stream might then be air floated or recentrifuged to clean up the centrate.

This option involves treatment of a recycle stream. This stream would use part of the planned secondary expansion and could degrade the treatment plant effluent. The percentages of anticipated 1990 BOD , SS and NH-N loading attributable to the recycle stream are the same as for Alternative 3A. Again there would be a dependence on chemicals for conditioning.

4. CH2M Hill Study

The aforementioned studies all came to the same basic conclusion, that the most cost-effective method of sludge management for MMSD is land disposal of liquid digested sludge. Therefore, MMSD resolved to pursue that method of disposal. The firm of CH2M Hill was hired by MMSD subsequent to the aforementioned studies to further evaluate the sludge treatment processes which would be employed prior to land application. They compared aerobic vs. anaerobic digestion and determined that anaerobic digestion should be utilized for primary and secondary sludges due to the higher power consumption requirements and requirements for separate land application required for aerabic digestion. They also compared various type thickeners (gravity, air flotation, centrifuge, and centrifugal screen concentrators) and determined that a two-stage thickening process first employing gravity thickening and then air flotation thickening would be least costly. The system of land application of liquid sludge which they propose includes gravity and air flotation thickening and anaerobic digestion prior to disposal.

5. Reuse level alternatives

Section 3.1 and Table 3-1 of the facilities plan give a complete summary of the three reuse categories, (fertilization, high rate fertilization and disposal) including loading rates, objectives, suitable soils and impact on soil and water. Section 7.1 is somewhat misleading because it implies that high rate fertilization and disposal would definitely affect surface and groundwater. Those impacts can be avoided, however, only with a very strict management program. The selected reuse program is a fertilization type program.

6. Reuse Program Alternatives

Section 7.2 and 7.6 of the facilities plan adequately discusses how the reuse program of supplying sludge to farmers at their request was selected as the proposed reuse plan.

7. Transportation Method Alternatives

Section 3.02 of the environmental assessment adequately discusses the advantages and disadvantages of the three most feasible methods of sludge transport which are rail, truck, and pipeline transport. Section 7.5 and Appendix B compare truck and pipeline transport. As was discussed, although pipeline transport is less expensive and has other advantages, a pipeline route could not be determined until a reliable and sufficiently large sludge market develops. Therefore, Madison proposes to use truck transport in the immediate future until a market develops.

8. Intermediate Storage Facility Alternatives

Section 7.5 of the facilities plan and Section 3.02 of the environmental assessment adequately discuss the two types of intermediate storage facilities considered for on-site sludge storage to increase the efficiency of the sludge transportation and application systems. The additional alternative exists of not providing for intermediate sludge storage. Not utilizing such facilities would result in a less efficient system, especially during peak application periods.

9. Application Method Alternatives

Section 7.5 of the facilities plan and Section 3.02 of the environmental assessment are adequate in their discussion of application methods with one exception. Since air borne pathogens at sludge irrigation sites has been considered by some as a potential public health problem, the subject should be discussed. According to Burge (1974), "The threat of infection to sprinkler irrigation site workers and to the surrounding communities through exposure to aerosols containing pathogens has not been completely defined, but experience and what literature is available seem to indicate that the threat is minimal." A USEPA - sponsored research project currently being conducted at the Fulton County, Illinois sludge disposal area of the Metropolitan Sanitary District of Greater Chicago is expected to provide some additional information related to airborne transmission and survival of pathogens in aerosols from big gun sprinkler irrigation systems. It would appear unlikely that truck spreader and soil injection systems would present any kind of potential airborne pathogen problem since the formation of aerosols is not a problem, with those methods.

10. No Action Alternative

The "No Action" alternative is adequately discussed in Section 3.03 of the environmental assessment.

11. Other Considerations in Developing the Proposed Plan

Existing State and Federal guidelines were followed in formulating the proposed plan. The Federal guidelines mentioned on page 3-6 of the environmental assessment will be superceded by a technical bulletin (published in draft form in the Federal Register on June 3, 1976) when it becomes final. This bulletin is meant as guidance and does not have the force of a regulation. Where state guidelines exist, the stricter of the two guidelines, Federal or state, would be followed in developing a sludge management plan.

CHAPTER 4
DESCRIPTION OF THE PROPOSED ACTIONS

Summary of the Proposed Actions

The studies which were conducted regarding the treatment and final disposal of sludge produced at Nine Springs Wastewater Treatment Plant determined land application of liquid anaerobically digested sludge to be the most cost-effective method of disposal. The plan involves marketing of sludge to farmers at their requests. Initially truck hauling and spreading will be employed until an adequate market for sludge develops. Various sludge lagoon abandonment options were also evaluated to eliminate the potential for lagoon dike failure. Past failures have resulted in toxic spills to Nine Springs Creek and adjacent wetlands. It was determined that a lagoon dike rehabilitation and maintenance program is necessary. One lagoon will gradually be dredged out and eventually abandoned. The other lagoon will also be cleaned out and one-half of this lagoon will also be abandoned. The other half will be used for seasonal sludge storage. The lagoon sludge resulting from lagoon cleanout will be applied to land just as the new treatment plant sludge will be.

EPA Review of the Plan and Environmental Assessment

Chapter 8 of the facilities plan and Section 4 of the environmental assessment present an adequate description of the proposed actions with a few exceptions. Construction of additional sludge treatment facilities is now considered part of the organic solids reuse plan. Therefore, some information on the proposed treatment facilities is provided. Related to the cost of the proposed system; some supplementation and correction is required. Additional information on the lagoon dike rehabilitation and abandonment is also provided.

A. Sludge Treatment Facilities

Additional facilities are necessary for thickening and digestion of the additional organic sludges produced by the expanded and upgraded treatment plant. The Basis of Design for the solids handling facilities and construction staging is presented in Appendix C.

1. Gravity Sludge Thickener Improvements

The mechanisms on the two original gravity thickeners will be refurbished and worn parts will be replaced as needed. An additional 55' diameter gravity thickener may be needed to supplement the two original units. Facilities will be constructed to facilitate the addition of secondary effluent to the thickeners in order to reduce odors caused by septic conditions.

2. Dissolved Air Flotation Thickeners

Dissolved air flotation thickeners will be constructed in order to pre-thicken waste activated sludge prior to digestion.

3. Sludge Digester Improvements

A total of five new digesters (two primary and three secondary digesters) will be constructed to serve the plant through the year 2000. The units will be two-stage digesters operating in the mesophilic temperature range. A new digester control building will also be constructed.

Modifications will be made to the existing digesters including resealing, replacement of heat exchangers, the addition of gas mixing equipment and the renovation of the waste gas burners. In addition, MMSD will consider installation of a supernatant draw-off system and a supernatant treatment system in order to return supernatant from the secondary digester back to the head end of the treatment plant. The supernatant draw off systems would be used only on the secondary digesters (non-mixed tanks).

B. Cost of the Organic Solids Reuse Program

Table 8-1 of the organic solids reuse program is incorrect as shown. Table C-3 in Appendix C is a revised version of Table 8-1. Information on total present worth of the proposed system was not included in the organic solids reuse plan or environmental assessment. Table C-4 in Appendix C summarizes the calculation of the total present worth of the proposed system.

C. Lagoon Dike Rehabilitation

The sludge storage lagoons at the Madison Metropolitan Sewerage District's (MMSD) Nine Springs Sewage Treatment Works are located just east of the treatment works on Raywood Road (Plate I). There are two lagoons—one approximately 45 acres in size, and one approximately 85 acres in size. The smaller lagoon (Lagoon 1) was constructed in about 1942. The larger lagoon (Lagoon 2) was constructed in 1967. Digested sludge produced at the Nine Springs Sewage Treatment Works is currently being discharged and held in these two lagoons.

This project involves rehabilitation of certain portions of the existing Lagoon 2 dikes. Approximately 3,000 lineal feet of dike will be modified to provide increased freeboard through the use of a lightweight fill embankment improvement. Approximately 700 lineal feet of dike will be completely reconstructed. The objective of the work is to minimize the risk of an uncontrolled release of sludge and supernatant because of the continued subsidence and spreading of the existing containment dikes.

The area of the proposed dike rehabilitation consists of the eastern 1600 feet of the existing north dike of Lagoon 2 and the entire south dike of Lagoon 2. The proposed rehabilitation consists of two parts: modification and reconstruction. Plan reviews and typical sections of the proposed rehabilitation are shown on Plates II, III, and IV.

Modification will consist of constructing a lightweight fill of wood chips on and adjacent to the existing dikes. The lightweight fill will be constructed with a 16-foot-wide crest that will be approximately 7 feet above the existing marsh. Nonwoven synthetic fabric will be used as lateral reinforcement (corduroy) and as a filtering and separation medium at the base of and on the inboard sloping face of the lightweight fill. Both the inboard and outboard sloping faces of the lightweight fill will be covered by a 1-foot-thick layer of well graded granular soil (15 to 25 percent by weight of this soil will pass the No. 200 sieve). The crest of the modified dike will be surfaced with 6 inches of granular base course to provide all-weather access.

Reconstruction will consist of backfilling the area where the existing dike has subsided below the marsh level (1973 failure zone), and constructing a new lightweight dike. Backfilling will be done with channel fill, a mixture of approximately one part granular soil to one part wood chips (volume basis). Nonwoven fabric will be used at the base of the channel fill to provide lateral reinforcement. The surface of the completed channel fill will be approximately

at the level of the surrounding marsh. The lightweight dike will be constructed of wood chips and nonwoven fabric will be placed at the base of the wood chips to provide lateral reinforcement. The geometry and details will be essentially identical to those for dike modification.

D. Lagoon Abandonment

On 15 July 1971 the Wisconsin Department of Natural Resources (WDNR) issued Pollution Abatement Order No. 4B-71-1L-22 to MMSD. The order required that MMSD provide for satisfactory disposal of liquid sludge from the Nine Springs Sewage Treatment Works and that the operation include provision for abandonment of the present method of disposal of liquid sludge in Nine Springs Marsh.

The disposition of liquid sludge was studied as a part of the Facilities Plan. This study recommends that the program to implement the abandonment directive consist of the following:

1. Continue using the western half of Lagoon 1 for annual or temporary storage of sludge.

2. Begin cleaning out Lagoon 2 and the eastern half of Lagoon 1 and apply the sludge to agricultural lands. An estimated 9-14 years will be required to completely unload the lagoons.

3. Continue to return and treatment supernatant until the lagoons are fully unloaded.

4. After the lagoons are fully unloaded, allow Lagoon 2 and the eastern half of Lagoon 1 to revert to marsh.

Implementation of this program requires that the dikes perform satisfactorily until the lagoons are unloaded. The review of existing conditions and evaluation of past performance led to the following conclusions (among others) in the special report entitled, "Geotechnical Evaluation of Sludge Lagoon Embankments."

1. Certain reaches of the embankments of Lagoon 2 are unstable.

2. Failures and possible damaging spills are imminent, and for portions of the dikes of Laggon 2, incipient.

3. Regardless of the disposition of the sludge in the lagoons, the unstable reaches must be repaired as soon as possible.

The special report recommended:

1. Stabilize portions of the dikes of Lagoon 2 as soon as possible.

2. Stabilize those portions of the Lagoon 2 embankment by replacing the existing dikes with embankments constructed using berm and corduroy techniques.

The method which has been selected for cleaning the sludge out of the lagoons prior to abandonment is the use of a Mudcat dredge. This is a small portable floating dredge which is self-propelled and can move into the sludge to be pumped. It can slurry the sludge prior to pumping.

The various lagoon abandonment options were discussed in detail in Section 5.5 of the facilities plan.

CHAPTER 5
ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTIONS

Summary of Significant Environmental Impacts

Water

The abandonment of lagoon disposal of sludge at Nine Springs sewage treatment plant will eliminate the threat of lagoon dike failure and resultant toxic spills of the lagoon contents into Nine Springs Creek and the adjacent wetlands. As long as the proposed land disposal program is strictly managed and operated as planned, there will be no significant effect on water quality and quantity.

Air Quality

As long as the precautions related to sludge hauling and application which have been outlined in the facilities plan and environmental assessment are taken, potential odor problems will be minimized. Dust generated from construction of solids treatment and handling facilities will cause a temporary change in ambient conditions. Significant odor-producing sludge treatment processes will be abandoned or modified by this plan so that odor problems will be minimized.

Land Use

The only significant effect on land use which is expected to result from the proposed plan is the beneficial one which is the eventual return of the abandoned sludge lagoons to a wetland condition.

Soils and Biota

The soil fertilizer value of the sludge will improve the fertility of the soils on which sludge is applied while reducing the quantities of expensive commercial fertilizers which must be used. Possible impacts on the soils and plant and animal life of the study area could result form the build-up of materials contained in the sludge to levels which may be toxic to normal life functions. This potential effect will be minimized because MMSD's plan proposes to limit annual application rates and total allowable loadings to levels which would provide for protection of the soils and plant and animal life of the area while at the same time obtaining the maximum soil amendment value to be gained from land application of the sludge.

Cadmium levels and the ratio of cadmium to zinc to MMSD sludge are higher than the United States Department of Agriculture would recommend for sludge being applied to privately-owned land. MMSD's conservative application rates and their proposed cadmium source control program should minimize the potential for build-up of cadmium to toxic levels.

EPA Review of Plan and Environmental Assessment

In many cases the environmental effects section of an EIS would compare the environmental impacts of the proposed action and its alternatives. For this plan the information available on the effects of various alternatives was discussed in Chapter 3 of this EIS and in sections of the facilities plan and environmental assessment referenced therein. Although the information available on the environmental affects of system and subsystem alternatives considered by MMSD is not presented in a great level of detail, we feel that it is adequate to assess how the most cost-effective sludge management plan was selected. It remains, then, to ensure that the plan proposed by MMSD is environmentally sound and should indeed be pursued. The discussion of impacts will therefore relate

strictly to the effects of MMSD's proposed plan and not to the effects of alternatives.

MMSD's organic solids reuse plan has been developed to be in accordance with Wisconsin DNR Technical Bulletin No. 88 entitled "Guidelines for the Application of Wastewater Sludge to Agricultural Land" and with recommendations of the proposed USEPA Technical Bulletin on "Municipal Sludge Management: Environmental Factors" published June 3, 1976, in the Federal Register.

Since, overall, MMSD's plan has been carefully formulated to minimize adverse environmental effects and the facilities plan and environmental assessment systematically discuss the potential effects of the proposed plan in a generally adequate fashion, we will identify here only those critical impact issues which require further discussion or have not been mentioned. The discussion of impacts of the proposed plan is divided into sections which correspond to various segments of the organic solids reuse plan.

A. Sludge Lagoon Abandonment Program

The impacts resulting from these actions are discussed in the environmental assessment Sections 5.02 D, 5.02 F, 5.02 K, 5.02 L and 5.02 M. The effects of transporting of lagoon sludge and applying it to agricultural land will be considered under "Operation of the Organic Solids Reuse Plan."

The potential impacts of dike repair and sludge removal on the fishery of Nine Springs Creek and adjacent wetlands were not specifically addressed in the facilities plan or environmental assessment. They were only addressed in terms of the net beneficial effect expected to result from the lagoon abandonment program, i.e., removing the threat of lagoon dike failure and toxic spills into Nine Springs Creek and adjacent wetlands. Obtaining this net positive impact requires that the dikes perform satisfactorily until the sludge has been removed from the lagoons.

The proposed rehabilitation construction carries inherent risks with the consequence of loss of lagoon contents by spilling. However, if nothing is done, failure or overtopping of the dikes of Lagoon 2 is a virtual certainty. If sludge is released, oxygen-depleting organics, taste and odor-producing constituents, toxic substances, and heavy metal ions will be introduced to the receiving waters. A spill will also release tremendous amounts of nutrients, increase color and turbidity, increase suspended and dissolved solids, and introduce potentially pathogenic wastes to the adjacent surface waters. The environmental consequences would be deposition of sludge in Nine Springs Creek, stimulation of excessive growths of weeds and algae, deterioration of water quality, killing and prohibiting the existence of certain species of fish and aquatic life, and devaluation of aesthetic and recreational values of the affected waters.

To minimize the risks of failure caused by construction activities, the following techniques will be used:

1. Lightweight aggregates will be used to substantially reduce loads imposed on the low strength foundation soils.

2. Corduroy techniques will be used to increase the stability of the modification and reconstruction by providing lateral reinforcement.

3. Surface instrumentation including survey hubs and settlement platforms will be used to monitor movements during construction. This information will be used to measure actual performance versus predicted performance and to forewarn of impending failure.

4. All construction activities will be closely observed by a qualified geotechnical engineer.

The potential adverse environmental impact of the proposed construction is less than the probable environmental impact of the introduction of sludge and supernatant into the adjacent surface waters that would occur during a failure or overtopping of the existing unstable dikes.

Should a failure occur during construction, a contingency plan to prevent spilling of lagoon contents will be immediately implemented. Wood chips will be placed on the existing dike to maintain freeboard, and a covering of corduroy fabric will be used to prevent the woodchips from floating away. Pins will be driven through the fabric to secure it. The contractor will be using very light equipment for construction, and loadings from equipment working at a failure zone should not cause progressive failure. The wood chips will only be a temporary measure against breaching, and after the new dike is in place, they will no longer be needed for freeboard. MMSD also has a supply of sandbags which can be filled with mixed soil and wood chips to construct lighweight temporary repairs.

Response to potential failure conditions will be immediate since the contractor will have the necessary equipment at the site and can go straight to work without time-consuming mobilization of men and materials. Past failures have been progressive in nature because the soil that was added to maintain freeboard as the dike settled merely added more weight which, in turn, led to more settlement. The contingency plan will prevent recurrence of this situation.

No natural marsh habitat will be lost as a result of this construction. A limited area of man-made wildlife habitat will be temporarily lost where dike modifications are placed at the outboard toe of the existing dike. As vegetation develops on the soil cover, this habitat will return. No adverse effect on wildlife (other than the temporary loss of habitat) is expected.

The new dikes require a useful life of 9-14 years, during which time the sludge will be fully unloaded. The lagoon area will then be allowed to revert to natural marsh and provide about 120 additional acres of wildlife habitat and green area for the City of Madison.

The only structure adjacent to the proposed construction is the Chicago, Milwaukee, St. Paul and Pacific Railway line which is parallel to and approximately 160 feet north of the centerline of the existing north dike. This railway line crosses the marsh on a fill constructed in 1854. No records of fill construction exist. However, it is undoubtedly a displacement fill, constructed by dumping material until settlement ceased. Consequently, the base of the fill probably rests on the glacial till underlying the soft marsh soils. The loads imposed by the proposed north dike modifications will be very low and the distance between the railway fill and the existing dikes is relatively large. As a result, no interaction with or effect on the railway line is expected.

Studies made at MMSD Station 14 in the Cherokee Marsh indicate that the scars of construction heal very rapidly in the marsh environment. No controlled revegetation measures were instituted at Station 14, and the disturbed area was quickly covered with natural grasses that moved in readily on the excation spoils. Rapid revegetation of disturbed marsh areas has also been observed at the Phase I demonstration project.

Natural vegetation is expected to establish itself on the side slopes of the rehabilitated dikes shortly after construction. The marsh environment provides sufficient moisture as well as abundant, fast-growing plant life to readily establish ground cover on disturbed areas. Straw cover will be placed on the side slopes of the rehabilitated dikes to help speed revegetation and prevent surface erosion. Natural vegetation outside the limits of work will be protected.

While sludge is being removed from the lagoons, some spillage of sludge could potentially occur. This would negate some of the net positive benefit to be gained by remvoing the source of toxic spills to Nine Springs Creek and permitting the lagoons to return to a wetland condition. MMSD will take precautions to insure that such spillage is avoided.

B. Construction and Operation of Expanded Solids Treatment Facilities

The construction of the expanded solids treatment facilities is expected to have a substantial net beneficial impact because the facilities will alleviate the problems created by overloading the existing facilities. There will be no significant adverse impact on the site where the facilities will be constructed because the facilities will be built on a portion of the existing treatment plant site which has been graded several times. (Personal communication with staff of MMSD). There will be temporary adverse impacts caused by truck traffic carrying construction supplies and the operation of construction equipment. The major impact of truck traffic will be in the immediate area of the construction site where there will be an increase in traffic volume and therefore an increase in the required road maintenance, an increase in noise levels and consumption of fuel by the vehicles. The temporary effects of operation of construction machinery will be an increase in noise levels, temporary deterioration of air quality and consumption of fuel. Since the construction site is not in a heavily populated area, the number of persons temporarily affected will be minimized.

The operation of sludge treatment facilities could have an adverse impact because of odors affecting nearby residents unless proper control measures are employed. Odor control could include abandoning the odor-causing process, imposing equipment or chemical controls, and buying the property in the region of impact. Odor control at an expanded plant would be best accomplished by controlling the source. Acquisition of a buffer zone surrounding the plant as a means of controlling or elminating odor complaints is a weak solution. Residential encroachment has already occurred to the point that effective control by this method would require purchasing expensive developed properties. The plant expansion and upgrading will involve the abandonment or modification of all significant odor-producing processes, including the trickling filters and grit dump in the sludge lagoon. Abandonment of these odor sources will reduce the total odor problem, and the remaining odor can be managed effectively. These include odors from the headworks, gravity thickeners, and aeration basins.

Related to potential noise impacts of construction and operation, the following noise criteria were used by MMSD in their planning process to minimize any noise impacts.

Although temporary, construction noise could potentially have a significant impact upon the surrounding area. Most construction equipment used would exceed an operating noise level of 80 dBA at the source. The most sensitive receptors of noise in the area are understandably residential dwellings. The nearest dwellings are curently 500 to 600 feet from the plant property boundary. To prevent interference with normal speech communications, noise levels in the vicinity of these receptors should not exceed 55 dBA. The levels observed during construction of the Fifth Addition appear to be within these limits, and no problem is anticipated.

If construction noise becomes a problem in the future, however, then a combination of the following measures might be used.

- Use electric rather than diesel or gas-powered machines.
- Use hydraulic or electric impact tools, rather than pneumatic.
- Use mufflers on all equipment powered by internal combustion engines.
- Mix concrete offsite.
- Keep noisy equipment as far as possible from noise-sensitive areas.
- Avoid construction acitivity during noise-sensitive hours (nighttime).

Typically, the overall treatment facility, even in an expanded mode, would be a reasonably tranquil operation. Some processes and equipment used in the final design, however, are potentially noisy, including aeration blowers, exhaust fans, and worn pump bearings. To avoid any serious conflicts with adjacent uses, the following noise criteria have been employed in the planning process.

1. Noise levels contributed from the treatment facilities at the affected property shall not exceed the ambient noise level by more than 3 dBA for properties zoned residential.
2. If the affected property is commercially zoned, the levels may exceed ambient by 5 dBA.
3. If the affected property is open space, agricultural or industrial zone land, the noise levels may exceed ambient by 10 dBA.

The guidelines are accomplished by either localizing noisy operations away from noise-sensitive areas or abating noise through acoustical treatment.

C. Construction of Solids Handling Facilities

The impacts of this action (i.e. constructing loading docks, etc.) are briefly but adequately discussed in the environmental assessment Section 5.03 C.

D. Operation of the Organic Solids Reuse Program

This segment of the plan includes use of one of the existing lagoons for seasonal sludge storage, sludge transfer and intermediate storage, and marketing of the liquid anaerobically digested sludge to farmers for application to their agricultural land as a fertilizer.

1. Seasonal Sludge Storage in an Existing Lagoon

The impacts of use of the western half of Lagoon 1 for seasonal storage of sludge is accurately discussed in Section 5.02 I of the environmental assessment.

2. Sludge Transfer and Intermediate Storage

The impacts of sludge transfer by trucks and potential storage in on-farm lagoons is adequately considered in the environmental assessment Sections 5.02 H, 5.02 I, 5.02 L, 5.02 M and 5.03 A.

3. Sludge Application to Privately-owned Agricultural Land

a. General Discussion

Of all segments of the organic solids reuse program this segment has the potential for the most adverse short-term and long-term effects if the management and monitoring programs are not carried out strictly as planned. At the same time the plan represents substantial benefits to be gained by return of the organic solids and nutrients contained in the sludge back to the land.

With only minor exception the potential adverse environmental effects which could result from operation of this sludge marketing and application program have been considered and the plan has been developed to minimize or eliminate the potential for those effects. The facilities plan and environmental assessment present very clearly the environmental considerations which went into development of the plan.

The critical issues which must be addressed in a sludge management plan with sludge applied as a fertilizer to privately-owned land include the following: 1) effects on soils, especially potential for accumulation of heavy metals and nutrients; 2) effects on groundwater and surface water quality; 3) effects on water quantity; 4) effects on air quality; 5) effects on land use; 6) effects on vegetation, primarily crops; and 7) effects on public health. These critical issues as well as some less significant concerns have been addressed in the facilities plan and environmental assessment. In each case the measures which will be taken to minimize or eliminate the potential for these effects have also been addressed. The key to minimizing or eliminating the most significant effects is to insure that the management program (which includes limiting maximum annual application rates and total allowable loading rates and controlling time and method of application) and monitoring program are carried out as planned.

There is no mechanism by which the Federal government can insure that the management and monitoring programs will be carried out as planned. The Wisconsin Department of Natural Resources, however, is setting up a program to regulate sludge disposal activities in Wisconsin which includes requirements for self-monitoring of sludge disposal activities and reporting to the State. It is felt that the Madison Metropolitan Sewerage District will have the resources and capabilities necessary to carry out their proposed management and monitoring programs.

b. Issues Not Considered in the Facilities Plan or Environmental Assessment or Which Require Further Discussion

PCB Monitoring

The facilities plan and environmental assessment did not consider the potential problem of PCB's in the sludge. Region V is recommending that MMSD analyze their sludge for PCB's and include monitoring for PCB's as part of their monitoring program. Since MMSD has not previously analyzed its sludge for PCB's, it is not known whether their sludges are contaminated by PCB's and to what level. PCB's are of concern because of their known toxic effects. Background information on PCB's in particular is discussed in a July 1975, paper by the USEPA titled "Statement of Concerns of the Lake Michigan Toxic Substances Committee Related to Polychlorinated Biphenyls". The proposed USEPA Technical Bulletin titled "Municipal Sludge Management: Environmental Factors published in the Federal Register on June 3, 1976, recommends that sludge management programs include monitoring for persistent organics such as PCB's because of their potential toxic effects.

Nitrogen

Sections 5.02 C, 5.02 D and 5.02 J of the environmental assessment discuss some problems resulting from excess nitrogen leaching into groundwater and to surface water if application rates are not based on crop uptake of nitrogen. One issue related to nitrogen leaching which has not been discussed here is the fact that through groundwater contamination excessive nitrates in drinking water can cause human and animal health problems. Excessive accumulation of nitrate will not be a problem if proper annual application rates based on crop uptake of nutrients are followed.

Heavy Metal Considerations - Cadmium

Cadmium is a heavy metal which demands special consideration in developing a sludge land application program because it can be relatively mobile in the soil and is not excluded by plants (see page 6-29 of the facilities plan). It is of particular concern in this plan because the level of cadmium in sludge from Nine Springs Sewage Treatment Plant is relatively high compared to the levels recommended by the USDA. USDA recommendations related to sludge which is to be applied to privately owned land are:

> If sludge Cd is greater than 25 mg/kg the ratio of Cd/Zn must be less than 0.015. Soil ph should initially be greater than 6.5 and greater than 6.2 thereafter. Do not apply on land normally cropped to leafy vegetables.

The level of cadmium in MMSD's treatment plant sludge is currently 73 mg/kg dry sludge. The Cd/Zn ratio of the sludge is .031. Both of these values are above USDA's recommendations. Region V, USEPA is recommending that this sludge management program be implemented even though MMSD sludge has higher cadmium levels than USDA recommendations. Several factors which should minimize the effects of applying MMSD sludge on land support our recommendation. These factors include: 1) application rates which are very conservative, 2) a source control program which will identify cadmium sources and decrease these levels significantly, and 3) a monitoring program designed to detect cadmium uptake in plant tissues. It is essential that MMSD carry out their strict management and monitoring program as proposed so that effects of cadmium uptake will be minimized.

The MMSD currently has 94 points established throughout the district at which samples are taken and flow measurements are made quarterly. The main purpose of the sampling is to obtain the information necessary to operate the User Charge System. However, since the establishment of the program in 1976, samples from a majority of these stations have been analyzed quarterly for cadmium. MMSD is attempting to locate the areas within its boundaries where the cadmium concentration is highest. They will then follow up the highest concentrations in an attempt to isolate potential sources. This is a time consuming effort which may or may not lead them to major sources of cadmium.

Related to cadmium uptake by leafy vegetables, there are certain precautionary measures which MMSD should take. On page 6-20 of the organic solids reuse plan it is stated that "The total loading should be reduced for land which will be used for leafy vegetables, by one-half because cadmium tends to accumulate in the leaves." Because of the relatively high level of cadmium in MMSD sludge, it is strongly advised that MMSD follow USDA's recommendation as a precautionary measure and not apply their sludge to land on which leafy vegetables will be grown until the source control program has significantly lowered the sludge cadmium levels.

Economic Effects

Since the sludge will be applied to cropland as fertilizer, it would appear that this program could potentially impact on the commercial fertilizer market. In reality, this program will have little impact on the commercial fertilizer market for the reasons stated in Section 6.4 of the facilities plan.

Effect on Endangered or Threatened Species

The proposed project is not expected to have an impact on endangered or threatened species of plants or animals.

Effect on Soil Structure

MMSD intends to include as part of their sludge application site management program provisions to insure sludge application will minimize soil compaction, destruction of aggregate structure, puddling and increased susceptibility to erosion.

Soil Conservation Practices

Since the sludge will be applied to privately-owned land at the farmer's request, it is out of EPA's authority to control conservation practices on the land used. However, we are recommending that MMSD suggest to the farmers that they contact their local soil conservation service and extension offices if they require assistance in determining the best conservation practices to use.

CHAPTER 6

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG TERM PRODUCTIVITY

A. Water Quality

The water quality of the surface waters of Nine Springs Creek, the Yahara River below the confluence with Nine Springs Creek, and in Mud Lake have been adversely affected in the past by the release of approximately 85,000,000 gallons of lagoon supernatant. This resulted from the failure of a portion of the Lagoon 2 dike in 1970. The spill was cited as the cause of a fish kill which occurred downstream of the spill. An additional dike failure occurred in 1973 but little supernatant was spilled, prior to the sealing of the failure zone, by a mud wave which developed in the lagoon. The proposed actions would alleviate the threat of future spillage to nearby surface waters by removing the material now stored in the lagoons.

Groundwater quality has not been affected by the storage of sludge in the lagoons.

Development of annual application rates, proper site management, and close monitoring of environmental factors at the application sites would minimize possible adverse impacts on the surface and groundwater quality from developing over a period of time.

B. Open Space

Accidental spillage of supernatant from the storage lagoons in the past has contributed to the temporary degradation of the water quality areas downstream from the lagoons. The fish kill may have decreased the fish populations in these areas and hence the recreational opportunity afforded to fisherman by their presence. Aesthetic enjoyment of these areas may have been temporarily decreased by the presence of dead fish in the water. Increased weed and algae growth may also have been accelerated by the discharge of nutrients with the spills.

The unstable condition of the dikes of Lagoon 2 appear to be susceptible to structural failures in the future if corrective measures are not taken. The proposed actions would remove the threat of future spills. In addition to the removal of the threat to the water quality, the proposed actions would allow the land area currently devoted to Lagoon 2 (approximately 85 acres) to eventually return to its natural sedge-meadow condition. This would be a distinct departure from the general practice of draining wetland areas to provide additional acreage farming or other development.

C. Long Term Productivity of Application Site Soils

If the buildup of metal concentrations is not carefully managed and limited as the plan proposes, there is the potential for adverse effects on long-term productivity of the land on which sludge is applied. Proper program management will insure that total allowable loadings are not exceeded and the private agricultural land on which the sludge will be applied will be useable and productive for future generations.

CHAPTER 7
FEDERAL/STATE AGENCY AND PUBLIC PARTICIPATION

A. Facilities Planning Advisory Committee

The Facilities Planning Advisory Committee (FPAC) was established in the fall of 1974 by the MMSD to act as an advisory group for the engineering firms engaged to complete the Facilities Plan. Members of the FPAC included representatives from the MMSD, Dane County Regional Planning Commission, Rock County Board, Rock Valley Metropolitan Council and an independent private citizen. Representatives of this Agency and the Wisconsin Department of Natural Resources also attended these committee meetings.

The committee met regularly during the course of the study to monitor the progress of the study work and to offer advice to the engineers regarding areas of concern. The FPAC meetings served as a time for presentation of work progress; to interchange views on areas of concern; and to identify additional study tasks. All committee meetings were open to the public and news media.

B. Public Information Meetings

A public information meeting was held November 6, 1973, in Madison by MMSD to present to the public an account of the progress of the sludge disposal study being conducted at that time by the engineering firm of Roy F. Weston, Inc.

On May 15, 1974, a second public meeting was held in Madison by MMSD to present the recommendations of the Weston report and of the addendum which had been prepared by the staff of the MMSD. It was the recommendation of this report that the alternative of the land application of liquid anaerobically digested sludge be developed. Public comments on this recommendation were favorable.

The Capitol Community Citizens (CCC), a concerned group of area citizens, submitted a position statement to MMSD on May 30, 1974, stating that they approved of the land application of sludge only on a temporary basis. They suggested that a long-term sludge disposal program should include the composting of the sewage sludge along with the solid wastes generated in the area.

The commissioners of MMSD, after consideration of the Weston report recommendations, and public input, resolved on June 7, 1974, that the disposal of sludge should be handled through a land application program. On July 15, 1974, the MMSD commissioners resolved that the land application program should be implemented immediately.

A letter describing the land application alternative and a questionnaire requesting their comments was sent by MMSD to area farmers in August of 1974. The comments received from the farmers were quite favorable and a high degree of interest in the alternative was shown.

During September of 1974, Wisconsin Pollutant Discharge Elimination System (WPDES) Permit No. WI-0024597 was received. It was stated in the permit that funding for the construction of any additional wastewater treatment and disposal facilities, including sludge treatment and disposal facilities, would not be forthcoming until a Facilities Plan was completed.

Contracts were awarded for the preparation of a Facilities Plan late in 1974. Public input to the study was continued through the FPAC and through a series of public meetings held during the course of the study. Public meetings

conducted by MMSD were held on June 26, 1975, at the Town of Dunn Town Hall, and again on October 2, 1975, at the Town of Fitchburg Town Hall. At each of these meetings progress of the sludge study was reported. Various methods of field application were discussed as were the potential advantages and disadvantages of land application program. Interest expressed in the program by members of the farm community in attendance was high at each meeting.

A demonstration of liquid and dry sludge spreader trucks manufactured by Big Wheels, Inc. was conducted for members of the FPAC and other interested persons on May 30, 1975, at the Nine Springs Wastewater Treatment Plant. On September 4, 1975, a demonstration of a dredge manufactured by Mud Cat was conducted at the existing sludge lagoons.

C. Final Public Hearing Held by Applicant

On April 28, 1976, the final public hearing conducted by MMSD was held at the Town of Fitchburg Town Hall. The purpose of this hearing was to present to the public the recommended organic solids reuse plan and the assessment of that plan on the environment. Public comments and questions on the program were also accepted for the record. Notice of the hearing was published in area newspapers thirty days prior to the hearing. Copies of the Environmental Assessment Statement were available for public review for a period of thirty days prior to the hearing.

Approximately 80 to 100 people attended the hearing including members of the local farm community; City of Madison, Dane County, State of Wisconsin and Madison Metropolitan Sewerage District personnel; and other interested member of the public. A member of the engineering firm of CH2M-Hill presented a summary of the work which was done in the evaluation of the various alternatives available for the reuse program and a review of MMSD's sludge handling and storage programs. Members of the engineering firm of O'Brien and Gere presented a summary of the work which was done in evaluating the potential impacts which the proposed reuse program may have on the environment.

Comments and questions from the members of the public present were taken. None of the comments expressed or questions raised at the hearing were negative to the proposed reuse of sludge on agricultural lands. Several members of the farm community spoke in endorsement of the proposed program. Another endorsement was given by Professor Arthur Peterson, Soil Science professor at the University of Wisconsin. A representative of the City of Madison, Engineering Department read into the record a resolution, dated April 28, 1976, which had been passed by the City of Madison Common Council and signed by Mayor Paul Soglin, also endorsing the proposed program.

Some concerns were expressed regarding certain aspects of the proposed program, such as the suitability of lands receiving sludge application for development in the future. A review of material presented in both the Organic Solids Reuse Program and the Environmental Assessment Statement indicated that such concerns had been considered and accounted for in the development of the program.

Written comments were accepted at the MMSD offices for a period of 15-days following the public hearing. Any written comments which have been received as well as an official transcript of the public hearing are contained in Volume VIII of the Facilities Plan. The official transcript also contains a copy of the notice, a list of th newspapers which published the notice as well as other materials.

D. Hearing on Draft Environmental Impact Statement

A draft EIS was filed with the Council on Environmental Quality on October 29, 1976, and was distributed for public comment.

This hearing was held on Tuesday, November 30, 1976, at 8:00 pm at the Fitchburg Town Hall, Dane County, Wisconsin.

Complete hearing transcripts may be viewed at USEPA, Region V, Chicago, Illinois; Wisconsin Department of Natural Resources, Bureau of Environmental Impact, Madison, Wisconsin; and at the Janesville Public Library, Janesville, Wisconsin.

Approximately thirty people were in attendance.

The following is a summary of comments received at the hearing along with EPA responses to comments where appropriate. The actual correspondence received can be found in Appendix A. (C=Comment, R=Response).

Wisconsin Department of Natural Resources Southern District Office

C - We have reviewed the EIS and we feel it was rather well done.

It did address many of the problems that we felt might be encountered in that situation.

The Southern District does agree with the concept of incorporating the material into the soil. We think it is a wise use to recycle those nutrients.

We do, however, see a few potential problems associated with the program. Most of these were adequately addressed in the statement.

We feel the potential problems will be involved in the actual implementation of the program such as has been pointed out with potential problems with heavy metals, potential surface water pollution due to runoff or perhaps even public acceptance of the program. I think it's been discussed tonight that that apparently will be no problem.

We felt that most of these problems can be overcome just by good program supervision and management and that is to say when this program is initiated.

R - In summary, these comments indicate that the Department of Natural Resources feels that there are some potential problems which could occur because of this project. However, they feel that a good program of supervision and management will overcome these potential problems. We have expressed this same concern several places in the EIS. We feel that if MMSD carries out their program as proposed, any potential adverse effects will be minimized and the maximum positive benefits will be gained.

Dane County Regional Planning Commission

C - In our opinion, all of the major areas of environmental concern are adequately addressed in the plan and the environmental impact statement. The proposed program, if implemented in accordance with these documents, appears to be

environmentally sound as well as cost-effective. In addition, the use of organic residuals from the wastewater treatment plant as a substitute for commercial fertilizers represents a direct form of recycling, and should reduce the demand for commercial fertilizers.

If the proposed program is to be successful, the stringent management and operation controls and environmental monitoring called for in the plan are absolutely essential. Because the program relies on the voluntary cooperation of individual landowners and units of government, it is critical that the Madison Metropolitan Sewerage District conduct the operation so as to prevent any occurrences of environmental degradation or other possible causes of public complaints. This will entail a high level of MMSD control of transporting and applying the organic solids, including locations, methods and timing, as well as extensive environmental monitoring.

R - As we stated in the previous response as well as in the EIS, we feel that if MMSD carries out their program as proposed, any potential adverse effects will be minimized and the maximum positive benefits will be gained.

E. Correspondence Received Related to the Draft EIS

Federal

United States Department of Agriculture, Soil Conservation Service - November 23, 1976
United States Department of the Interior - December 23, 1976

State

State Historical Society of Wisconsin - December 10, 1976
Wisconsin Department of Natural Resources - December 23, 1976

Local

Dane County Regional Planning Commission - November 23, 1976
(Their comment letter was entered as part of the record at the EIS hearing).

Holtzman Company - November 12, 1976

The following are comments received related to the draft EIS subsequent to the EIS hearing along with EPA responses to the comments as appropriate. (C=Comment, R=Response). In some cases comments were made related to portions of the applicant's facilities plan which was provided as Part II of the draft EIS as supporting information. Since the text of the applicant's plan will not be revised as part of the final EIS, we have included the appropriate information in the responses or in the final EIS. The actual correspondence received related to the EIS can be found in Appendix A.

United States Department of Agriculture - Soil Conservation Service

C - More consideration needs to be given to the protection of lands where the sewage sludge will be disposed. Careful conservation treatment and management of disposal areas will be needed to minimize pollution.

R - The site investigations, monitoring programs and careful development of annual and total application rates proposed by MMSD if carried out as planned will insure that pollution is minimized.

C - Existing conservation practices on disposal areas should be maintained.

R - Since the sludge will be applied to privately-owned land at the farmer's request, it is out of EPA's authority to control conservation practices on the land used. However, we are recommending that MMSD suggest to the farmers that they contact their local soil conservation service and extension offices if they require assistance in determining the best conservation practices to use.

C - No SCS projects will be affected by the proposed project.

R - The comment is of an informational nature and has been noted.

United States Department of Interior

C - The environment and impacts of the proposed action are described inadequately with reference to Nine Springs Creek. Water quality and fishery information for Nine Springs Creek are not presented, nor are impact of dike repair and sludge removal on the fishery of Nine Springs Creek or on the existing wildlife and habitat addressed. This information should be made part of the final EIS.

R - The text of Chapters 2 and 5 of the final EIS includes fishery and habitat information for Nine Springs Creek and adjacent wetlands and potential impacts of dike repair and sludge removal on them. We were not able to obtain water quality information for Nine Springs Creek in the area of potential impact. However, the effects of dike repair and sludge removal can still be determined. The intent of dike repair and sludge removal is to protect the water quality and biota of the creek by preventing toxic spills into Nine Springs Creek. It is MMSD's intention to carry out these actions in a manner that will protect this resource. Therefore, we feel there can only be a net positive impact on water quality and biota in the area.

C - Since much of the area surrounding the lagoons is high-quality wetland habitat, we ask that you contact the Green Bay Field Office of the U. S. Fish and Wildlife Service with more detailed information on the dike repair, to ensure that all measures will be taken to minimize harm. A Department of the Army Section 404 permit may be required for placement of fill in these wetlands. The District Engineer, U. S. Army Engineer District-Rock Island, should be contacted for additional information.

R - MMSD has contacted both the Corps of Engineers and the U. S. Fish and Wildlife Service Green Bay Field Office with more detailed information on the dike repair. The Corps of Engineers has indicated that a Section 404 permit will not be necessary for the dike maintenance. The U. S. Fish and Wildlife Service has no objection to MMSD proceeding with their proposed dike rehabilitation as planned. Correspondence from these agencies can be found in Appendix A.

C - The discussion of recreational areas and activities in Section 2.13 of the environmental assessment is not an "adequate summary of these subjects," as stated in Part I. Not only should a list of parks (and other recreation facilities) be included in the discussion, but a site location map is necessary to get a clear picture of the relationship of open-space land to the project area. A land-use map indicating the actual spectrum of uses should supplement figure 6-5 (Part II) to aid in the review process.

R - The paragraph on recreation and open-space on page 2-19 of the draft EIS referred to the environmental assessment for a general discussion of recreation and open-space. The paragraph also indicated that a list of parks in the

area was included in the environmental inventory for MMSD's facilities plan but was excluded from the draft EIS. We felt that the general summary in the assessment was adequate and that it was not necessary to list all the parks in the entire study area in the draft EIS because we did not feel that any additional information would aid in identifying the impacts of the project. The major part of the project involves application of sludge to suitable private cropland at farmer's requests. Since these application sites have not yet been identified, we still feel that listing recreational areas and parks in the entire potential application area would not aid in identifying impacts from sludge application.

We do agree, however, that some additional information on recreation and open-space and other land uses in the vicinity of the Nine Springs Sewage Treatment Plant site is warranted since this project also proposes lagoon dike rehabilitation, lagoon abandonment, and some sludge treatment facility expansion which have the potential to impact on the area adjacent to the plant site. Land use in the vicinity of the plant site is described in Chapter 2 of the Final EIS. The section of Chapter 2 related to recreation and open space has been expanded to include discussion of recreation and open space areas in the vicinity of the plant site.

C - The proposed Nine Springs Corridor/Dane County E-way (environmental way) has been overlooked. In the eastern portion of the Nine Springs Corridor of the Dane County E-way, 139.5 acres, adjacent to the public land controlled by the Madison Metropolitan Sewerage District, have been acquired with monies from the Land and Water Conservation Fund. Section 6(f) of the Land and Water Conservation Fund Act of 1965, as amended, states that no property acquired or developed with these funds can be converted to other than public outdoor recreation use without the approval of the Secretary of the Interior.

R - As indicated in this comment, Dane County Regional Planning Commission has proposed E-way corridors. The E-way corridor system consists of public roads, streets, walkways and open-space systems. These connected corridors enclose Madison in an environmental loop which highlights its prominent educational, ecological and environmental characteristics. The Nine Springs Creek corridor in the vicinity of Nine Springs Sewage Treatment Plant includes the parcel of land mentioned in this comment. It is parcel 13, one of the parcels which is shown as being in public ownership on Figure 2-5 in Chapter 2 of the Final EIS. It is held by Dane County and has been set aside for future park use. For a further description of land use and ownership in the Nine Springs E-way corridor refer to Chapter 2 of the Final EIS.

C - The Madison Metropolitan Sewerage District has orally indicated plans for coordination with Dane County and the Wisconsin Department of Natural Resources regarding one-time sludge deposition on E-way land before seeding and public use. A thorough discussion of these plans should be included in the statement along with site maps indicating the relationship of the E-way to the proposed project area.

R - MMSD was asked by the Director of the Dane County Parks to apply sludge on approximately 60 acres of County acquired farmland within the proposed E-way. The land in question had previously been planted in corn and is not in the best of condition. The Parks Department felt that the land was in need of organics and fertilization to insure that a good grass cover crop could be grown prior to public use. The sludge was applied as requested. The text of Chapter 2 has been revised to discuss the E-way and its relation to the project area.

C - The groundwater monitoring program seems too arbitrary in its specifications, in view of the many natural variables and the importance of groundwater to public health. Plans now call for baseline monitoring followed by a check on nitrate nitrogens and total dissolved solids at three-year intervals for wells within 500 feet of any area of sludge application. Shallow water table conditions apparently prevail over most of the area (p. 6-10 and 6-11); thus, the probability for downward migration to groundwater and accelerated movement of pollutants in groundwater flow is fairly high. Most of the reported rates of groundwater movement are in the range from tenth of a foot to over three feet per day (figure 6-1). Since it is anticipated that domestic supply wells will commonly be perhaps 200 feet away (p. 6-8), the three year sampling interval may give protection only in the areas of slowest movement--particularly if some mounding of the water table occurs in the areas of application. Therefore, we believe that although a maximum precautionary sampling interval may be appropriate, the results of the groundwater study for each site (p. 3-7) should be used to determine the need for more frequent sampling of groundwater. For example, in some parts of the project area it is evident that groundwater may travel 200, 500, or even 1,000 feet in a year or less (p. 6-4 and figure 6-1). On the other hand, the slow movement of groundwater in some parts of the area suggest that the travel of pollutants to affected wells may exceed the arbitrary 5-year post-application limit set on page E-9. Because of the shallow depths to groundwater, testing to determine the rate of movement of groundwater toward given wells should not be an excessive burden. This seems to be especially true inasmuch as the allowable distance to wells is to be lowered to 200 feet (p. 6-8). Monitoring should be much more frequent in the vicinity of storage lagoons, in order to assure integrity of the clay linings. We agree also in general (p. 4-4 of the environmental assessment) that the baseline inventory should include all existing wells and groundwater sources within one-half mile of each application site, and periodic monitoring of nitrate nitrogen and total dissolved solids as indicators of pollution should be on an annual basis as a minimum.

R - The groundwater study for each site will consist of the preapplication background monitoring and post-application monitoring outlined in the facilities plan (Section E.4). We are recommending to MMSD that their well and groundwater source monitoring program be expanded to include a higher frequency of well monitoring. We would recommend that the well monitoring be done annually instead of every three years as they propose, that it be done for all wells and groundwater sources within one-quarter mile of each application site and that the sampling be conducted during the summer months or in the periods subsequent to application of sludge to nearby sites. If farm storage lagoons are constructed, groundwater monitoring programs specific for each site should be set up to insure protection of groundwater. It has been the experience of this Agency that the existing technology does not entirely eliminate the potential for groundwater contamination from these sources. Related to testing to determine the rate of movement of groundwater, we feel that the cost of testing every site would be an excessive burden for the applicant especially since it is possible that sites could change every year and since the applicant proposes a conservative sludge application rate. If the features of a particular site indicate the need, the applicant will be responsible for performing additional tests.

C - The statement should also include at least representative values for permeability and/or transmissivity, and storage coefficient or specific yield of the soils and groundwater bearing materials in order that the evaluations of potential for groundwater impacts can be appraised.

Wisconsin Department of Natural Resources

C - Page 2-4 (4.) , second paragraph - Threatened plant species should be avoided. Section 2.07 of the Environmental Assessment does not elaborate on the effect of the proposed project on threatened species.

R - Page 5-4 of the final EIS has been revised to indicate that it is not expected that the proposed project will have an impact on any endangered or threatened species of plants or animals.

C - Page 2-6 (2.) - Present land use in the project area should be described.

R - We feel that the information on land use discussed in this section of the draft EIS was adequate to be able to determine the impact of the proposed action. Since land application sites have not yet been determined, we felt that only general discussion of land use in the potential application area was warranted. The referenced section of the draft EIS presented a more specific discussion of land use in the vicinity of Nine Springs Sewage Treatment Plant. To supplement this discussion we have included several figures in Chapter 2 of the final EIS which depict present and proposed land use, zoning, committed development, and ownership in the area of Nine Springs Sewage Treatment Plant. In addition, the section of Chapter 2 on recreation and open space has been expanded to discuss the area around the plant site and its inclusion in the "E-way" corridor system proposed by Dane County Regional Planning Commission.

C - Page 2-6 (5.) - Legal descriptions of the locations of unique scientific or natural areas should be included.

R - Of those areas listed on Table 2-2 there is only one site which could potentially be impacted on by this project. It is listed as Upper Mud Lake wetlands. The referenced section has been expanded to discuss these wetlands.

C - Page 2-6, Odor - This section states the information contained in the Environmental Assessment is incomplete. Additional summary information should be added to describe the potential odor problems.

R - The only additional information on odors which can be incorporated into the above-referenced paragraph is the fact that some of the significant odor producing processes on the Nine Springs Plant site in the past will be abandoned or modified because of this plant expansion and upgrading. The trickling filters and grit dump in the sludge lagoon were two significant odor producing processes in the past.

Chapter 5, Section B has been modified to discuss the potential odor impacts which could result from the construction and operation of the proposed expanded solids treatment facilities. Since the significant odor producing processes will be abandoned or modified as part of this plan, there will be a net beneficial impact on odors resulting from the implementation of this project.

C - Page 2-19, Recreation and Open Space - Why were recreational areas and parks excluded from the report?
Page 2-19 - Facilities Report information should be summarized and included.

The paragraph on recreation and open space on page 2-19 of the draft EIS referred to the environmental assessment for a general discussion of recreation and open space. The paragraph also indicated that a list of parks inventory for MMSD's facilities plan but was excluded from the draft EIS. We felt that the general summary in the assessment was adequate and that it was not necessary to list

all parks in the entire study area in the draft EIS because we did not feel that any additional information would aid in identifying the impacts of the project. The major part of the project involves application of sludge to suitable private cropland at farmer's requests. Since these application sites have not yet been identified, we still feel that listing recreational areas and parks in the entire potential application area would not aid in identifying impacts from sludge application.

We do agree, however, that some additional information on recreation and open space in areas in the vicinity of the Nine Springs Sewage Treatment Plant site is warranted since this project also proposes lagoon dike rehabilitation, lagoon abandonment, and some sludge treatment facility expansion which have the potential to impact on the area adjacent to the plant site. Land use in the vicinity of the plant site is described in Chapter 2 of the final EIS. The section of Chapter 2 related to recreation and open space has been expanded to include discussion of recreation and open space areas in the vicinity of the plant site.

C - Page 5-1 - The subjects of increased road maintenance, increased noise generation and the numbers of persons in the affected area should be addressed.

R - More detailed information is not available on the probability of increased road maintenance other than to acknowledge that it is likely to result from increased traffic in the vicinity of the construction site during the two-year construction period.

Related to potential noise impacts the following noise criteria were used by MMSD in their planning process to minimize any noise impacts. This additional information has been incorporated into the section of Chapter 5 (Section B) to which DNR's comment relates.

C - The Department's staff feels that this section of the document failed to offer the reader adequate summary information.

R - The summary sheet and introductions to the sections of the EIS have been revised to provide additional summary information.

C - The many references to the facilities plan and the Environmental Assessment make Part I very difficult to read.

R - In attempting to not duplicate the information presented in the facilities plan and environmental assessment it was necessary to sacrifice some readibility.

C - <u>Part 2 - Specific Comments</u>

Page 6-7 - A 200-foot horizontal separation of the sludge site from an existing well may be satisfactory in some cases. However, additional evaluations may be necessary on a site specific basis depending on the topographic, hydrologic and geological features of the area.

R - This comment will be given as a recommendation to MMSD to incorporate into their site management program.

C - Page 6-9 - The evaluation of soil structure may be a useful eighth criterion for soil suitability tests. Aeration, tilth improvement and ultimately fertility will be directly affected. Management of the program would have to insure that sludge application would minimize soil compaction, destruction of aggregate struction (puddling) and increased susceptibility to erosion.

R - Soil structure is just one of many other factors which could have been used to evaluate the soils. While soils structure was not specifically identified as a factor, its consideration is included in such factors as permeability and soil texture. All of the soils, regardless of soil structure, will be managed to minimize soil compaction, puddling, and erosion.

C - Page 6-12 - The discussion of Cation Exchange Capacity (CEC) should also relate to fertility.

R - This particular discussion of CEC on page 6-12 of the facilities plan did not discuss soil fertility as it relates to the CEC because it was directed toward determining soil suitability for sludge disposal primarily for calculating the heavy metal loading rates for each soil. As the DNR points out in this comment, the CEC of a soil does affect the soils fertility. Exchangeable cations are the primary source of calcium, magnesium and potassium in plant nutrition. The exchangeable cations represent nature's mechanism for insuring a continuous storehouse of cations that are readily available for plant growth.

C - Page 6-14 - Crop Suitability - This section should include a discussion of soluble salts and potential imbalances of macro and micro element requirements. If additional amendments or supplements would be required, they should be explained.

R - We do not feel it is reasonable or necessary to require that MMSD's facilities plan include a discussion of specific amendments or supplements which would be required since they would vary with factors such as existing soil condition and crop to be grown. However, we can offer some general statements in this regard. Some fertilizer supplementation of the sludge could be required depending on the soil type and condition and crop grown. Since sewage sludge typically is low in potassium (K) relative to its nitrogen (N) and phosphorus (P) contents, K fertilizer may need to be supplemented. MMSD's monitoring program includes soil analyses which should identify any potential nutrient imbalance to prevent crop deficiencies and maximize crop yields. We feel that there was an adequate discussion of dissolved salts in the sludge presented on page 6-19 of the facilities plan. The discussion indicates that dissolved salts in the sludge should not cause salinity problems to crops grown on sludge-amended land.

C - Page 6-18, Heavy Metals - "Other" heavy metals should be named and discussed in Table 6-4, page 6-19. Heavy metal concentrations should be stated. What are the heavy metal sources? To what extent will heavy metals be attenuated in the soil atmosphere? Potential threats to groundwater resources should be clearly explained.

R - We feel that MMSD's facilities plan (pages 6-18-6-19) presents an adequate discussion of heavy metals and their bases for determining heavy metals loadings. They first discussed the heavy metals for which more specific information on safe loading rates is available (Zn, Cu, Ni, and Cd). They then discussed the metals for which no standards have been developed specifically related to sludge application. They then set a limit for metals other than Zn, Cu, Ni, and Cd by applying heavy metal criteria for irrigation water. They then separately discussed mercury. The environmental assessment (pages 5-2, 5-3, 5-6, 5-7, 5-10) and the EIS (Chapters 5 and 6) also discuss heavy metals and how any potential impacts will be mitigated.

C - Page 6-20 - The methods employed to determine sludge application rates for crops intended for human consumption are not fully explained.

R - These total sludge application rates for crops intended for human consumption were developed for MMSD by its consultants. These total sludge application rates were arbitrarily determined in recognition of the fact that heavy metals, particularly cadmium, can accumulate in soils and can be taken up by plants in differing ways. The leafy and vegetative portions generally accumulate cadmium in higher concentrations than the reproductive tissue (pea and corn seeds). In order to increase the safety factor for human consumers MMSD's consultant elected to arbitrarily reduce the total sludge application rate for crops grown for direct human consumption. Since leafy vegetables generally are greater accumulaters of cadmium they elected to reduce the total sludge application by 1/2 for these crops. For crops such as processing peas and sweet corn which accumulate less cadmium in the edible portions of the plant they elected to reduce the total sludge loading rate by 1/4 as an additional safeguard.

Related to this subject Wisconsin Department of Natural Resources sludge management guidelines, USEPA sludge management guidelines and USDA sludge management recommendations recommend avoiding growing leafy vegetables on sludge-amended land, particularly when the sludge contains a relatively high level of heavy metals such as cadmium.

C - Page 6-21, Tables 6-5 and 6-6 - The source of the information presented in these tables should be given. If this information was researched by the consultant, does EPA agree with the analysis presented?

R - How this information (total application rates and annual application rates) was developed by MMSD's consultant is adequately discussed in the facilities plan Section 6.3. Soil suitability for sludge application was developed taking several factors into consideration. Crop suitability for sludge application was then discussed. The development of annual sludge application rates based on nitrogen uptake of crops was then presented. In addition, total sludge application rates based on constituents which accumulate in the soil, particularly heavy metals, was discussed. Tables 6-5 and 6-6 represent estimates of annual and total sludge application rates which were developed by MMSD's consultants in the manner discussed in previous sections of the chapter. The analyses done by MMSD's consultants is in keeping with available EPA guidelines with one exception. Current guidelines recommend as an additional safeguard that growing leafy vegetables be avoided on sludge-amended land when the sludge has a relatively high content of heavy metals such as cadmium.

C - Page 6-22 - The summary section should include plans for long-term monitoring.

R - We feel that MMSD's comprehensive monitoring program was adequately discussed in other portions of the facilities plan such as Appendix E so as not to require duplication in this particular section.

C - Page 6-22, Section 6.4 - The Department feels that it is in the best interest of the proposed project that a factual statement outlining the expected benefits of sludge application be included in the final statement. This would prove very useful in the public's understanding of the document.

R - The summary sheet and Chapter 1 - Background of the final EIS have been revised to include additional discussion of the benefits of the proposed action.

C - Page 6-23 - How many acres of the potential 5,000 acres have been evaluated as sludge sites?

R - The 5,000 acres mentioned as belonging to farmers apparently willing to use sludge represents a potential market. Detailed site investigations, evaluating land as sludge application sites will not be conducted until the organic solids reuse program is actually underway and the farmers have formally requested that their land be used as sludge application sites.

C - Page 6-26 - How will grazing near restricted sludge application areas be controlled? In the event of cattle intruding on a restricted site, what are the potential hazards? This may be particularly sensitive in the area of high producing dairy herds.

R - Since MMSD's program involves marketing of sludge to farmers at their request for application to their land, the grazing restrictions discussed on page 6-26 can only be carried out through voluntary action on the part of farmers after having been informed by MMSD of the need for these controls.

On page 8-3 of the plan MMSD stated their intent to inform farmers accepting sludge of the necessary buffer areas and other areas of special concern. We will recommend to MMSD that each farmer be given a brochure explaining the various precautions which should be taken to insure that the potential for environmental degradation is minimized while benefits are maximized. We will also recommend that MMSD make spot checks to insure that farmers are taking the necessary precautions.

Since MMSD is proposing a conservative application rates, we expect that hazards which could occur if cattle inadvertently strayed onto the application site on a one-time or infrequent basis should be minimal. If rain or some other method has not removed the sludge from the plants and/or sufficient time has not elapsed since sludge application to allow for pathogen die-off, there are potential hazards which could occur. The cattle could directly ingest the sludge with its nutrients, contaminants (such as heavy metals), and perhaps pathogens. We do not feel that the risk to cattle or human consumers would be very high if such an event should occur. However, in the absence of specific data on the level of risk, we feel it is important for the farmers to recognize the potential risks and take the necessary precautions to prevent such occurrences.

C - Page 6-26 - The effects of soil wetting, water balance, and leaching potential require a more thorough explanation.

R - The maximum annual sludge application will be approximately one-half inch of liquid, while the total annual precipitation in the Madison area is approximately 36-inches. It would appear, therefore, that the soil wetting, water balance and leaching potential due to the sludge are minimal and minor compared to normal precipitation. Although soil wetting by liquid sludge would be a minor problem, it can be alleviated by the management suggested on page 6-26 of the plan. The conservative application rate MMSD proposes would not have the same problems as programs where several feet of water is applied to the land.

C - Page 6-28 - The need for 10 to 20 percent additional herbicide usage should be explained. Will this alter acceptance of the program in the farm community? What price considerations have been taken into account to insure the sludge plus the additional herbicide will be competitive with commercial amendments. The benefits of increased organic material should be strongly emphasized.

R - The cost of herbicide use is normally in the range of $3-$20 per acre per year. Increasing the amount of herbicide applied by 10-20 percent will increase the farmer's cost by $0.30-$4.00 per acre. This will be more than offset by the

fertilizer value of $45.00 per acre. Several farmers who noted this problem were quick to add that they would continue to use the sludge.

The benefits of increased organic material are noted, but it should not be strongly emphasized because, unless sludge applications of many tens of tons per acres are applied, the beneficial effect will be minor.

C - Page 6-28 - The statement appears to lack information concerning types of pathogenic organisms, any potential problems and how good management will minimize potential adverse effects.

R - We agree that the Public Health Aspects statement lacks information concerning specific pathogenic organisms, however, we believe it is adequate to address the pathogen question in the terms stated. Most of the public would not understand nor could they relate to specific organisms. For the informed public, the references cited in the statement provide the detailed information referred to.

The pathogen question is always a primary concern. In anticipating this question, the statement on page 6-28 was prepared by MMSD as a handout for those attending the public meetings held by MMSD. The handout was picked up by many of the attendees and, as far as we know, adequately addressed the potential problems and how these potential problems would be minimized by good management.

C - Page 6-31 - Soil classifications other than Class 1 or 2 should be included. Is 72 tons per acre correct?

R - This discussion was used to indicate a general concept and does not require a discussion of a Class 3 soil. A Class 3 soil could accept 48 tons (2 tons per year for 24 years). Seventy-two tons equal 3 tons per year for 24 years. Class 4 soil could not accept application.

C - Page 7-3 - Facilities Requirements - Farm storage lagoons are discussed as sites for seasonal storage of sludge. The location of such lagoons is extremely important, particularly if seepage or leakage should occur. If such lagoons are with 500 feet of navigable water, Section 30.19, Wisconsin Statutes, would be applicable.

A pipeline distribution system presents the additional potential problem of leakage should a break occur. Therefore, the location of such a pipeline with respect to lakes or streams is very important. Section 30.20 permits would be required for all stream crossings.

R - As indicated in page 7-3 of the plan only the farm storage lagoons or pipeline would be utilized if the District would obtain a commitment from a farmer to accept sludge for several years. It is therefore not known at this time where any of these structures would be located. We will recommend to MMSD that DNR's siting concerns be taken into account when constructing any such structures.

C - Page 7-6 - The discussion of existing methods of sludge incorporation points out that large pieces of frozen sludge were left on top of the frozen ground in February of 1975. During the spring thaw, the sludge was washed into Lake Waubesa which resulted in adverse public reaction. Such mismanagement in the future could jeopardize the entire project.

R - As we indicated in the summary sheet and several other places in the EIS, we feel that the potential impacts of MMSD's proposed organic solids reuse

plan can be minimized or avoided only if MMSD's proposed management programs are strictly adhered to.

C - Page 8-19 - Additional data should be presented on the reasonableness of the fee schedule.

R - Table 8-3 gives a complete breakdown of the sludge use fees in relation to the benefit gained. MMSD feels it is reasonable that a farmer with 40 acres would pay a first year fee of $220 and subsequent yearly payment of $20 to obtain $1,800 worth of sludge yearly. These fees were presented to the farm community during the public meetings held by MMSD and there was no opposition. The major part of the fee is record keeping and soil and crop analyses; costs the farmer would normally incur with commercial fertilizer use.

C - Page 3-1 - Additional comments concerning the lagoon abandonment are in Specific Comments, Part 2, page 9-3, Section 9-5 of this letter.

Page 9-3, Section 9.5 - In its docket SD-306, acting as the trustee for navigable waters, the DNR issued a permit for Lagoons 1 and 2. In that permit, are the following:

"1) The project site shall be restored to the Department of Natural Resources specifications upon abandonment of the sludge lagoons.

2) The authority herein granted can be amended or rescinded if the structure becomes a material obstruction to navigation or becomes detrimental to the public interest."

No standards for restoration were discussed or enumerated. The intent was that current standards (and laws) would be applied at the time of abandonment.

R - MMSD has previously coordinated their lagoon rehabilitation and abandonment program with portions of the Department of Natural Resources. We will recommend to them that they should also coordinate any further development and implementation of this plan with the portion of DNR having the permit authority so that the above concerns can be satisfied.

General Comments, Part 2

1. Organization and readability are very good.

2. Important information could be summarized more concisely, i.e., sludge advantages and disadvantages.

3. Technical data in the statement should be referenced. It should be readily apparent to the reader which information was accumulated by the consultant, and what your agency's comments and analyses were concerning that material.

R - These three comments are related to Part 2 which was attached to the draft EIS so that the EIS would not duplicate information already compiled and reported by the applicant. Part 1 is Region V's evaluation of the adequacy of the plan and environmental assessment (Part II) submitted to us by MMSD. Where Region V felt there were inadequacies in MMSD plan and assessment we included supplemental information in Part I. In many cases the supplemental information was acquired from portions of MMSD's overall facilities plan aside from the volumes in Part II. All references used were cited at the end of the draft EIS (Part I).

In preparing the final EIS the text of the applicant's documents (Part II) have not been changed. Rather the information requested by the comments will be included in either the text or comment-response section of the final EIS.

State Historical Society of Wisconsin

C - There are not sites listed on the National Register of Historic Places that would be affected by this project. Furthermore, there are no sites known to us of archeological, architectural, or historical significance in the project area that would be eligible for inclusion on the National Register of Historic Places.

R - This comment is of an informational nature and has been noted.

Holtzman Company

C - As a producer of albino rats use (sic) for medical research, we have customers who require non-estrogen-stimulated rat uteri. We produce our own corn for rat feed and have grown corn (Pfizer's Trojan DMS102) on land spread with sewerage sludge from Madison Metro Sewerage District to a depth of 3"-5". We made an assay comparing the uterine weights of rats fed corn grown on sludged and non-sludged land. There was no significant difference in uterine weights. We conclude that birth control pill residues do not enter corn.

R - This comment is of an informational nature and has been noted.

Appendix A

DEPARTMENT OF THE ARMY
ROCK ISLAND DISTRICT, CORPS OF ENGINEERS
CLOCK TOWER BUILDING
ROCK ISLAND, ILLINOIS 61201

IN REPLY REFER TO

NCROD-S

25 MAR 1977

MADISON METROPOLITAN
SEWERAGE DISTRICT
RECEIVED
MAR 28 1977

Mr. W. J. Landwehr, Director
Madison Metropolitan Sewerage District
104 N. First Street
Madison, Wisconsin 53074

Dear Mr. Landwehr:

Reference is made to your letter dated 11 March 1977 requesting a determination as to the need for a Department of the Army Section 404 permit to perform maintenance rehabilitation work to existing dikes surrounding sludge lagoons at the Nine Springs Wastewater Treatment Plant.

The project construction site is determined to be located in a wetland area contiguous to the Yahara River. The discharge of dredged or fill material into the subject wetland area came under Corps of Engineers Section 404 Phase II permit jurisdiction on 1 September 1976. New construction involving the discharge of dredged or fill material will require Department of the Army Section 404 permit authorization prior to work commencing.

Based on the information provided during Mr. Hines' telephone conversation with Mr. Nemke, we understand the work proposed will involve the discharge of fill material over the old dike for the express purpose of maintenance and reparation. Corps of Engineers regulation 33 C.F.R. 209.120, Paragraph (d) (6) (ii) provides that material placed for the purpose of maintenance, including emergency reconstruction of recently damaged parts of currently serviceable structures, such as dikes and levees, will not require Department of the Army Section 404 permit authorization.

I emphasize the point that the referenced paragraph pertains to the discharge of fill material not the discharge of dredged material.

A-1

NCROD-S
SUBJECT: Mr. W. J. Landwehr

25 MAR 1977

It is the determination of this office that no Department of the Army Section 404 permit will be required for the project as proposed, provided no fill material is obtained by dredging or excavating within navigable waters.

For your information inclosed is a pamphlet explaining the Corps of Engineers Regulatory Permit program. Also inclosed is a list of example activities this office has determined will or will not require Department of the Army Section 404 permit authorization. This example list, however, is not complete and any discharge of dredged or fill material into a navigable water, including contiguous or adjacent wetland areas, should be construed as requiring Section 404 permit authorization pending official determination by this office.

Should you have any questions please contact our Permits and Statistics Branch by letter, or telephone 309/788-6361, extension 213.

Sincerely yours,

HENRY G. PFIESTER, P.E.
Chief, Operations Division

Incl
Pamphlet
List of Example Items

United States Department of the Interior

OFFICE OF THE SECRETARY
NORTH CENTRAL REGION
230 S DEARBORN STREET, 32nd FLOOR
CHICAGO, ILLINOIS 60604

RECEIVED
DEC 27 1976
EPA REGION 5
OFFICE OF REGIONAL ADMINISTRATOR

ER 76/1041

December 23, 1976

Mr. George R. Alexander, Jr.
Regional Administrator
Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Alexander:

This is in response to your request of October 29 for the Department of the Interior's comments on the draft environmental statement for the Madison, Wisconsin Metropolitan Sewerage District's Organic Solids Reuse Plan.

GENERAL COMMENTS

The environment and impacts of the proposed action are described inadequately with reference to Nine Springs Creek. Water quality and fishery information for Nine Springs Creek are not presented, nor are impacts of dike repair and sludge removal on the fishery of Nine Springs Creek or on the existing wildlife and habitat addressed. This information should be made part of the final EIS.

Since much of the area surrounding the lagoons is high-quality wetland habitat, we ask that you contact the Green Bay Field Office of the U. S. Fish and Wildlife Service with more detailed information on the dike repair, to ensure that all measures will be taken to minimize harm. A Department of the Army Section 404 permit may be required for placement of fill in these wetlands. The District Engineer, U. S. Army Engineer District-Rock Island, should be contacted for additional information.

The draft statement should contain more adequate discussion of both existing and proposed recreation areas in the vicinity of the proposed project and of any effects the project may have on these recreation areas.

SPECIFIC COMMENTS

The discussion of recreational areas and activities in section 2.13 of the environmental assessment is not an "adequate summary of these subjects," as stated in part I. Not only should a list of parks (and other recreation

A-2

facilities) be included in the discussion, but a site location map is necessary to get a clear picture of the relationship of open-space land to the project area. A land-use map indicating the actual spectrum of uses should supplement figure 6-5 (part II) to aid in the review process.

The proposed Nine Springs Corridor/Dane County E-way (environmental way) has been overlooked. In the eastern portion of the Nine Springs Corridor of the Dane County E-way, 139.5 acres, adjacent to the public land controlled by the Madison Metropolitan Sewerage District, have been acquired with monies from the Land and Water Conservation Fund. Section 6(f) of the Land and Water Conservation Fund Act of 1965, as amended, states that no property acquired or developed with these funds can be converted to other than public outdoor recreation use without the approval of the Secretary of the Interior.

The Madison Metropolitan Sewerage District has orally indicated plans for coordination with Dane County and the Wisconsin Department of Natural Resources regarding one-time sludge deposition on E-way land before seeding and public use. A thorough discussion of these plans should be included in the statement along with site maps indicating the relationship of the E-way to the proposed project area.

The ground-water monitoring program seems too arbitrary in its specifications, in view of the many natural variables and the importance of ground water to public health. Plans now call for baseline monitoring followed by a check on nitrate nitrogen and total dissolved solids at three-year intervals for wells within 500 feet of an area of sludge application. Shallow water-table conditions apparently prevail over most of the area (p. 6-10 and 6-11); thus, the probability for downward migration to ground water and accelerated movement of pollutants in ground-water flow is fairly high. Most of the reported rates of ground-water movement are in the range from tenths of a foot to over three feet per day (figure 6-1). Since it is anticipated that domestic supply wells will commonly be perhaps 200 feet away (p. 6-8), the three year sampling interval may give protection only in the areas of slowest movement -- particularly if some mounding of the water table occurs in the areas of application. Therefore, we believe that although a maximum precautionary sampling interval may be appropriate, the results of the ground-water study for each site (p. 3-7) should be used to determine the need for more frequent sampling of ground water. For example, in some parts of the project area it is evident that ground water may travel 200, 500, or even 1,000 feet in a year or less (p. 6-4 and figure 6-1). On the other hand, the slow movement of ground water in some parts of the area suggests that the travel of pollutants to affected wells may exceed the arbitrary 5-year post-application limit set on page E-9. Because of the shallow depths to ground water, testing to determine the rate of movement of ground water toward given wells should not be an excessive burden. This seems to be especially true inasmuch as the allowable distance to wells is to be lowered to 200 feet (p. 6-8). Monitoring should be much more

frequent in the vicinity of storage lagoons, in order to assure integrity of the clay linings. We agree also in general (p. 4-4 of the environmental assessment) that the baseline inventory should include all existing wells and ground-water sources within one-half mile of each application site, and periodic monitoring of nitrate nitrogen and total dissolved solids as indicators of pollution should be on an annual basis as a minimum. The statement should also include at least representative values for permeability and/or transmissivity, and storage coefficient or specific yield of the soils and ground-water bearing materials in order that the evaluations of potential for ground-water impacts can be appraised.

Sincerely,

for David L. Jervis

Madonna F. McGrath
Acting Special Assistant
to the Secretary

United States Department of the Interior

FISH AND WILDLIFE SERVICE

IN REPLY REFER TO:

Division of Ecological Service
University of Wisconsin-Green Bay
Green Bay, Wisconsin 54302

March 23, 1977

MADISON METROPOLITAN SEWERAGE DISTRICT
RECEIVED
MAR 25 1977

Mr. Waldemar J. Landwehr
Chief Engineer and Director
Madison Metropolitan Sewerage District
104 North First Street
Madison, Wisconsin 53704

Dear Mr. Landwehr:

We have reviewed material forwarded by Jim Nemke of your staff explaining details of phase II sludge lagoon dike rehabilitation at the Nine Springs Sewage Treatment Works, Madison, Wisconsin. The detailed information and a follow-up telephone conversation with Mr. Nemke on March 22 have satisfied our concern expressed in DOI comments on the dEIS that all measures be taken to minimize harm to the adjacent wetlands during construction.

Therefore, the U.S. Fish and Wildlife Service has no objection to your proceeding with the dike rehabilitation as proposed. If a Section 404 permit is required, we will respond directly to the Corps of Engineers.

Thank you for providing the more detailed information.

Sincerely yours,

R. A. Hoppe

Richard A. Hoppe
Field Supervisor

RGRuesink:dp
cc: Bureau of Environmental Impact, WDNR, Madison, WI
Regional Office, FWS, Twin Cities, MN

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Madison, Wisconsin 53711

November 23, 1976

George R. Alexander, Jr.
Regional Administrator
Environmental Protection Agency
Attn: Planning Branch
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Alexander:

We have reviewed the draft environmental impact statement for the Organic Solids Reuse Plan, Madison Metropolitan Sewerage District, Dane County, Wisconsin, referred to our agency on November 1, 1976. Our review comments follow:

1. More consideration needs to be given to the protection of lands where the sewage sludge will be disposed. Careful conservation treatment and management of disposal areas will be needed to minimize pollution.

2. Existing conservation practices on disposal areas should be maintained.

3. No SCS projects will be affected by the proposed project.

We appreciate the opportunity to review and comment on the proposed action.

Sincerely,

J. C. Hytry
State Conservationist

A-4

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Anthony S Earl
Secretary

BOX 450
MADISON, WISCONSIN 53701

December 23, 1976

IN REPLY REFER TO: 1600

Mr. Kent Fuller, Acting Chief
Planning Branch
Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

Dear Mr. Fuller:

Re: Draft Environmental Impact Statement,
Organic Solids Reuse Plan, Madison
Metropolitan Severage District,
Dane County, Wisconsin

A-5

The Wisconsin Department of Natural Resources has completed its review of the Draft Environmental Impact Statement and offers the following comments:

Part 1 - Specific Comments

Page 2-4 (4.), second paragraph - Threatened plant species should be avoided. Section 2.07 of the Environmental Assessment does not elaborate on the effect of the proposed project on threatened species.

Page 2-6 (5.) - Legal descriptions of the locations of unique scientific or natural areas should be included.

Page 2-6, Odor - This section states the information contained in the Environmental Assessment is incomplete. Additional summary information should be added to describe the potential odor problems.

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Page 2-19 - Facilities Report information should be summarized and included.

Page 3-1 - Additional comments concerning the lagoon abandonment are in Specific Comments, Part 2, page 9-3, Section 9-5 of this letter.

Page 5-1 - The subjects of increased road maintenance, increased noise generation and the numbers of persons in the affected area should be addressed.

Part 1 - General Comments

1. The Department's staff feels that this section of the document failed to offer the reader adequate summary information.

2. The many references to the facilities plan and the Environmental Assessment make Part 1 very difficult to read.

Part 2 - Specific Comments

Page 6-7 - A 200-foot horizontal separation of the sludge site from an existing well may be satisfactory in some cases. However, additional evaluations may be necessary on a site specific basis depending on the topographic, hydrologic and geological features of the area.

Page 6-9 - The evaluation of soil structure may be a useful eighth criterion for soil suitability tests. Aeration, tilth improvement and ultimately fertility will be directly affected. Management of the program would have to insure that sludge application would minimize soil compaction, destruction of aggregate structure (puddling) and increased susceptibility to erosion.

Page 6-12 - The discussion of Cation Exchange Capacity (CEC) should also relate to fertility.

Page 6-14 - Crop Suitability - This section should include a discussion of soluble salts and potential imbalances of macro and micro element requirements. If additional amendments or supplements would be required, they should be explained.

Page 6-18, Heavy Metals - "Other" heavy metals should be named and discussed in Table 6-4, page 6-19. Heavy metal concentrations should be stated. What are the heavy metal sources? To what extent will heavy metals be attenuated in the soil atmosphere? Potential threats to ground water resources should be clearly explained.

Page 6-20 - The methods employed to determine sludge application rates for crops intended for human consumption are not fully explained.

Page 6-21, Tables 6-5 and 6-6 - The source of the information presented in these tables should be given. If this information was researched by the consultant, does EPA agree with the analysis presented?

Page 6-22 - The summary section should include plans for long-term monitoring.

Page 6-22, Section 6.4 - The Department feels that it is in the best interest of the proposed project that a factual statement outlining the expected benefits of sludge application be included in the final statement. This would prove very useful in the public's understanding of the document.

Page 6-23 - How many acres of the potential 5,000 acres have been evaluated as sludge sites?

Page 6-26 - How will grazing near restricted sludge application areas be controlled? In the event of cattle intruding on a restricted site, what are the potential hazards? This may be particularly sensitive in the area of high producing dairy herds.

Page 6-26 - The effects of soil wetting, water balance, and leaching potential require a more thorough explanation.

Page 6-28 - The need for 10 to 20 percent additional herbicide usage should be explained. Will this alter acceptance of the program in the farm community? What price considerations have been taken into account to insure the sludge plus the additional herbicide will be competitive with commercial amendments. The benefits of increased organic material should be strongly emphasized.

Page 6-28 - The statement appears to lack information concerning types of pathogenic organisms, any potential problems and how good management will minimize potential adverse effects.

Page 6-31 - Soil classifications other than Class 1 or 2 should be included. Is 72 tons per acre correct?

Page 7-3 - Facilities Requirements - Farm storage lagoons are discussed as sites for seasonal storage of sludge. The location of such lagoons is extremely important, particularly if seepage or leakage should occur. If such lagoons are within 500 feet of navigable water, Section 30.19, Wisconsin Statutes, would be applicable.

A pipeline distribution system presents the additional potential problem of leakage should a break occur. Therefore, the location of such a pipeline with respect to lakes or streams is very important. Section 30.20 permits would be required for all stream crossings.

Page 7-6 - The discussion of existing methods of sludge incorporation points out that large pieces of frozen sludge were left on top of the frozen ground in February of 1975. During the spring thaw, the sludge was washed into Lake Waubesa which resulted in adverse public reaction. Such mismanagement in the future could jeopardize the entire project.

A-6

Page 8-19 - Additional data should be presented on the reasonableness of the fee schedule.

Page 9-3, Section 9.5 - In its docket SD-306, acting as the trustee for navigable waters, the DNR issued a permit for Lagoons 1 and 2. In that permit, are the following:

> "1) The project site shall be restored to the Department of Natural Resources specifications upon abandonment of the sludge lagoons
>
> 2) The authority herein granted can be amended or rescinded if the structure becomes a material obstruction to navigation or becomes detrimental to the public interest."

No standards for restoration were discussed or enumerated. The intent was that current standards (and laws) would be applied at the time of abandonment.

General Comments, Part 2

1. Organization and readability are very good.

2. Important information could be summarized more concisely, i.e., sludge advantages and disadvantages.

3. Technical data in the statement should be referenced. It should be readily apparent to the reader which information was accumulated by the consultant, and what your agency's comments and analyses were concerning that material.

Summary

The Department of Natural Resources fully supports the concept of organics reuse and realizes that this material is a valuable resource. Our concerns center around the practical application and management of the proposed project. The Department feels that many of the public questions and concerns can be effectively addressed in the final document.

Thank you for the opportunity to comment on this Draft Environmental Impact Statement. We would appreciate receiving six copies of the Final Statement.

Sincerely,
Bureau of Environmental Impact

James R. Huntoon
Director

cc: A. E. Ehly
D. F. Gebken
L. A. Posekany
John Cain
Robert Krill

THE STATE HISTORICAL
SOCIETY OF WISCONSIN

816 STATE STREET / MADISON, WISCONSIN 53706

December 10, 1976

Mr. George R. Alexander, Jr.
Regional Administrator
Environmental Protection Agency, Region V
230 South Dearborn
Chicago, Illinois 60604

SHSW 0279-76

Dear Mr. Alexander:

We have reviewed the Draft Environmental Impact Statement for the Madison Metropolitan Sewerage District's Organic Solids Reuse Plan.

There are no sites listed on the National Register of Historic Places that would be affected by this project. Furthermore, there are no sites known to us of archeological, architectural, or historical significance in the project area that would be eligible for inclusion on the National Register of Historic Places.

Sincerely,

Richard A. Erney
State Historic Preservation Officer

RAE:rdc

Dane County Regional Planning Commission
Room 312 City-County Bldg. Madison, Wisconsin 53709 Tel. 608 266-4137

November 23, 1976

Mr. Kent Fuller, Acting Chief
Planning Branch, Region V
U.S. Environmental Protection Agency
230 South Dearborn Street
Chicago, Illinois 60604

RE: Madison Metropolitan Sewerage District
Organic Solids Reuse Plan

Dear Mr. Fuller:

A-8

The Dane County Regional Planning Commission has reviewed the Organic Solids Reuse Plan for the Madison Metropolitan Sewerage District, and the Environmental Impact Statement for the plan prepared by the U.S. Environmental Protection Agency.

We previously conducted an A-95 review of the proposed project (RPC Planning Review No. 76-56) and submitted our comments to the U.S. Environmental Protection Agency on July 29, 1976, along with written comments submitted to us by other groups and governmental units. We commented that the proposed plan was consistent with areawide policies and plans. Other comments submitted to us at that time were also supportive.

In our opinion, all of the major areas of environmental concern are adequately addressed in the plan and the environmental impact statement. The proposed program, if implemented in accordance with these documents, appears to be environmentally sound as well as cost-effective. In addition, the use of organic residuals from the wastewater treatment plant as a substitute for commercial fertilizers represents a direct form of recycling, and should reduce the demand for commercial fertilizers.

If the proposed program is to be successful, the stringent management and operation controls and environmental monitoring called for in the plan are absolutely essential. Because the program relies on the voluntary cooperation of individual landowners and units of government, it is critical that the Madison Metropolitan

RPC

Sewerage District conduct the operation so as to prevent any occurrences of environmental degradation or other possible causes of public complaints. This will entail a high level of MMSD control of transporting and applying the organic solids, including locations, methods and timing, as well as extensive environmental monitoring.

We appreciate the opportunity to provide our comments on the environmental impact statement for the proposed project.

Sincerely,

Charles Montemayor
Executive Director

WL:CM:ds

RPC

HOLTZMAN COMPANY

P.O. BOX 4068 MADISON, WISCONSIN 53711
1-608-271-6441

Nov 12, 1976

Mr Kent Fuller, Acting Chief
EPA Planning Branch
Chicago Ill 60604

Dear Mr Fuller,

This letter is in support of plans to dispose of sludge on agricultural lands. I am writing because there is less than a 100% chance I will be able to attend the November 30 hearing at Town of Fitchburg Hall, Madison Wis and I want my views to be considered.

As a producer of albino rats used for medical research, we have customers who require non-Pfizer irradiated pellets. We produce our own corn for rat feed and have grown corn (Pfizer's hybrid DM5102) on land spread with sewerage sludge from Madison Metro Sewerage District to a depth of 3"-5". We made an assay comparing the interim weights of rats fed corn grown on sludged and non-sludged land. There was no significant difference in interim weights. We conclude that both untreated pellet residues do not enter corn.

Sincerely, Jerry Holtzman Pres.

P.S. I tried to obtain copy of E.I.S. at U Wis Mem Union but failed.

A-9

Appendix B

TABLE B-1 **

CAPITAL COST ESTIMATE*

ALTERNATIVE 1A - LAND TRENCHING OF DEWATERED SLUDGE

Thickening Tanks	$ 0.(1)
Sludge Storage Tanks	0.(2)
Centrifuges 8 @ 46 GPM	1,155,000.
Centrifuge Building	124,000.
Centrate Storage Tank	86,000.
Sludge Cake Storage Tank	0.(3)
Trucks and Associated Equipment	374,000.
Secondary Treatment Plant Requirements	328,000.
Land	
Sub-total	2,091,000.
Process Contingencies (8%)	167,000.
Sub-total	2,258,000.
Engineering (7%)	158,000.
TOTAL CAPITAL COST	$2,416,000.

*The ENR Index used throughout is 2000.

(1) Thickener costs are included in the cost of the proposed Greeley and Hansen plant expansion.

(2) The existing sludge storage tanks can be used.

(3) All trucks and associated equipment are amortized to $0. over 5 years and included in annual operating cost only.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-2**

CAPITAL COST ESTIMATE*

ALTERNATIVE 2A - LAND APPLICATION OF LIQUID SLUDGE

Thickening Tanks	$	0.(1)
Digestion Tanks 2 @ 160,000 cu. ft. each		948,000.
Sludge Transfer Pipeline		
Pipe - Purchase and Installation		528,000.
Manholes		13,000.
Pumping Stations w/o Pumps		60,000.
Pumps		56,000.
Sludge Storage Lagoon		620,000.
Sludge Irrigation Equipment		51,000.
Land		2,377,000.
Sub-total		4,653.000.
Process Contingencies (8%)		372,000.
Sub-total		5,025,000.
Engineering (7%)		352,000.
TOTAL CAPITAL COST		$ 5,377,000.

(1) Thickener costs are included in the cost of the proposed Greely and Hansen plant expansion.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-3**

CAPITAL COST ESTIMATE*

ALTERNATIVE 3A - LANDFILLING OF SLUDGE/MILLED REFUSE MIXTURE

Thickening Tanks	$ 0.(1)
Digestion Tanks 2 @ 160,000 cu. ft. each	948,000.
Storage Tanks	0.(2)
Centrifuges 7 @ 46 GPM	1,012,000.
Centrifuge Building	112,000.
Centrate Storage Tank	86,000.
Sludge Cake Storage Tank	13,000.
Trucks and Associated Equipment	0.(3)
Secondary Treatment Plant Requirements	154,000.
Sludge Receiving and Unloading Area	27,000.
Drum Mixes	1,431,000.(4)
Land	0.(5)
Sub-total	3,783,000.
Process Contingencies (8%)	303,000.
Sub-total	4,086,000.
Engineering (7%)	286,000.
Total Capital Cost	$ 4,362,000.

(1) Thickener costs are included in the cost of the proposed Greeley and Hansen plant expansion.

(2) The existing sludge storage tanks can be used.

(3) All trucks and associated equipment are amortized to $0. over 5 years and included in annual operating costs only.

(4) A more economical mixer could possibly be designed.

(5) All costs associated with the landfilling operation are considered operating costs.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-4**

CAPITAL COST ESTIMATE*

ALTERNATIVE 3B - LAND APPLICATION OF DEWATERED SLUDGE

Thickening Tanks	$ 0.(1)
Digestion Tanks 2 @ 160,000 cu. ft. each	948,000.
Sludge Storage Tanks	0.(2)
Centrifuges 7 @ 46 GPM	1,012,000.
Centrifuge Building	112,000.
Centrate Storage Tank	86,000.
Sludge Cake Storage Tank	18,000.
Trucks and Associated Equipment	0.(3)
Secondary Treatment Plant Requirements	154,000.
Land	2,377,000.
Sub-total	4,707,000.
Process Contingencies (8%)	377,000.
Sub-total	5,084,000.
Engineering (7%)	356,000.
TOTAL CAPITAL COST	$ 5,440,000.

(1) Thickener costs are included in the cost of the proposed Greeley and Hansen plant expansion.

(2) The existing sludge storage tanks can be used.

(3) All trucks and associated equipment are amortized to $0. over 5 years and included in annual operating costs only.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District Madison, Wisconsin, April 1974

TABLE B-5**

CAPITAL COST DATA SOURCES

MAJOR UNIT	DATA SOURCES
Digesters	Weston Cost Estimate
Centrifuges	Weston Cost Estimate
Pipeline	MMSD Staff Estimates
Pumping Stations	MMSD Staff Estimates
Pumps	L.W. Allen and ITT Marlow
Manholes and Valving	MMSD Staff Estimates
Buildings	MMSD Staff Estimates
Storage Tanks	MMSD Staff Estimates
Trucks	Verona International Trucks
Sludge Transportation Trailers	Fruehauf Trailer Div., Fruehauf Corporation
End Loaders, Farm Machinery	Brooks Industrial Sales
Sludge Storage Lagoon	Weston Cost Estimate
Drum Mixers	Buhler Co. Cost Estimate and E.P.A. Report (1)
Irrigation Equipment	Roberts Irrigation Company
Secondary Treatment Plant Requirements	MMSD Staff Estimate and Greeley and Hansen Projected Cost Estimate for Plant Addition

(1) Recovery and Utilization of Municipal Solid Waste, by M.L. Drobny, M. E. Hull, and R. L. Testim, Battelle Memorial Institute, Columbus, Laboratories E.P.A. Contact No. PH 86-67-265.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-6**

1975 ANNUAL OPERATING COST ESTIMATE

ALTERNATIVE 1A - LAND TRENCHING OF DEWATERED SLUDGE

ASSOCIATED OPERATING COSTS

Cost of Thickening and Sludge Storage Absorbed in Present Operation

Polymers	$ 150,000.
Labor	30,000.
Power	5,600.
Maintenance	21,400.
Air Blowers	4,900.
Labor, fuel, maintenance, tires, license, taxes, etc.	52,000.
Amortization of three 20-ton tri-axle trucks over 5 yrs.	20,500.
Labor	12,000.
Power	3,100.
Maintenance	1,300.
Amortization of field equip.	7,500.
Payment in lieu of taxes	1,300.
1975 ANNUAL OPERATING COST	$ 309,600.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-7**

1975 ANNUAL OPERATING COST ESTIMATE

ALTERNATIVE 2A - LAND APPLICATION OF LIQUID SLUDGE

ASSOCIATED OPERATING COSTS

Cost for Thickening Absorbed in Present Operation

Labor	$ 52,000.
Power	2,400.
Maintenance	9,500.
Power	3,200.
Maintenance	2,000.
Maintenance	1,000.
Labor	33,000.
Power	3,800.
Amortization of field equip.	2,300.
Maintenance	6,500.
Payment in lieu of taxes	9,700.
Sub-total	125,400.
Return from leasing land	-33,600.
1975 ANNUAL OPERATING COST	$ 91,800.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-8**

1975 ANNUAL OPERATING COST ESTIMATE

ALTERNATIVE 3A - LANDFILLING OF SLUDGE/MILLED REFUSE MIXTURE

ASSOCIATED OPERATING COSTS

Cost for Thickening Absorbed in Present Operation	
Labor	$ 52,000.
Power	2,400.
Maintenance	9,500.
Use Available Tank	0.
Polymers	77,500.
Labor	24,000.
Power	4,500.
Maintanence	30,000.
Air Blowers	12,600.
Labor, fuel, maintenance, tires, license, taxes, etc. to haul sludge portion	54,600.*
Amortization of two 20-ton capacity trucks over 5 years	13,700.
Labor	12,000.
Power	1,100.
Maintenance	3,000.
Purchase, preparation and operation	134,400.*
Payment in lieu of taxes	1,700.
1975 ANNUAL OPERATING COST	$ 438,000.

*Only includes handling & disposal of sludge portion.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison Wisconsin, April 1974

TABLE B-9*

1975 ANNUAL OPERATING COST ESTIMATE

ALTERNATIVE 3B - LAND APPLICATION OF DEWATERED SLUDGE

Cost for Thickening Absorbed in Present Operation

Labor	$ 52,000.
Power	2,400.
Maintenance	9,500.
Polymers	77,500.
Labor	24,000.
Power	4,500.
Maintenance	30,000.
Air Blowers	12,600.
Labor, fuel, maintenance, tires, license, taxes, etc.	54,600.
Amortization of two 20-ton capacity trucks over 5 years	13,700.
Labor	24,000.
Power	1,300.
Maintenance	1,000.
Amortization of field equip.	4,500.
Payment in lieu of taxes	9,700.
Sub-total	321,300.
Return from leasing land	-33,600.
1975 ANNUAL OPERATING COST	$ 287,400.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-10**

BASIC COST FACTORS FOR CALCULATION OF OPERATING COSTS

Labor:	$12,000/operator/year $8/hr./truck driver
Power:	1.2 cent/kw-hr
Chemicals:	Altasep 105C - $1.25/lb. Hercafloc 814.3 - $1.60/lb.
Maintenance:	A given percentage of the unit capital cost or experience.
Recycle Stream Treatment	
Air Requirements:	1200 cu. ft./lb. BOD applied 7500 cu. ft./lb. NH_3-N applied
Capital Investment:	The portion of the unused capacity of the planned expansion which would be used by the recycle stream.
Fuel:	$0.50/gallon

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

TABLE B-11**

ANNUAL SYSTEM COSTS - 1975

Sludge Handling System	Fixed Annual Cost	Annual Operating Cost	Total Annual Cost	Cost Per Ton Dry Solids
Alternative 1A - Land Trenching of Dewatered Sludge	$225,000	$309,600	$534,600	$50
Alternatice 2A - Land Application of Liquid Sludge	$342,000	$ 91,800	$433,800	$41
Alternative 3A - Landfilling of Sludge/Milled Refuse Mixture	$406,000	$438,000	$844,000	$79
Alternative 3B - Land Application of Dewatered Sludge	$348,000	$287,400	$635,400	$60

(1) Cost per ton is based on 1975 dry solids of 58500 lbs/day = 10,676 tons/year.

(2) Includes interest payments for purchase of land for final disposal.

(3) Includes a return from leasing 2/3 of the productive land per year for $35/acre.

(4) Does not include any costs for milling, transporting or landfilling the refuse portion of sludge/milled refuse mixture.

(5) Assumes no land recovery after use as final disposal site. Cost of land amortized to $0 over 15 years.

**Source: "Addendum to Nine Springs Sewage Treatment Works Sludge Disposal Study for Madison Metropolitan Sewerage District," prepared by Staff of the Madison Metropolitan Sewerage District, Madison, Wisconsin, April 1974

Appendix C

TABLE C-1

BASIS OF DESIGN FOR ADDITIONAL SLUDGE FACILITIES

ANAEROBIC DIGESTERS	
Type - Mesophilic, high rate, completely mixed mixing mode compressed digester gas	
Primary Digesters	
Hydraulic Detention Time	10 days
Volatile Solids Loading Rate	0.1 lb. VSS/cu.ft./day
Secondary Digester (thickening mode, supernatant draw-off; mixing mode, compressed digester gas)	
Hydraulic Detention Time	10 days
GRAVITY THICKENERS	
Type - Center feed	
Surface Overflow Rate	800 gal/day/sq.ft.
Solids Loading Rate	
Primary	20 lbs/day/sq. ft.
Secondary	5 lbs/day/sq.ft.
FLOTATION THICKENERS	
Type - Dissolved air	
Surface Overflow Rate	1 gal/min/sq.ft.
Solids Loading Rate	3 lbs/hr/sq.ft.

Courtesy CH2MHill (Taken from Table 9-2, draft copy of "Summary Facilities Plan-MMSD", May 1976)

Note: Values used for preliminary design estimates

TABLE C-2

RECOMMENDED CONSTRUCTION STAGING FOR IMPROVEMENTS IN THE SOLIDS TREATMENT FACILITIES AT NINE SPRINGS WASTEWATER TREATMENT PLANT

Item (Quantity)	Description	Year On Line
GRAVITY THICKENERS		
Refurbish Mechanisms (2)	Inspect and repair as needed	1980
Gravity Thickener No. 5	55 feet diameter	1980
Thickener Sweetening Equipment	500 gpm secondary clarifer effluent to each gravity thickener	1980
DISSOLVED AIR FLOTATION THICKENERS		
Flotation Thickeners No. 1 and 2	500 square feet surface area	1980
Flotation Thickener No. 3	250 square feet surface area	1990
Sludge Blenders No. 1 and 2	15 feet diameter	1980
ANAEROBIC DIGESTERS		
Digester Upgrading	Gas mixers, roof sealing, overall refurbishing	1980
Heat Exchanger Modifications	New external heat exchanger with water softener	1980
Digester Control Building No. 2	Housing for controls, boilers, pumps & mixers	1980
Primary Digester No. 4	Volume 181,000 cu. ft., diameter 85 ft.	1980
Primary Digester No. 5	Volume 181,000 cu. ft., diameter 85 ft.	1985
Secondary Digester No. 3	Volume 181,000 cu. ft., diameter 85 ft.	1980
Secondary Digester No. 4	Volume 181,000 cu. ft., diameter 85 ft.	1980
Secondary Digester No. 5	Volume 181,000 cu. ft., diameter 85 ft.	1985
Digested Sludge Thickening Equipment	Supernatant drawoff piping	1980

Courtesy CH2Hill (Taken from Table 9-3, draft copy of "Summary Facilities Plan, MMSD," May 1976.)

TABLE C-3

REVISED TABLE 8-1 OF THE ORGANIC SOLIDS REUSE PLAN*
ESTIMATED INITIAL CONSTRUCTION COST
SLUDGE REUSE PROGRAM

Madison Metropolitan Sewerage District

ITEM	COST
REUSE PROGRAM	
Lagoon Sludge Removal Equipment	$ 100,000
Sludge Distribution Equipment (6 tanker trucks, 1 sludge loading dock, 2 nurse tanks, 1 slurry pump).	351,000
Sludge Application Equipment (4 truck spreaders, 1 soil injector, 1 tractor spreader)	240,000
Subtotal Reuse Program	$ 691,000
SOLIDS TREATMENT FACILITIES	
Gravity Thickeners	
Refurbishment	5,000
Sweetening Equipment	15,000
Gravity Thickener No. 5	110,000
Flotation Control Building	100,000
Flotation Thickeners No. 1 and 2	550,000
Anaerobic Digesters	
Refurbishment and Upgrading	430,000
Digester Control Building No. 2	350,000
Digester Utility Tunnel	220,000
New Digesters and Equipment**	1,390,000
Supernatant Drawoff Equipment	70,000
Subtotal Solids Treatment Facilities	$ 3,240,000
Subtotal Initial Construction Costs	$ 3,931,000
Engineering (12%)	472,000
Legal and Fiscal Costs (2.5%)	98,000
Administration (0.5%)	20,000
Contingency (15%)	590,000
Total Initial Construction Costs	$ 5,111,000
Less Federal Grant (75%)	3,833,000
Less State Grant (5%)	256,000
NET COST TO MMSD	$ 1,022,000

TABLE C-3 Cont.

*The solids treatment facilities costs were revised to correspond to those on Table 13-8 of Volume II, Wastewater Treatment Systems. All costs are in January 1976, dollars.

**Primary Digesters No. 4 and 5 and Secondary Digester No. 3

TABLE C-4
PRESENT WORTH COST OF ORGANIC SOLIDS REUSE PLAN

Madison Metropolitan Sewerage District

BASIS:

Reuse plan construction and O&M costs were computed by converting the year-by-year costs in Table B-14 of the organic solids reuse plan to January 1976, present worths.

Solids treatment construction present worth costs were computed for the facilities listed in Table 13-8 of Volume II of the comprehensive facilities plan assuming construction will begin in 1978.

Solids treatment power and other O&M present worth costs were computed from a fraction of the upgraded secondary treatment and advanced wastewater treatment costs listed in Table 13-9 of Volume II of the comprehensive facilities plan.

Engineering, legal and fiscal administrative and contingency costs are included in the present worth cost estimate.

CONSTRUCTION COSTS:

Solids Treatment	
Gravity Thickeners	$ 148,000
Flotation Thickeners	738,000
Anaerobic Digesters	2,793,000
Reuse Program	
Lagoon Program	250,000
Sludge Distribution	1,100,000
Sludge Application	418,000
Subtotal P.W. of Construction Costs	$ 5,447,000

OPERATING AND MAINTENANCE COSTS:

Solids Treatment	
Power	$ 3,115,000
Other O&M	4,361,000
Reuse Program	
Lagoon Program	130,000
Sludge Distribution	875,000
Sludge Application	385,000
Program Management	336,000
Monitoring Program	360,000
Income	- 60,000

TABLE C-4 Cont.

Subtotal P.W. of O&M Costs	$ 9,502,000
PRESENT WORTH:	
Total Present Worth	$14,949,000

Appendix D

Fishes - Nine Springs Creek, 1972-73*

AMIIDAE - BOWFIN

Bowfin, Amia calva Linnaeus

SALMONIDAE - TROUT

Rainbow trout, Salmo gairdneri Richardson
Brown trout, Salmo trutta Linnaeus

UMBRIDAE - MUDMINNOW

Central mudminnow, Umbra limi (Kirtland)

CYPRINIDAE - MINNOWS AND CARP

Carp, Cyprinus carpio Linnaeus
Brassy minnow, Hybognathus hankinsoni Hubbs
Golden shiner, Notemigonus crysoleucas (Mitchill)
Emerald shiner, Notropis atherinoides Rafinesque
Common shiner, Notropis cornutus (Mitchill)
Sand shiner, Notropis stramineus (Cope)
Spotfin shiner, Notropis spilopterus (Cope)
Bluntnose minnow, Pimephales notatus (Rafinesque)
Fathead minnow, Pimephales promelas Rafinesque
Creek chub, Semotilus atromaculatus (Mitchill)

CATOSTOMIDAE - SUCKER

White sucker, Catostomus commersoni (Lacepede)

ICTALURIDAE - FRESHWATER CATFISH

Black bullhead, Ictalurus melas (Rafinesque)
Yellow bullhead, Ictalurus natalis (Lesueur)
Brown bullhead, Ictalurus nebulosus (Lesueur)

ATHERINIDAE - SILVERSIDE

Brook silverside, Labidesthes sicculus (Cope)

GASTEROSTEIDAE - STICKLEBACK

Brook stickleback, Culaea inconstans (Kirtland)

PERCICHTHYIDAE - TEMPERATE BASS

White bass, Morone chrysops (Rafinesque)
Yellow bass, Morone mississippiensis Jordan and Eignmann

CENTRARCHIDAE - SUNFISH

Green sunfish, Lepomis cyanellus Rafinesque
Pumpkinseed, Lepomis gibbosus (Linnaeus)
Bluegill, Lepomis macrochirus Rafinesque
Smallmouth bass, Micropterus dolomieui Lacepede
Largemouth bass, Micropterus salmoides (Lacepede)

(con't.)

PERCIDAE - PERCH

Yellow perch, Perca flavescens (Mitchill)

SCIAENIDAE - DRUM

Freshwater Drum, Aplodinotus grunniens Rafinesque

*Source: Wisconsin Department of Natural Resources

Appendix E

BIBLIOGRAPHY

This list includes only those references specifically cited in the text.

Burge, W.D., "Health Aspects of Applying Sewage Wastes to Land", ARS, USDA, 1974.

CH2M Hill, "Organic Solids Reuse Plan" prepared for the Madison Metropolitan Sewerage District, 1976.

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