# REGIONAL COPPER-NICKEL STUDY
# WATER SUPPLY AND WASTEWATER DISPOSAL IN NORTHEAST MINNESOTA

Minnesota Environmental Quality Board

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TABLE OF CONTENTS

ABSTRACT

The importance of water to human health dictates the need for an adequate supply of drinking water of satisfactory quality and the proper disposal of wastewater. In general, municipal water and wastewater systems are preferable to individual systems; however, in many instances municipal systems are not available and individual systems must be employed.

Drinking water may be derived from either surface or groundwater sources. Surface water sources are generally more susceptible to intermittent pollution. In the four-county region of Carlton, Cook, Lake, and St. Louis an estimated 72 percent of the population is served by municipal supplies. Based on this estimate there are approximately 24,000 private wells in regular use and an undetermined number in seasonal use.

Municipal wastewater treatment plants may employ primary (sedimentation), secondary (biological), or tertiary (chemical) treatment. An estimated 74 percent of the four-county population is served by municipal systems. Based on this estimate there are approximately 22,000 individual systems in regular use and an undetermined number in seasonal use.

Drinking water may be contaminated directly or indirectly by industrial wastes, or by overloading of wastewater treatment systems. Surface sources of drinking water are most likely to be affected.

Comprehensive lists of municipal water and wastewater systems in the four-county area are included as appendices.

## INTRODUCTION TO THE REGIONAL COPPER-NICKEL STUDY

The Regional Copper-Nickel Environmental Impact Study is a comprehensive examination of the potential cumulative environmental, social, and economic impacts of copper-nickel mineral development in northeastern Minnesota. This study is being conducted for the Minnesota Legislature and state Executive Branch agencies, under the direction of the Minnesota Environmental Quality Board (MEQB) and with the funding, review, and concurrence of the Legislative Commission on Minnesota Resources.

A region along the surface contact of the Duluth Complex in St. Louis and Lake counties in northeastern Minnesota contains a major domestic resource of copper-nickel sulfide mineralization. This region has been explored by several mineral resource development companies for more than twenty years, and recently two firms, AMAX and International Nickel Company, have considered commercial operations. These exploration and mine planning activities indicate the potential establishment of a new mining and processing industry in Minnesota. In addition, these activities indicate the need for a comprehensive environmental, social, and economic analysis by the state in order to consider the cumulative regional implications of this new industry and to provide adequate information for future state policy review and development. In January, 1976, the MEQB organized and initiated the Regional Copper-Nickel Study.

The major objectives of the Regional Copper-Nickel Study are: 1) to characterize the region in its pre-copper-nickel development state; 2) to identify and describe the probable technologies which may be used to exploit the mineral resource and to convert it into salable commodities; 3) to identify and assess the impacts of primary copper-nickel development and secondary regional growth; 4) to conceptualize alternative degrees of regional copper-nickel development; and 5) to assess the cumulative environmental, social, and economic impacts of such hypothetical developments. The Regional Study is a scientific information gathering and analysis effort and will not present subjective social judgements on whether, where, when, or how copper-nickel development should or should not proceed. In addition, the Study will not make or propose state policy pertaining to copper-nickel development.

The Minnesota Environmental Quality Board is a state agency responsible for the implementation of the Minnesota Environmental Policy Act and promotes cooperation between state agencies on environmental matters. The Regional Copper-Nickel Study is an ad hoc effort of the MEQB and future regulatory and site specific environmental impact studies will most likely be the responsibility of the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency.

## INTRODUCTION

Water is a major component of the environmental factors which affect human health. It is therefore important that both the supply of water be adequate and of satisfactory sanitary quality, and the disposal of wastewater be conducted in a proper manner. In general, municipal water and sewage systems are preferable to individual systems (such as wells and septic tanks) because municipal systems usually have competent supervision (Salvato 1972). However, in many instances municipal systems are not available, or economically feasible, so individual systems must be employed. In these cases it is crucial to the protection of public health that these systems be constructed and operated properly.

This paper will identify and discuss the existing municipal water and sewer systems in Carlton, Cook, Lake, and St. Louis counties. Estimates of the populations served by municipal systems and individual systems will be made. Additional information about water supply and wastewater disposal has been prepared by the Water and Socio-economic sections of the Regional Copper-Nickel Study.

## WATER SUPPLY

Sources of water can be divided into two major categories: surface and underground. Underground sources are generally preferable to surface water sources because they are less subject to intermittent pollution and fluctuations in quantity. In northeastern Minnesota the sources of municipal water supplies may be divided into five groups: groundwater (drilled wells); surface water; combined—groundwater and surface water; combined—drilled wells and mine shaft; and those which obtain water from a

nearby municipal water system (Figures 1 and 2). Information concerning type of treatment, population served, average daily consumption, and the State Plumbing Code is shown for each of these municipal supplies in Appendix 1.

Most of the municipal water supplies in the region use groundwater sources. However, surface water sources are used by several municipalities, including Aurora, Ely, Hoyt Lakes, and Winton, which are all in close proximity to the Duluth Gabbro Contact, and Beaver Bay, Duluth, Eveleth, Grand Marais, Silver Bay, and Two Harbors, which are somewhat farther away from the Contact.

Estimates of the population served by municipal supplies and by individual systems are given in Table 1. The proportion of the population served by municipal supplies ranges from 38 percent in Cook County to 77 percent in St. Louis County. These figures indicate that about 28 percent of the people in this four-county region have individual systems. Assuming that there is one well for every three persons not served by a municipal supply, it is estimated that this region has over 24,000 wells in regular use. In addition, there are many seasonal residences in the region which would also be served by wells; however, the number of wells and the size of the population in this category are not known.

## WASTEWATER DISPOSAL

Sewage treatment plants are generally divided into three groups, depending on the amount of treatment given to the wastewater: primary, secondary, and tertiary. Primary treatment may be thought of as gross removal of solids by physical processes such as screens and settling tanks (sedimentation). Secondary treatment consists of biological processes. Trickling filters

and/or activated sludge aerobically decompose waste materials and eliminate most of the biochemical oxygen demand (BOD) and suspended solids (SS), after the sewage has undergone primary treatment. Tertiary treatment, applied to the effluent of secondary treatment, generally consists of chemical treatment to further remove specific undesireable substances—usually phosphorus and nitrogen. Locations of municipal wastewater disposal facilities are shown in Figures 3 and 4. Information about population served, age of the system, and type of treatment provided are presented in Appendix 2.

Estimates of the populations served by municipal wastewater treatment systems and by individual systems are given in Table 2. The proportion of the population served by municipal systems ranges from 38 percent in Cook County to 78 percent in St. Louis County. These figures indicate that 26 percent of the population in the four-county region are served by individual (or on-site) systems. Assuming there is one individual system (septic tank, cesspool, or privy) for every three persons not served by a municipal system, it is estimated there are over 22,000 individual systems in use. Again, this figure does not include seasonal residents, whose numbers would greatly increase the estimated number of individual systems.

## DISCUSSION

Several aspects pertaining to water supply and wastewater disposal need to be addressed in assessing potential impacts on public health. First is whether the sources of water supplies are adequately protected both in terms of quality and quantity of water. Surface water sources are most susceptible to intermittent pollution and should be most carefully monitored

(this would apply predominantly to Aurora, Ely, Hoyt Lakes, and Winton). If groundwater aquifers could be affected, groundwater supplies may need monitoring as well. When a source of drinking water becomes contaminated several steps may be taken: 1) find another source of water which is not contaminated; 2) provide additional treatment of the water; or 3) find the source of contamination and eliminate it.

If new construction occurs outside of areas with municipal systems care must be taken that individual systems are properly installed. Septic tanks located too close or hydraulically above wells may cause contamination of the wells. Certain soils are not suitable for septic tanks and other soils place great limitations on septic tank design and land requirements. Similarly, if two wells are constructed too close to each other, sufficient groundwater may not be present to supply the users' needs. Adequate legal mechanisms to ensure proper installation of individual systems exist at both the state and county level; however, rapid development may strain local resources so that regulations are not enforced.

Evaluation of potential impacts on health from copper-nickel development for water supply and wastewater disposal should begin with an examination of whether the quality of surface sources of drinking water may be affected. Next, the possibility of impacts on groundwater sources, including private wells, should be examined. Contamination of drinking water may occur either directly from industrial sources or indirectly from municipal or individual sources of wastes. Early identification of potential impacts should provide sufficient time to institute measures for the protection of public health.

Analyses of community needs and abilities to provide these services, and water quality and quantity have been addressed in reports prepared by the Socio-economic and water sections of the Regional Copper-Nickel Study.

Table 1. Proportion of population served by municipal and individual water supplies in northeastern Minnesota 1975.

| COUNTY | ESTIMATED POPULATION SERVED BY MUNICIPAL SYSTEM* | ESTIMATED POPULATION SERVED BY PRIVATE WELLS** | ESTIMATED NUMBER OF PRIVATE WELLS IN REGULAR USE*** |
|---|---|---|---|
| Carlton | 13,300 (46%) | 15,400 (54%) | 5,133 |
| Cook | 1,400 (38%) | 2,300 (62%) | 767 |
| Lake | 8,300 (60%) | 5,500 (40%) | 1,833 |
| St. Louis | 166,600 (77%) | 49,600 (23%) | 16,533 |
| TOTAL | 189,600 (72%) | 72,800 (28%) | 24,266 |

*Information from Appendix 1. Population is rounded to the nearest 100. Estimates of total population in 1975 are from the U.S. Bureau of the Census (1977).

**Population is rounded to the nearest 100. Assumes everyone not on a municipal system is served by private wells.

***Assumes one private well for every three persons not on a municipal system.

Table 2. Proportion of population served by municipal and individual wastewater disposal facilities in northeastern Minnesota 1975.

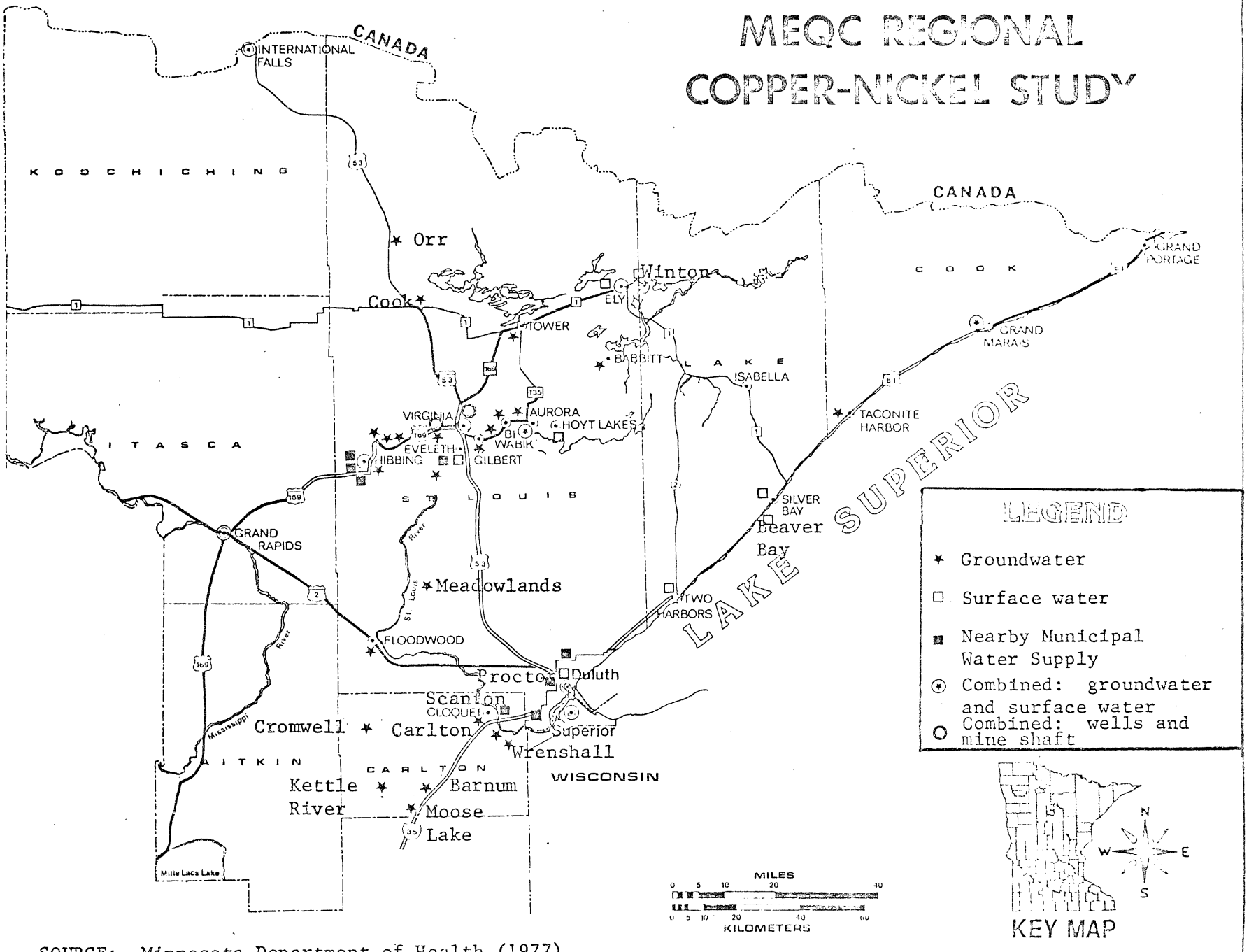
| COUNTY | ESTIMATED POPULATION SERVED BY MUNICIPAL SEWER SYSTEM* | ESTIMATED POPULATION SERVED BY INDIVIDUAL (On-Site) SYSTEM** | ESTIMATED NUMBER OF INDIVIDUAL (On-Site) SYSTEMS IN REGULAR USE*** |
|---|---|---|---|
| Carlton | 15,700 (55%) | 13,000 (45%) | 4,333 |
| Cook | 1,400 (38%) | 2,300 (62%) | 767 |
| Lake | 7,900 (57%) | 5,900 (43%) | 1,967 |
| St. Louis | 169,100 (78%) | 47,100 (22%) | 15,700 |
| TOTAL | 194,100 (74%) | 68,300 (26%) | 22,767 |

*Information from Appendix 2. Populations is rounded to the nearest 100. Estimates of the total population in 1975 are from the U.S. Bureau of Census (1975).

**Population is rounded to the nearest 100. Assumes everyone not on a municipal system is served by an individual system.

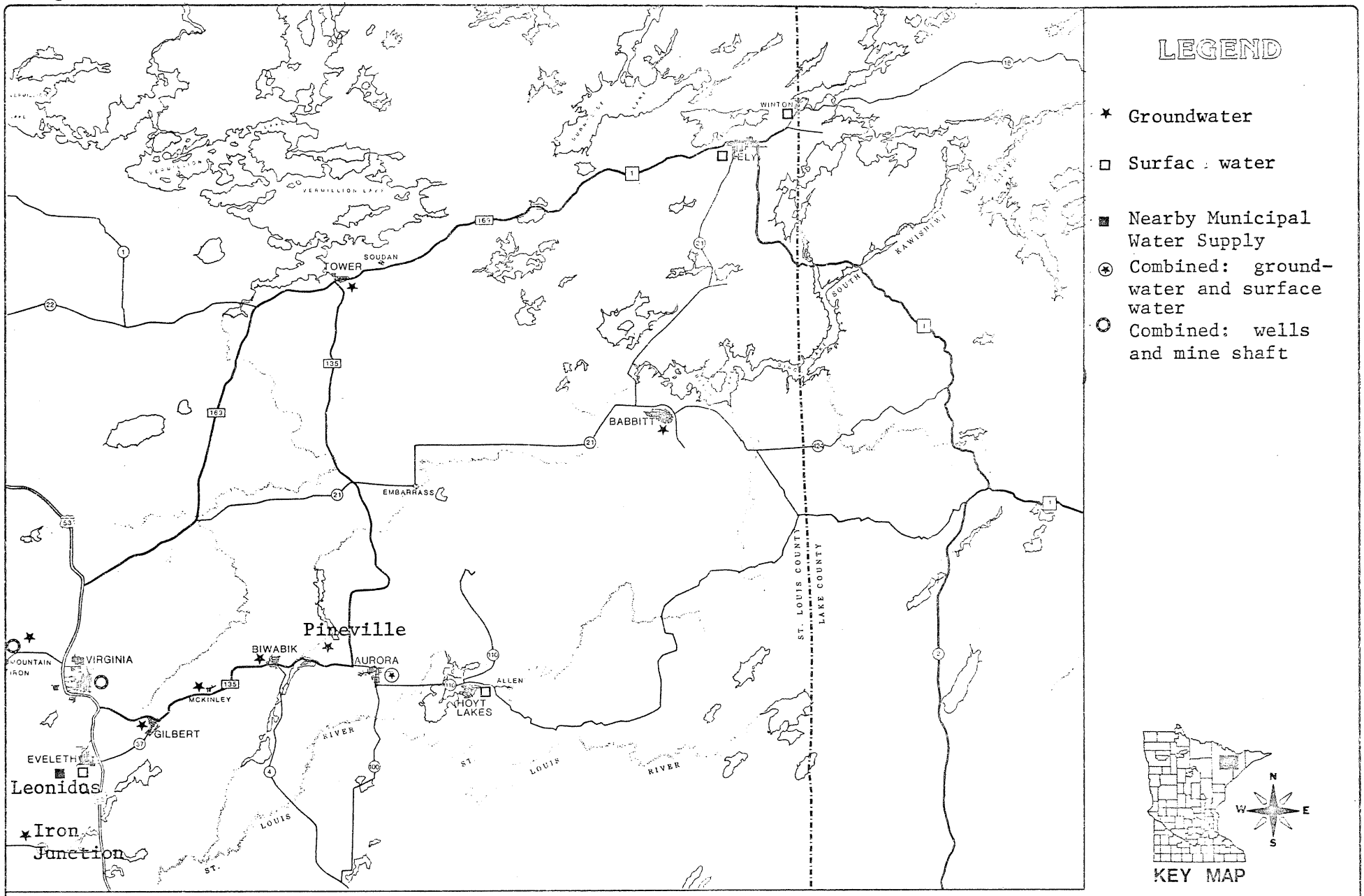
***Assumes one individual system for every three persons not on a municipal system.

Figure 1. Source of Public Water Supplies in Northeast Minnesota




SOURCE: Minnesota Department of Health (1977)

Figure 2. Source of Public Water Supplies on the East Range

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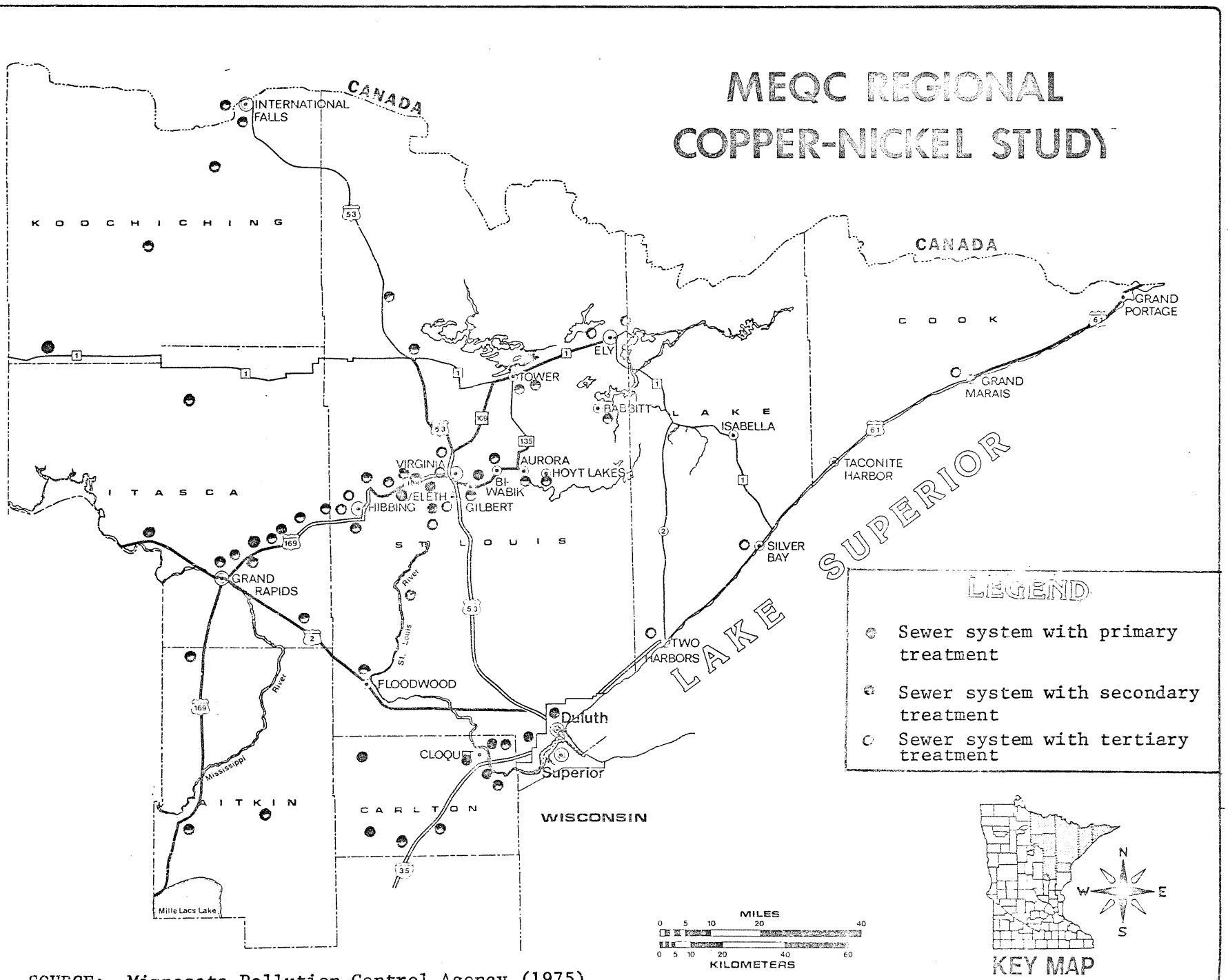
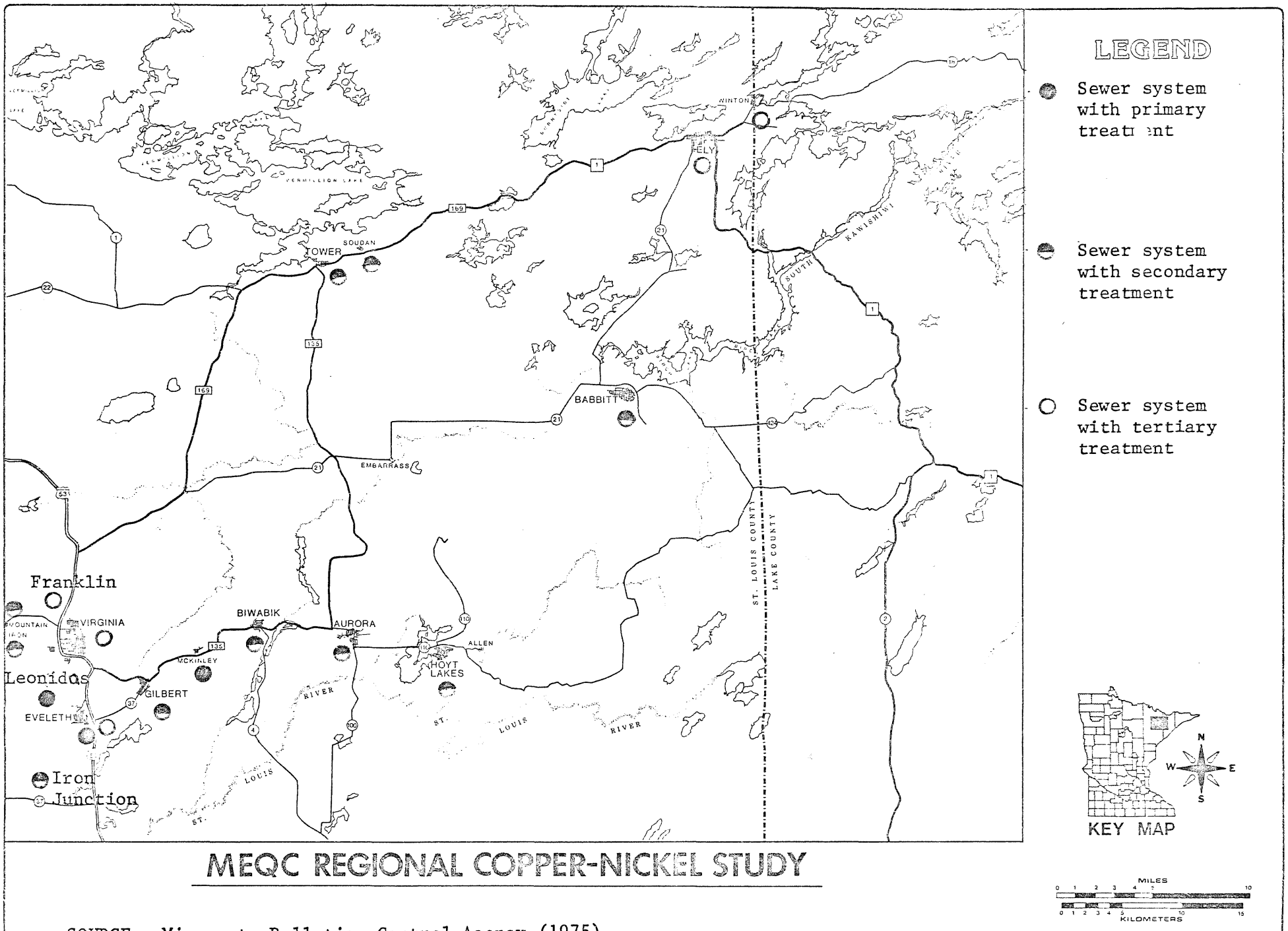
SOURCE: Minnesota Department of Health (1977)

Figure 3. Municipal Wastewater Disposal Facilities in Northeast Minnesota




SOURCE: Minnesota Pollution Control Agency (1975)

Figure 4. Municipal Wastewater Disposal Facilities on the East Range




SOURCE: Minnesota Pollution Control Agency (1975)

REFERENCES

Minnesota Department of Health. 1977. Personal communication from David Geise, Assistant Director, Division of Environmental Health, dated February 25, 1977. Information was abstracted from the most recent reports of municipal water supply investigations.

Minnesota Pollution Control Agency. 1975. Wastewater disposal facilities inventory. State of Minnesota. July 1, 1975. Division of Water Quality, Facilities Section, Minnesota Pollution Control Agency.

Salvato, J.A. 1972. Environmental engineering and sanitation. Wiley-Interscience. New York.

United States Bureau of the Census. 1977. Population estimates and projections. 1973 (revised) and 1975 population estimates and 1972 (revised) and 1974 per capita income estimates for counties, incorporated places, and selected minor civil divisions in Minnesota. Series P-25. No. 671. United States Government Printing Office. Washington, D.C.

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977.

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| Carlton | Barnum | Drilled Well | Fluoridation | 420 | 120 | 49,000 | Not Adopted |
| | Carlton | Drilled Well | Disinfection Aeration Filtration Fluoridation | 1000 | 200 | 80,000 | Adopted |
| | Cloquet | Drilled Wells | Disinfection Aeration Fluoridation | 9831* | 2977* | 950,000 | Adopted |
| | Cromwell | Drilled Wells | Fluoridation | 187 | 31 | 8,000 | Not Adopted |
| | Kettle River | Drilled Well | Disinfection Aeration Filtration Fluoridation | 179 | 85 | 25,000 | Not Adopted |
| | Moose Lake | Drilled Wells | Fluoridation | 1500 | 420 | 170,000 | Adopted |
| | Scanlon | Drilled Wells (from Cloquet) | Disinfection Fluoridation | 1132* | 350* | 67,000 | Adopted |
| | Wrenshall | Well | None | 147 | 6 | -- | --- |
| Cook | Grand Marais | Drilled Well Lake Superior | Filtration Disinfection Fluoridation | 1299 | 400 | 150,000 | --- |
| | Taconite Harbor | Drilled Wells | ---- | 100 | 24 | -- | --- |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| Lake | Beaver Bay | Lake Superior | Filtration<br>Disinfection<br>Fluoridation | 359 | 80 | 40,000 | --- |
| | Silver Bay | Lake Superior | Filtration<br>Disinfection<br>Fluoridation | 3504 | 850 | 780,000 | --- |
| | Two Harbors | Lake Superior | Disinfection | 4437 | 1800 | 810,000 | --- |
| St. Louis | Anne's Acres (Mt. Iron) | Drilled Wells | Fluoridation | 300 | 68 | 26,667(est) | --- |
| | Aurora | Well St. James Pit (surface) | Disinfection<br>Filtration<br>Softening<br>Sedimentation<br>Fluoridation | 2725 | 840 | 375,000 | Adopted With Permits and Inspections |
| | Babbitt | Drilled Wells | Disinfection<br>Fluoridation<br>Corrosion Control | 3038 | 630 | 280,000 | Not Adopted |
| | Biwabik | Drilled Wells | Disinfection<br>Fluoridation<br>Corrosion Control | 1483 | 539 | 170,000 | Adopted With Permits & Inspections |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| St. Louis | Buhl | Drilled Well | Aeration<br>Fluoridation | 1330 | 420 | 160,000 | Not Adopted |
| | Chisholm | Wells | Disinfection<br>Aeration<br>Filtration<br>Coagulation<br>Recarbonation<br>Softening<br>Sedimentation<br>Fluoridation<br>Corrosion Control | 6400 | 2400 | 500,000 | Adopted With Permits and Inspections |
| | Cook | Drilled Wells | Disinfection<br>Aeration<br>Filtration<br>Fluoridation | 687 | 302 | 100,000 | Not Adopted |
| | Duluth | Lake Superior | Disinfection<br>Ammoniation<br>Fluoridation<br>Filtration<br>Coagulation<br>Sedimentation | 113,790** | 25,453** | 15,000,000 | |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| St. Louis | Ely | Burntside Lake<br>Shagawa Lake (stand-by) | Disinfection<br>Aeration<br>Filtration<br>Taste & Odor<br>Ammoniation<br>Sedimentation<br>Fluoridation<br>Corrosion Control & Stabilization | 5000 | 1882 | 600,000 | Adopted |
| | Eveleth | St. Mary's Lake | Disinfection<br>Filtration<br>Taste & Odor<br>Fluoridation | 4900*** | 1800*** | 750,000 | Adopted |
| | Floodwood | Drilled Wells | None | 650 | 325 | 42,000 | Not Adopted |
| | Gilbert | Ground Water | Disinfection<br>Aeration<br>Filtration<br>Coagulation<br>Softening<br>Sedimentation<br>Fluoridation<br>Corrosion Control & Stabilization | -- | 1000 | 350,000 | Not Adopted |
| | Herman Township | Duluth Munic. Water System | --- | ** | ** | | |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| St. Louis | Hibbing | Drilled Wells | Disinfection<br>Fluoridation | 20,000**** | 5417**** | 1,900,000 | Adopted w/Permits & Inspections |
| | Hoyt Lakes | Colby Lake | Disinfection<br>Aeration<br>Filtration<br>Coagulation<br>Sedimentation<br>Fluoridation | 3,634 | 900 | 350,000 | Not Adopted |
| | Iron Junc. | Drilled Well | None | 90 | 20 | 6,000 | Not Adopted |
| | Kelly Lake | Hibbing Munic. Water System | Disinfection<br>Fluoridation | 1,000**** | 338**** | -- | Not Adopted |
| | Kerr Location | Hibbing Munic. Water System | Disinfection<br>Fluoridation | 65**** | 20**** | -- | Not Adopted |
| | Kinney | Drilled Well | Aeration<br>Filtration<br>Taste & Odor<br>Fluoridation<br>Pyrolusite<br>Ore-catalytic<br>Bed | 360 | 135 | 32,000 | Not Adopted |
| | Leetonia | Hibbing Munic. Water System | Disinfection<br>Fluoridation | 120**** | 30**** | -- | Not Adopted |
| | Leonidas | Eveleth Munic. Water System | Disinfection<br>Filtration<br>Sedimentation<br>Fluoridation | 150*** | 30*** | -- | Not Adopted |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| St. Louis | McKinley | Drilled Well | None | 317 | 112 | 50,000 | --- |
| | Meadowlands | Drilled Wells | Fluoridation | 128 | 56 | 13,000 | Not Adopted |
| | Mt. Iron | Mine Shaft | Disinfection Fluoridation | 3294 | 500 | 225,000 | Not Adopted |
| | Orr | Drilled Well | Disinfection Fluoridation | 313 | 100 | 70,000 (May-Sept.) 40,000 (Sept.-May) | Not Adopted |
| | Pineville | Drilled Well | None | 35 | 14 | --- | Not Adopted |
| | Proctor | Duluth Munic. Water System | Disinfection Ammoniation Fluoridation | 3000** | 1060** | 436,000 | Adopted w/Permits & Inspections |
| | Rice Lake Township | " " | | ** | ** | | |
| | Tower-Soudan | Drilled Wells | Disinfection Fluoridation Corrision Control & Stabilization | 1600 | -- | 165,000 | Not Adopted |

Appendix 1. Municipal water supplies in Northeastern Minnesota. 1977. (contd.)

| COUNTY | COMMUNITY | WATER SOURCE | TREATMENT | POPULATION SERVED | NUMBER OF SERVICE CONNECTIONS | AVERAGE DAILY CONSUMPTION (gallons) | STATE PLUMBING CODE |
|---|---|---|---|---|---|---|---|
| St. Louis | Virginia | Mine Shaft Drilled Well | Disinfection Filtration Coagulation Sedimentation Fluoridation Corrosion Control & Stabilization | 14,000-14,500 | 4,250 | 2,500,000 | Adopted |
| | Winton | Fall Lake | Disinfection Filtration Coagulation Sedimentation | 290 | 107 | 20,000 | Not Adopted |

SOURCE: Minnesota Department of Health (1977).

*Totals for Cloquet include Scanlon.

**Totals for Duluth include Herman Township, Proctor, and Rice Lake Township.

***Totals for Eveleth include Leonidas.

****Totals for Hibbing include Kelly Lake, Kerr Location, and Leetonia.

--No information.

Appendix 2. Wastewater disposal facilities in northeastern Minnesota. 1975.

| COUNTY | COMMUNITY | POPULATION (1975)* | YEAR CONSTRUCTION OF SANITARY SEWER SYSTEM COMMENCED | YEAR WASTEWATER TREATMENT WORKS CONSTRUCTED | TREATMENT |
|---|---|---|---|---|---|
| Carlton | Barnum | 358 | 1923 | 1963 | Activated sludge extended aeration, Final settling tank, Sludge storage tank for hauling by truck, Chlorination. |
| | Carlton | 939 | 1914 | 1955 | Primary settling, Chlorination, Digester, Open sludge bed. |
| | Cloquet | 11,296 | 1905 | 1957 | Grit chamber, Primary settling, Chlorination, Digester. |
| | Cromwell | 173 | 1952 | 1953 | Imhoff tank, Open sludge bed. |
| | Kettle River | 168 | 1951 | 1952 | Imhoff tank, Open sludge beds. |
| | Moose Lake | 1,371 | 1919 | 1966 | Stabilization Pond. |
| | Scanlon | 1,245 | 1941 | 1941,1953 | Imhoff tank, Open sludge beds, Chlorination. |
| | Thomson Township (Esko Corner) | N.A. | 1964 | 1964 | Cutting screen, Activated sludge extended aeration, Final settling, Activated sludge, Digester, Chlorination. |
| | Wrenshall | 163 | 1964 | 1964 | Stabilization Ponds. |
| Cook | Grand Marais | 1,420 | 1933 | 1940,1960,1975 | Primary Settling, Activated sludge complete mix, Final settling, Aerobic sludge digestion, Chlorination, Chemical treatment (removal of phosphates, BOD, and/or SS), Sludge hauling by tank truck. |
| Lake | Silver Bay | 3,429 | 1953 | 1953,1975 | Cutting screens, Grit chamber, Coarse screens, Primary settling, High-rate trickling filter, Final settling, Digester, Chlorination, Open sludge beds, Chemical treatment (removal of phosphate, BOD, and/or SS). |

Appendix 2. Wastewater disposal facilities in northeastern Minnesota. 1975. (contd.)

| COUNTY | COMMUNITY | POPULATION (1975)* | YEAR CONSTRUCTION OF SANITARY SEWER SYSTEM COMMENCED | YEAR WASTEWATER TREATMENT WORKS CONSTRUCTED | TREATMENT |
|---|---|---|---|---|---|
| Lake | Two Harbors | 4,465 | 1894 | 1959,1974 | Mechanical bar screens, Cutting screen, Activated sludge complete mix, Final settling, Aerobic sludge digestion, Mixed media gravity filters, Sludge storage tank, Sludge thickening, Vacuum filtration, Chemical treatment (removal of phosphates, BOD, and/or SS). |
| St. Louis | Aurora | 2,750 | 1936 | 1958 | Cutting screen, Primary settling tank, High-rate trickling filter, Final settling tank, Chlorination, Digester, Open sludge bed. |
| | Babbitt | 1,880 | 1953 | 1953 | Combination primary settling tank/sludge digestion, Activated sludge, Final settling tank, Chlorination, Open sludge bed. |
| | Biwabik | 1,483 | 1916 | 1966 | Stabilization Ponds. |
| | Breitung Township (Soudan) | N.A. | N.A. | 1946 | Imhoff tank, Low-rate trickling filter, Final settling, Chlorination, Open sludge beds. |
| | Buhl | 1,333 | 1909 | 1961 | Primary settling, High-rate trickling filter, Final settling, Chlorination, Digester, Open sludge bed. |
| | Chisholm | 6,074 | 1905 | 1955 | Grit chamber, Primary settling tank, High-rate trickling filter, Final settling, Chlorination, Digester, Open sludge bed. |
| | Cook | 696 | 1938 | 1964 | Cutting screen, Activated sludge extended aeration, Final settling, Chlorination, Sludge storage tank for hauling by truck. |

Appendix 2. Wastewater disposal facilities in northeastern Minnesota. 1975. (contd.)



| COUNTY | COMMUNITY | POPULATION (1975)* | YEAR CONSTRUCTION OF SANITARY SEWER SYSTEM COMMENCED | YEAR WASTEWATER TREATMENT WORKS CONSTRUCTED | TREATMENT |
|---|---|---|---|---|---|
| St. Louis | Duluth: | 93,971 | | | |
| | -Main Plant | | 1883 | 1940 | Grit chamber, Flocculation, Primary settling, Digester, Chlorination, Vacuum filtration, Incineration. |
| | -Fairmont Park | | 1883 | 1960 | Grit chamber, Pre-aeration, Primary settling, Sludge storage tank, Chlorination. |
| | -Gray-New Duluth | | | | Same as Fairmont Park |
| | -Smithville | | | | Same as Fairmont Park |
| | Ely | 4,931 | 1901 | 1954,1963,1972 | Cutting screens, Grit chamber, Coarse screens, Primary settling, High-rate trickling filter, Fine screens, Chlorination, Digester, Open sludge beds, Chemical treatment (removal of phosphates, BOD, and/or SS), Mixed media gravity filters, Sludge thickening. |
| | Eveleth: | 4,522 | | | |
| | -Main Plant | | 1900 | 1972 | Cutting screen, Grit chamber, Activated sludge complete mix, Final settling, Aerobic sludge digestion, Retention tank, Chemical treatment (removal of phosphates, BOD, and/or SS). |
| | -West Eveleth Plant | | N.A. | N.A. | Imhoff tank, Open sludge bed. |
| | Floodwood | 613 | 1941 | 1970 | Stabilization Ponds. |
| | Franklin | 36 | 1923 | N.A. | Virginia Sewer System. |

Appendix 2. Wastewater disposal facilities in northeastern Minnesota. 1975. (contd.)



| COUNTY | COMMUNITY | POPULATION (1975)* | YEAR CONSTRUCTION OF SANITARY SEWER SYSTEM COMMENCED | YEAR WASTEWATER TREATMENT WORKS CONSTRUCTED | TREATMENT |
|---|---|---|---|---|---|
| St. Louis | Gilbert | 2,553 | 1912 | 1957 | Grit chamber, Primary settling, High-rate trickling filter, Chlorination, Digester, Open sludge beds. |
| | Hermantown | 6,689 | 1970 | N.A. | Duluth Sewer System, Main Plant. |
| | Hibbing: | 16,123 | | | |
| | -North Plant | | 1900 | 1940,1972 | Cutting Screen, Grit chamber, Primary settling, High-rate trickling filter, Chlorination, Intermediate and final settling, Digester, Open sludge bed, Chemical treatment (removal of phosphates, BOD, and/or SS). |
| | -South Plant | | 1970 | 1970,1972 | Activated sludge complete mix, Aerobic sludge digestion, Final settling, Chlorination, Aerated Pond, Effluent polishing pond, Chemical treatment (removal of phosphates, BOD, and/or SS). |
| | Hoyt Lakes | 3,734 | 1954 | 1957 | Cutting screen, Primary settling, High-rate trickling filter, Final settling, Chlorination, Digester, Vacuum filtration. |
| | Iron Junction | 132 | Unknown | 1963 | Septic tank, Chlorination. |
| | Kinney | 446 | 1920 | 1920 | Imhoff tank, Open sludge beds. |
| | Leonidas | 154 | N.A. | 1935 | Imhoff tank, Open sludge beds. |
| | McKinley | 240 | 1920 | 1918 | Imhoff tank, Open sludge beds. |
| | Meadowlands | 153 | Unknown | 1964 | Stabilization Pond. |

Appendix 2. Wastewater disposal facilities in northeastern Minnesota. 1975. (contd.)

| COUNTY | COMMUNITY | POPULATION (1975)* | YEAR CONSTRUCTION OF SANITARY SEWER SYSTEM COMMENCED | YEAR WASTEWATER TREATMENT WORKS CONSTRUCTED | TREATMENT |
|---|---|---|---|---|---|
| St.Louis | Mountain Iron -Main Plant | 3,574 | 1920 | 1954 | Primary settling, High-rate trickling filter, Final settling, Open sludge beds. |
| | -Nichols Plant | | 1963 | 1964 | Stabilization Pond. |
| | Orr | 365 | 1949 | 1949,1965 | Imhoff tank, Low-rate truckling filter, Final settling, Chlorination. |
| | Proctor | 3,079 | 1911 | N.A. | Duluth Sewer System, Fairmont Park Plant. |
| | Stuntz Township (Kelly Lake) | N.A. | 1940 | 1940 | Imhoff tank, Low-rate trickling filter, Final settling, Chlorination, Open sludge beds. |
| | Tower | 713 | 1937 | 1959 | Imhoff tank, Low-rate trickling filter, Final settling, Chlorination, Open sludge beds. |
| | Virginia | 11,588 | 1907 | 1952, Under Construction | Mechanical bar screens, Grit chamber, Aeration, Activated Sludge, Final settling, Mixed media gravity filtration, Chlorination, Chemical treatment (removal of phosphates, BOD, and/or SS), Sludge thickening, Sludge lagoon. |
| | Winton | 269 | 1960 | 1961 | Activated sludge extended aeration, Final settling, Chlorination. |

SOURCE: Minnesota Pollution Control Agency (1975).
N.A. = Not available.
BOD = Biochemical oxygen demand.
SS = Suspended solids.

*Estimates of the United States Bureau of Census (1977).