

ALTERNATIVE WASTEWATER FACILITIES  
FOR  
SMALL UNSEWERED COMMUNITIES IN RURAL AMERICA

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SSWMP PUBLICATION #14.3

Small Scale Waste Management Project  
University of Wisconsin  
Madison, Wisconsin

July, 1976



## PREFACE

The accepted approach to abate water pollution problems resulting from inadequately treated sewage is to provide central sewerage with a common treatment facility. For small communities where homes are typically scattered, this is an impractical approach because of the high per capita costs involved to extend sewers to each home. Capital costs can reach \$8,000 per household for a central system. It is not unusual for the cost of the system to approach the total equalized value of the community.

To relieve this financial burden on communities, state and federal aid programs provide money for construction of pollution abatement projects. However, to distribute the limited funds available, a priority system is used which favors the larger municipalities because a greater cost/benefit ratio is realized. Though it is the small communities that are in greatest need of financial assistance because of the higher per capita costs, they must wait for construction grants which will not be available for many years. Thus, the citizens of regions without large urban centers and with dispersed industrial activity receive no direct benefit from their tax dollars and the pollution problem continues, often impeding or halting economic development and limiting effective land use planning in their area.

Because this is such a common problem throughout Michigan, Minnesota and Wisconsin, the Upper Great Lakes Regional Commission granted money to the Small Scale Waste Management Project through the University of Wisconsin-Extension in September 1974 to demonstrate a more cost-effective solution to water pollution abatement in small communities. The objectives of the project were to develop a wastewater facilities plan for a selected community by utilizing several small on-site treatment systems placed in strategic locations within the community but under central management to serve individual homes or clusters of homes where

appropriate, to compare total costs of the alternate plan to a conventional facility, to determine the best method for management of such alternate plans, and to investigate methods of financing construction.

The Sanitary District No. 1 of the Town of Westboro in Taylor County, Wisconsin, was selected for this study because it is typical of many small rural communities in the Midwest. Westboro is an older community of about 200 residences all served by private individual septic tank systems, many of which are failing. The public health hazard and stream pollution created by the failing systems led the Wisconsin Department of Natural Resources to order Westboro to stop all such discharges. Small lot sizes and unsuitable soils have prevented the community from replacing their septic tank systems and a plan for conventional central sewerage developed for Westboro is too costly to construct without substantial financial aid. The result is that the public health remains in danger and economic development is hampered. This situation occurs in many communities throughout the region.

#### ACKNOWLEDGEMENTS

The assistance given by Allen H. Lietzke, Taylor County Extension Resource Agent and Earl M. Kilby, Taylor County Zoning Administrator in coordinating activities between Westboro and the Small Scale Waste Management Project was essential to the success of this project. The active support given by Wayne T. Barbier, Westboro Sanitary District Chairman and Earl Thums, Westboro Town Chairman resulted in the ultimate acceptance of the proposed alternate plan by the residents of Westboro. The assistance of these people in many important phases of this project is sincerely appreciated.

Lester Forde, Research Assistant in the Department of Civil and Environmental Engineering, University of Wisconsin-Madison, was responsible for much of the preliminary design necessary to compare alternate plans. Much of his work appears in this report.

The expertise provided by others is also recognized. Carl C. Crane, Inc. employed as consulting engineers provided the technical assistance needed to complete the facilities plan. The Wisconsin Departments of Natural Resources and Health and Social Services, and the Northwest Wisconsin Regional Planning and Development Commission contributed technical, financing and planning advice.

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ALTERNATIVE WASTEWATER FACILITIES  
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Richard J. Otis and  
David E. Stewart<sup>1</sup>

INTRODUCTION

Status of Public Wastewater Facilities in Small Communities

Data from the 1970 Census indicates an estimated 19.5 million households in the United States or nearly 30 percent of all housing units are served by some form of private sewerage facilities (1). Approximately 85 percent of these homes utilize septic tank systems for their wastewater disposal. A large number of these systems fail to provide adequate treatment and disposal which allow raw or poorly treated sewage to reach the ground surface, surface body of water or even the groundwater.

Many of these households, while located in rural areas, are situated in small communities which are often unincorporated. These communities are typically a collection of scattered homes and shops ranging in population from a few households to a thousand or more. In such instances, failing septic tank systems create a severe public health hazard because of the close proximity of homes. Community facilities are often the only solution.

Assessment of wastewater facility needs of small rural communities is difficult because of the lack of information. The last known published status report is a survey conducted by the U.S. Department of Agriculture in 1962 (23). The results of the survey in Michigan, Minnesota, Wisconsin and the entire United States are presented in Table I. At the time of the survey, 88 percent of the communities

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in the three-state area with populations less than 1000 had no public facilities as compared to 14 percent for all communities with populations above 1000 people.

Since 1962, there have been several governmental programs initiated, namely the Federal Water Pollution Control Act (PL92-500) and various state programs, which attempt to abate water pollution by providing grants in aid for construction or upgrading community sewerage facilities. Consequently, the data presented in Table I needs to be updated. However, these figures do serve to indicate that few small communities have public wastewater facilities.

Table I. Number of Communities in Michigan, Minnesota and Wisconsin With and Without Public Sewerage Facilities in 1962 (23)

Size of Community Population	Michigan		Minnesota		Wisconsin		United States	
	With	Without	With	Without	With	Without	With	Without
26-999	25	1,262	183	772	181	884	3,803	42,837
1000-2499	91	70	124	12	121	15	3,079	1,391
2500-5500	69	13	58	-	56	3	2,027	349
Over 5500	107	2	68	-	66	7	2,926	142
Total	292	1,347	453	784	424	909	11,835	44,709

Certainly the need for improved facilities exists in many of these communities. The communities often were established long before sound design and installation criteria for septic tank systems were enforced. Some homeowners merely installed a pipe to discharge their wastewater into a ditch or stream away from the house. More conscientious homeowners installed septic tank systems, but without good design criteria and proper maintenance, many of these systems have failed. Nuisance and public health hazards result, often impeding or halting economic development.

### Central Sewerage as the Preferred Community Facility

The traditional method of providing public wastewater facilities is to construct a system of gravity collection sewers which convey all the wastewaters to a single community treatment plant. This "central" system is favored by governmental authorities for all communities regardless of size when approving proposed wastewater facilities or regulating construction funding.

There are probably several reasons for this preference. First, the gravity sewer system is tried and proven. There is much technical expertise in the theory, design and operation of central systems. Regulatory agencies have great confidence in this system. Second, central sewerage is usually more cost effective because of economies of scale. Third, central sewerage allows ready application of central (and usually public) management which is responsible for the proper functioning of the system. The availability of a single entity to manage the system is quite desirable from a regulatory authority's viewpoint because the authorities have an entity against whom they can bring administrative or judicial action to abate water pollution problems.

It is this surety-potential defendant role that makes central sewerage so appealing to most governmental authorities. In contrast, the typical private sewage disposal facility such as a septic tank system is managed by the individual owner. The limited value of assurances given by individual owners and the distaste on the part of many regulatory officials to bring actions against individuals makes central management all the more desirable. This desirability increases when one considers that if action must be brought against a small community using individual systems to abate a water pollution problem there would be a multitude of entities (owners) to deal with compared to one central entity if central sewerage were used instead.

### Disadvantages of Central Sewerage for Small Communities

For smaller communities, however, such a conventional collection and treatment facility is impractical because of the financial burden it places on the residents. This is largely due to the high cost of collecting wastewater from scattered homes and businesses. Smith and Eilers (21) computed the 1968 national average of total annual costs of municipal wastewater collection and treatment facilities which showed that 65 percent of the total annual cost is for amortization and maintenance of the collection system. A more recent study by Sloggett and Badger (20) of 16 small communities in Oklahoma showed a similar distribution. (See Table II) It is clear from this breakdown of the total annual costs that the collection system is the most expensive component of any system.

As the number and density of customers declines the costs per customer rise. In their study of 16 wastewater collection and treatment systems in Oklahoma Sloggett and Badger (20) compared construction costs per customer to density and number of customers served. (See Tables III and IV) Both factors were shown to have a significant effect but the density of customers was shown to have the largest impact on per capita construction costs.

Table II: Distribution of Total Annual Costs for Municipal Wastewater Collection and Treatment Facilities

	<u>Amortization Cost</u>		<u>Current Expenses</u>			<u>Total</u>
	<u>Collection</u>	<u>Treatment</u>	<u>Operation and Maintenance</u>		<u>Overhead</u>	
			<u>Collection</u>	<u>Treatment</u>		
Smith & Eilers (21) (1968)	60.3%	15.3%	4.7%	8.4%	11.3%	100.0%
Sloggett & Badger (20)	--	72.6%	--	14.2%	3.2% (lagoons)	100.0%

Table III: Cost of Construction per Customer Relative to Density of Customers for 16 Community Wastewater Facilities in Oklahoma (20)

	<u>Customers per Mile of Sewer</u>			
	Under 30	30-39	40-49	Over 50
Number of Systems	5	5	1	5
Average Cost/Customer (1972 dollars)	\$1,100	\$847	\$696	\$575
Average Number of Customers	96	119	310	256

Table IV: Cost of Construction per Customer Relative to Number of Customers for 16 Community Wastewater Facilities in Oklahoma (20)

	<u>Number of Customers Served</u>			
	Under 100	100-199	200-299	300-400
Number of Systems	6	4	3	3
Average Cost/Customer (1972 dollars)	\$1,000	\$798	\$594	\$434
Customers/Mile of Sewer	28.3	37.8	49.4	55.2

Sloggett and Badger (20) made similar comparisons using the total annual costs. They found both number and density of customers to be significant. (See Table V) In 1972, average annual costs per customer ranged from \$76.90 to \$43.36 for communities with populations less than 100 and 300-400 respectively. The national average for all municipalities was \$19.80 in 1968 (21).

Table V: Total Average Annual Cost per Customer for 16 Community Wastewater Facilities in Oklahoma (20)

No. of Customers	<u>Total Average Annual Cost (1972 dollars)</u>		
	0% Construction Grant	75% Construction Grant	100% Construction Grant
Under 100	\$76.90	\$33.06	\$18.44
100-199	57.55	25.39	14.63
200-299	52.10	24.09	14.75
300-400	43.36	20.72	13.17

These figures point out the problem small communities have in providing public wastewater facilities. Homes are typically scattered which cause construction costs of conventional sewerage to soar. Costs can reach \$8000 per household for the capital portion alone and may be even higher if treatment beyond secondary is required to meet water quality standards. It is not unusual for the cost of the system to approach the total equalized value of the community (15).

Because of the prohibitive costs of extending sewers, outlying members of the community may not be served. In 30 percent of the communities with public facilities surveyed in 1962 by the U.S. Department of Agriculture (23) at least one-third of the residences were not accommodated. In small communities this number would be much higher. Thus, central sewerage often does not abate the pollution problems as intended.

To help communities meet the water quality goals of the Federal Water Pollution Control Act Amendments of 1972, the federal government is authorized by a provision in the Act to provide grants in aid of construction for 75% of the grant eligible portions of the wastewater facility. The availability of these grants would help offset the high per capita costs in small communities but, unfortunately, small communities have difficulty in obtaining them.

The federal funds are allocated to the individual states on the basis of need, but each state is given the power to determine how the funds are to be spent. Only minimum requirements are set out by the Act for states to follow in preparing a priority list of projects. For example, the Act requires that consideration be given to the severity of the pollution problem, the population affected, the need for preservation of high quality waters and national priorities. The federal regulations seem to give the states some discretion by not requiring strict adherence to their rankings of pollution discharges. Thus, the priority lists usually work to the disadvantage of small communities in that many of them are near the bottom

preceded by communities with larger populations and larger pollution discharges. This emphasis denies small communities any expectation of receiving badly needed funding for public facilities in the near future.

It is obvious from this discussion that it is impractical to expect many small communities to construct conventional public wastewater facilities. However, they should not, nor will they, be exempt from complying with the established water quality standards. Thus, a need exists for a viable alternative to conventional sewerage which will be more cost effective in small rural communities.

#### NON-CENTRAL FACILITIES AS AN ALTERNATIVE

In small communities, a "non-central" facility of several treatment and disposal systems serving isolated individual residences or clusters of residences may offer a less costly alternative to the conventional central facility. As Table II indicates approximately two-thirds of the total annual cost of a conventional facility is due to the collection system. In a community of scattered homes this proportionate cost could be even higher. If the central treatment plant could be eliminated, long sewer extensions collecting wastes from widely spaced homes would not be necessary. Instead, treatment and disposal could be provided where the wastes are generated. Individual or jointly used septic tank systems or other treatment and disposal methods could be used. Such a non-central facility of disperse systems could result in a substantial savings.

The implementation of a non-central facility would not exclude the use of central management which is an extremely attractive factor of conventional community facilities. Though a relatively untried concept, central management of a non-central facility could be employed. In fact, central management may be crucial to its effectiveness.

### Advantages of Non-Central Facilities

The non-central facility offers several advantages over the central sewerage approach:

1. Existing functional septic tank-soil absorption systems can be utilized rather than providing new service. Often, homeowners who are not having trouble or who have recently installed new septic tank systems do not wish to support community action that will cost them more money unnecessarily. Utilizing existing systems minimizes this opposition, as well as reduces the total cost of the community facility.
2. Isolated single homes and clusters of homes can be served individually instead of extending costly sewer lines out to them.
3. Less costly treatment facilities can usually be constructed because of the smaller flows which are collected from limited areas. Excess capacity for anticipated growth need not be built. Instead, facilities are expanded only as needed by constructing new systems in areas of desired growth. In addition, subsurface disposal can often be employed which requires minimal treatment and avoids the necessity of upgrading the treatment plant to meet changing standards for effluent discharges to surface waters.
4. A more cost-effective facility may encourage smaller communities to proceed with construction rather than waiting for federal construction grants. This would speed abatement of water pollution problems. It would also increase the number of community facilities which could receive financial aids because of the fewer dollars required for each project.
5. More rational planning of community growth is possible. Strip growth, which is encouraged by the construction of interceptor sewers used to collect wastes from isolated clusters of homes could be avoided. The community can encourage growth in the more desirable areas by providing public service in those areas only.



6. Non-central facilities are more ecologically sound since the disperse systems dispose of the wastes over wider areas. Through this practice the environment is able to assimilate the waste discharge more readily, which reduces the need for mechanical treatment and the associated energy consumption.

#### Disadvantages of Non-Central Facilities

Of course, there are disadvantages to non-central facilities which must be overcome if this alternative is to be successful:

1. Central management of a facility of small disperse systems is a fairly new and untried concept. Methods of public ownership of systems on private land, necessary for proper operation and maintenance must be tested. Operation and maintenance costs also may be higher than for conventional facilities. Due to the lack of experience, other problems will arise, which may not be anticipated.
2. Public confidence in small systems, particularly septic tank systems, is low and, therefore, a non-central facility may be unacceptable. Failure of a conventional treatment plant is easy to accept since it is usually a safe distance from any homes. However, if failure of a treatment and disposal system within a non-central facility occurs, repairs must be made immediately.
3. Provision for the community's future growth is more difficult. A small reserve capacity can be built into each system which serves an area with some undeveloped lots, but if a landowner wishes to build where public service is not yet available, a decision must be made as to whether service should be provided. Since providing public service to single homes one at a time can be costly, a choice must be made between constructing individual systems or a larger joint system to handle anticipated growth in that area.
4. By present guidelines many components of a non-central facility may not be eligible for grants in aid of construction, which are available through various

federal and state financial aid programs. This would have the effect of increasing the cost to each customer served in comparison to central sewerage, even though the total costs may be less. However, guidelines may change if such a facility is proven successful.

In general, the advantages of non-central facilities seem to outweigh the disadvantages. Many of the objections to this alternate facility may vanish as some are constructed and experience gained.

#### COLLECTION AND TREATMENT ALTERNATIVES FOR NON-CENTRAL SYSTEMS

Proper facilities planning involves a systematic comparison of alternative methods of dealing with a wastewater treatment and disposal problem. The purpose of this comparison is to identify the most "cost-effective" solution which will minimize total costs to society over time. These costs include monetary and environmental, as well as other non-monetary costs.

The commitment by regulatory agencies and engineers to conventional gravity sewers with a common central treatment plant, however, has eliminated many worthy alternatives from consideration. The single most expensive portion of central sewerage is the gravity collection system, yet alternatives to it are rarely evaluated. Concentrating all the wastes at one treatment plant limits the number of alternatives further because high degrees of treatment are necessary for the environment to assimilate the pollutants in a smaller area. Thus, utilization of the non-central concept has the potential of significantly reducing the total costs of wastewater facilities in many communities by reducing the size or eliminating the collection system and lowering the cost of treatment.

The most extreme non-central system would be one where each home and other establishment were served by its own individual septic tank system. Unfortunately, septic tank systems are nearly always considered as only an interim method of sewage handling until sewers are available (11). The reason for this is because they are

poorly understood and therefore, improperly designed, installed and maintained. This has led to many failures creating a lack of confidence in the system.

The Small Scale Waste Management Project, however, has developed practical design criteria and installation procedures for soil absorption systems (4, 26). If these criteria are followed the septic tank systems can be expected to last 20 years or more under most soil conditions. Thus, septic tank-soil absorption systems should be seriously considered as an alternative.

Of course, the most cost-effective community system will usually lie somewhere between the two extremes of central sewerage and individual systems. Either because of economies of scale or because site conditions are unfavorable for individual disposal systems, joint systems serving several homes may be constructed. The end result may be a mix of several individual and joint systems.

#### Collection Alternatives

Small Diameter Gravity Sewers: To take advantage of economies of scale or to avoid adverse sites, a nearby area might be available for construction of a joint system. Gravity or conventional sewers can be used to collect and convey the wastes to the disposal site. To reduce the costs of gravity sewers, small diameter (4-inch) pipes offer an alternative if septic tank effluents rather than raw wastes are collected. The collection mains are joined by a typical gravity house connection coming from a septic tank or, in those instances where the elevation of a property would make it difficult to be served by a gravity system, without a large cut, the building would be provided with a pump located in a chamber immediately following the septic tank to elevate the effluent in to the system.

The individual septic tanks would provide non-central wastewater treatment by removing the larger solids from the waste. Therefore, very few solids would be transported in the mains allowing the use of smaller diameter pipe. Since cleaning

equipment is not available for pipes smaller than 4-inches in diameter, this is the smallest pipe that should be used. Since sand and other grit also would be removed in the septic tank, normal cleansing velocities need not be maintained, so the pipe can be laid at a lesser grade. The 4-inch diameter mains would be installed at a minimum gradient of 0.67 percent, based on a minimum velocity of 1.5 feet per second at half pipe capacity (22). Regular flushing to provide cleansing velocities (greater than 2.5 feet per second) can be provided if necessary by collecting and pumping the effluent from several homes at the upstream end of each main for periodic surcharging.

This type of collection system has been used extensively in South Australia without surcharging since 1962 with very good results. The pipe is sized assuming a flow rate at 1/2 pipe capacity, on a gradient of 0.67 percent of 1.5 fps (22). Under these conditions a 4-inch diameter pipe can carry over 2000 gph. Assuming a peak flow of 3 gph per person, the pipe can serve 670 persons.

Pressure Sewers: Where topography or soil conditions make gravity sewers costly, pressure sewers may be more economical. Pressure sewers have been tried in several places and have performed favorably (6, 7, 8). This system consists of a septic tank at each building or cluster of buildings, which collects and treats wastewater, a pump chamber with a submersible pump which receives the treated effluent from the septic tank and pumps it to a small diameter plastic main which has pressure-sustaining valves to insure that the main stays full at all times. Costs are reduced for pressure sewers because the depth of cut is kept to a minimum with the main being located just below the frost line and following the contour of the land.

Pressure sewers are sized by selecting a peak design flow from hydraulic tables based on the number of dwellings to be served. With the buildings plotted on a profile at their exact location and elevation, hydraulic grade lines for selected design flows are drawn, starting at the discharge end of the sewer. The discharge head required for each pump unit is the difference between elevation of the pump and the

hydraulic grade line for the chosen main. The costs of providing larger mains are compared to the costs of providing larger pumps. In general it is cheaper to provide a larger size main than a larger pump (6).

Flexibility for growth is good since the smallest pipe size used can accommodate up to 20 homes before a larger main is necessary. Further pipe size increases are necessary only by 30 dwelling increments (6). Such a system can easily be designed to handle nominal growth.

#### Treatment and Disposal Alternatives

Various low-cost methods of effluent treatment and disposal can be used for small community systems. Where soils are suitable, subsurface soil absorption fields or mound systems can be used. If the site is unsuitable for either of these, intermittent sand filters can be used with the effluent being disinfected prior to discharge to surface waters.

Soil Absorption: A conventional sub-surface soil absorption field is sized based on the estimated daily peak flow to be handled and the measured hydraulic conductivity of the soil in which it is to be constructed (4). Experience has indicated that a longer service life can be realized if the infiltrative surface of the soil is loaded uniformly and rested periodically. Uniform application can be provided by pressure distribution networks. To accommodate resting, additional fields should be constructed to provide at least 1.5 times the necessary estimated area. This allows for one or more fields to be "resting" while also serving as standby units in the event of an emergency or community growth.

The mound system was developed for use in some soils unsuitable for conventional absorption fields. This system is sized according to the guidelines outlined by SSWMP in the "Alternate Sewage Manual" published by the Wisconsin Department of Health and Social Services (26). The effluent is also uniformly distributed by pressure distribution networks. Standby units should also be provided.

Sand Filters: The intermittent sand filter is used where a site is unsuitable for sub-surface disposal. It consists of a concrete structure containing sand 2 to 3 feet deep over underdrains. The effluent is applied by flooding the sand surface at regular intervals. The filter media should be concrete or torpedo sand (effective size 0.2-0.3 with a uniformity coefficient of approximately 3.0). Sand filters loaded with septic effluent at rates of 5 gpd/ft<sup>2</sup> have been shown to produce effluents with less than 10 mg/l BOD<sub>5</sub> and TSS if regular maintenance is provided (18). Access to the sand surface is provided by removable insulated covers. Disinfection would be necessary following the filters prior to discharge.

It may be that after consideration of these and other alternatives central sewerage is the best solution. Generally speaking, however, most small communities can make use of one or a combination of alternative systems to achieve a more cost effective sewage handling facility.

#### PREVIOUS CASE STUDIES

Two studies have pointed out the savings that can be made by a non-central facility. One prepared by an engineering firm compared the costs per connection for a conventional system and individual septic tank systems (19). Assuming an 80 percent funding level for eligible costs of collection, transport and treatment (75 percent federal funds, 5 percent state funds), a total yearly cost of \$259 per connection for the community facility was estimated. This compares with a total yearly cost of \$244 per connection for individual septic tank systems. The individual systems were assumed to be entirely financed by the homeowner with no grants in aid. This simple analysis also assumes every lot has soils suitable for installation of a conventional septic tank system. This condition is doubtful, but the figures do indicate the large savings that can be made if central management of individual systems would qualify for construction grants. The engineers concluded, however, that

given the current funding levels that ". . . municipalities are better advised to construct collection, transport and treatment facilities than to *attempt to rely on individual systems*" (emphasis added) (19). This decision was clearly influenced by a general lack of confidence in septic tank systems rather than on economics alone.

The second study is more in depth comparing costs between several alternatives. It is supported by funds from the Wisconsin Department of Natural Resources through the Northwest Wisconsin Regional Planning and Development Commission to determine if more cost effective alternatives to central sewerage for small communities exist (2). A small lakeshore recreational community was chosen for this study. The alternatives considered for collection included conventional 8-inch minimum gravity sewers, 4-inch gravity sewers collecting septic tank effluent, pressure sewers, vacuum sewers, and holding tanks. Treatment and disposal alternatives considered included a central septic tank-soil absorption field, central soil absorption field (individual septic tanks), stabilization lagoon, and a physical-chemical package plant for treatment. The system would serve 62 seasonal residential units and 8 permanent residential units. No individual septic tank systems were considered. The cheapest alternative was found to be pressure sewer collection to a central septic tank-soil absorption field. A complete cost comparison is given in Table VI.

Both studies show the traditional commitment to central systems, even though non-conventional alternatives are considered. In the first, publicly owned conventional central sewerage was compared to individually owned septic tank systems. The second study only considered a publicly owned central system. In both cases the more cost-effective facility might rather be a mix of individual and joint systems all under public ownership. Public ownership would make many components of each system within the facility eligible for construction grants and provide proper and reliable maintenance needed for long life systems. It is this concept of public ownership and management that may be the greatest deterrent to the consideration of a mix of systems because it is relatively new and untried.

TABLE VI.

NORTHWOODS BEACH PROGRESS REPORT  
MARCH 19, 1976

Present Worth Comparison of Innovative Wastewater  
Collection & Treatment Facilities

All Costs Are Present Worth Values x \$1,000

TREATMENT ALTERNATIVES

Physical-Chemical Package Infil.-Perc. Basin	Stabilization Pond Infil.-Perc. Basin	Ind. Septic Tank Cent. S.A.F.	Central Imhoff Tank and Soil Absorption Field	Central Septic Tank and Soil Absorption Field
\$318.4	\$184.1	\$223.6	\$195.2	\$164.4

TRANSMISSION ALTERNATIVES

Hauling	L.S. 4" FM	L.S. 3" FM	L.S. 4" FM	L.S. 2" FM	Hauling	Discharge Pump	Grinder Pump	L.S. 4" FM	Hauling	Discharge Pump	Grinder Pump	L.S. 4" FM
\$189.4	\$161.2	\$153.9	\$161.2	\$84.8	\$181.9	\$29.8	\$12.3	\$82.9	\$181.9	\$29.8	\$12.3	\$82.9

COLLECTION ALTERNATIVES

Holding	Vac. Pump	Grinder Pump	Grav. 8"	Grav. 4"	Holding	Vac. Pump	Grinder Pump	Grav. 8"
\$287.0	\$401.1	\$269.6	\$245.4	\$194.7	\$287.0	\$401.1	\$269.6	\$245.4

TOTAL PRESENT WORTH OF ALTERNATIVES

\$794.8	\$880.7	\$741.7	\$725.0	\$503.1	\$664.1	\$626.1	\$477.1	\$523.5	\$632.7	\$594.7	\$445.7	\$492.1
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## MANAGEMENT ALTERNATIVES FOR NON-CENTRAL SYSTEMS

Though relatively untried, the use of individual or several jointly used on-site treatment and disposal systems does not exclude the use of central management. There are several methods of exerting public (or in some cases private) central management over such facilities. The powers needed by entity to properly manage a non-central facility are similar to those powers needed to manage a conventional community system. Some of the methods have been successfully applied in various locations in the United States.

### Powers Needed by a Management Entity

Necessary Powers: Any management entity which endeavors to effectively administer on-site wastewater disposal systems must have the power and authority to perform vital functions. The entity should be able to:

1. Own, operate, manage and maintain all wastewater systems within its jurisdiction. The entity must be empowered to acquire by purchase, gift, grant, lease or rent both real and personal property. It must also have the authority to plan, design, construct, inspect, operate and maintain all types of on-site systems whether the system is a typical individual septic tank system or a more complex system serving a group of residences. The entity should have at least these "ownership and operation" powers within its boundaries but it should not be limited to providing services only within its boundaries. The entity may be given extra territorial jurisdictional authority to operate, maintain and perhaps own such systems outside of the entities boundaries by state statute, by case law, or as terms under a contract.
2. Enter into contracts, to undertake debt obligations either by borrowing and/or by issuing bonds and to sue and be sued. These powers are more than mere legal niceties because without them the entity would not be able to acquire the property,

equipment and supplies and services necessary to construct or operate the individual or jointly used on-site systems.

3. Raise revenue by fixing and collecting user charges and levying special assessments and taxes. The power to tax is limited to various public or quasi-public management entities. In lieu of taxing powers, the non-government management entities must have the authority implied or directly granted to set and charge user fees to cover administrative costs.

4. Plan and control how and at what time wastewater facilities will be extended to those within its jurisdiction.

Additional Desirable Powers of a Management Entity:

Though not necessary to provide adequate management of a non-central facility, two additional powers are desirable. These are that the entity be able to:

1. Make rules and regulations regarding the use of on-site systems and provide for their enforcement through express statutory authorization. To promote good public sanitation, the entity should be empowered to require the abatement of malfunctioning systems and to require the replacement of all such systems, all according to the plans of the entity. This power, however, may already be inferred from the statutory authorization to operate a system.
2. Meet the eligibility requirements for both loans and grants in aid of construction from both the federal and state governments. While it is obvious that a management entity can function without being eligible for these loans and grants, the viability of the "non-central" system is strengthened when grant money is used to offset some or most of the costs to the families served by the entity. This is especially true considering that low income rural families typically can ill-afford to finance the entire cost of their sewerage system. Experience has shown that low-income families cannot pay wastewater bills in excess of \$7.00 per month or a combined water-sewage bill of \$14.00 per month (9). This rate is difficult to reach without benefit of

public subsidy. The inequity should be especially obvious to most non-rural residents who typically pay considerably less than this amount.

#### Types of Acceptable Management Entities

The types of entities which could manage a non-central facility vary from state to state. The various state constitutions, state statutes, administrative agency rules and regulations must be examined on a state by state basis, to determine which types of entities are authorized to manage on-site systems. In addition, the case law (essentially interpretations of state laws made by the courts) must be checked to determine if the courts have construed the constitution, statutes or regulations to give or remove the authority to manage such a system from a possible entity.

No such exhaustive study of all state constitutions, statutes, regulations and case laws is known, though an attempt to determine the authorization on a state by state basis was compiled on the basis of responses to a survey questionnaire in Guide to State and Federal Policies and Practices in Rural Water-Sewer Development (10). The following listing consists solely of a general discussion of various entities with no attempt made to identify which entities are permitted in each state. The entities may be enumerated as follows:

(1) Municipalities. While this term has many and various legal definitions, it is used here to include only incorporated cities and villages. The municipal charter granted to the city or village must authorize the administration of water and sewer services as a permissible governmental activity. In addition, most states provide this same authorization to cities and villages in the state statutes dealing with municipal law. Generally, these statutory provisions detail the procedures to be followed in supplying these services. Thus, both the municipal charter and any and all applicable municipal law statutory language must be checked to determine the extent of this entity's authority to own and operate non-central systems. However,

this entity is clearly most frequently used for this purpose.

(2) Counties and Townships. While the general authority of counties in the U.S. ranges from just a boundary drawn on a map to complete home rule powers bordering on that of a sovereign, the county may be empowered to own and operate the non-central system. The authority of both the counties and townships is set out in each state's statutes and laws which must be reviewed to determine whether either has been granted sufficient authority.

(3) Special Districts. There are many special purpose districts which are given the requisite authority to properly perform as central management entities. These districts are quasi-governmental in nature with their authority generally set out in the state statutes or state laws. Because the district is often included in the statutory definition of "municipality," however, the authority of such a district is expanded and hence it is necessary to examine the state's statutes on municipal law to determine the real extent of the district's power.

Single purpose special districts established for the purpose of dealing with public sanitation will typically have sufficient authority to manage non-central systems. Multi-purpose districts which have a primary purpose other than public sanitation might also have sufficient authority. While districts may have many different names, e.g., sanitation district, service district, sanitary district, etc., the authority of the district is determined by the underlying statutory language and not its name.

(4) Private Non-Profit Corporations. Privately owned non-profit entities must be incorporated as non-profit corporations in the state in which they seek to perform management functions. Depending on the laws of the individual state and the services to be provided, these corporations may be considered to be public utilities, and as such would have to comply with the laws and regulations of the state's public service or public utility commission. The authority of this type of entity

would be contained in its charter of incorporation and in the applicable public utility law of the particular state.

(5) Rural Electric Cooperatives. In some states REA co-ops are authorized to perform the functions necessary for proper administration of non-central systems. The authority of these co-ops is contained, in part, in each state's statutes.

(6) Private Profit-Making Businesses. Profit oriented entities may consist of a business incorporated to supply sanitation services or a partnership or a sole proprietorship. Regardless of the type of business, the state public service or public utility commission would usually regulate it. The authority of the private profit business is limited by any public utility laws or applicable regulations of the commission.

(7) Others. There are a few other types of entities which might be authorized in some states to own and operate non-central systems. For example, systems installed on Native American reservations would probably not fall within any of the six types of entities listed above but, instead, would be controlled by the U.S. Public Health Service. Further, some states such as Wisconsin have a strong history of cooperatives and it appears that Wisconsin law would possibly permit a co-op (other than a REA) to function as a management entity.

#### Examples of Central Management of Non-Central Systems

The following list of examples of the use of central management entities to administer non-central systems is not exhaustive, but is instead simply intended to be illustrative of the state of the art in central management. In at least half of these examples, the management entity is public or quasi-public; however, few of these entities both own and operate each system of the facility.

The case histories are drawn from California and those project areas affiliated with the National Demonstration Water Project (NDWP). The reason that California

is in the vanguard of the movement away from conventional central systems to centrally managed non-central systems to serve rural or disperse areas, is due, in part, to the efforts of Dr. John T. Winneberger, a septic tank consultant. Dr. Winneberger is a strong advocate of the septic system as an alternative to the sewered conventional sewage treatment plant, and for the past few years has proselytized California officials to the district or public management approach to non-central systems (25).

The NDWP rivals Dr. Winneberger's fervor in recognizing the centrally managed non-central systems as the preferred alternative to the typically more costly central system in rural or diffuse areas. The NDWP program developmental activities were originally funded by the Office of Economic Opportunities to establish a method of rural water development. The method developed consists of central management of a non-central system of individual wells and wells serving clusters of residences for a community water supply. Since the original development of rural water systems, the NDWP has expanded its concern to the development of a method of rural wastewater treatment and disposal. Essentially, the method consists of the same central management of non-central systems. However, the NDWP has, in general, shown some hesitancy to rely on public central management entities; instead, it espouses the use of private entities, especially non-profit corporations.

The examples of central management of non-central systems are as follows:

(1) California

- (a) Santa Cruz County Septic Tank Maintenance District. The primary function of this entity, as the name implies, is the inspection and pumping of all septic tanks within the district. The district is empowered to establish and collect a monthly charge or to obtain payment through taxes. Provision is made that the individual system owner will bear the cost of "exceptional" pumping (defined as more than one pumping in any consecutive 3 year period), as well as the

cost of repairing or replacing a poorly functioning system. To provide this service the county board of supervisors is required to contract out the inspection and pumping services.

This district is not given the authority to own systems and, it does not perform soil studies of individual sites, nor offer individual designs. Without actual ownership of the systems, the district is ineligible for most construction grants or loans. Also, by not providing individual site evaluation and system design, the district loses control over the effectiveness and reliability of the systems it seeks to maintain, since this burden falls upon the county health department. In these respects, this district is somewhat limited.

(b) Georgetown Divide Public Utility District (GDPUD). This district is located in El Dorado County, California. It employs one full time environmentalist. By legal arrangements through the formation of a special sewer improvement district within the GDPUD, the Auburn Lake Trails subdivision is receiving central management services from the GDPUD. The district's environmentalist is authorized to:

1. Perform feasibility studies on lots within the subdivision to evaluate the potential for the use of individual on-site systems;
2. Design specific kinds of on-site systems to serve the individual sites;
3. Monitor the installation of all systems within the subdivision;
4. Inspect and maintain the systems after installation; and
5. Monitor water quality to determine the effect of the individual systems upon water leaving the subdivision.

This district also may require the installation of public sewers

when and where necessary. Currently, one area of the subdivision is already sewered. More sewers may be required but the build out rate of this recreational subdivision is about 3 percent/year; thus, the need for additional sewers will be determined sometime in the future.

The functions performed by this district border on almost complete central management of non-central systems. The only limitation appears to be the fact that the district does not own the individual systems.

- (c) Bolinas Community Public Utility District (BCPUD). This district recently constructed a conventional sewer system to collect and treat the wastewater from the more populous area of Bolinas while individual systems are used in the less densely populated areas. The district has performed several management functions such as surveying all existing systems within the district, establishing design requirements and has proposed to monitor the construction of all systems, maintain the systems and monitor water quality in the district's watershed. Further, in an effort to preserve and protect the effectiveness of the area for individual soil disposal systems, the district has proposed to require permits for excavation, filling or grading within the district.

There has been a legal question involving the effect of overlapping county (Marin) and district jurisdiction in the area of individual on-site systems, however. Lack of resolution of this question has impeded this district in the management of individual on-site systems. However, it is anticipated that this district will approach the GDPUD in the degree of central management of individual systems, lacking only ownership of the systems themselves.



(2) National Demonstration Water Projects

(a) Guyandotte Water and Sewer Development Association (GWSDA).

This program, located in Logan County, West Virginia, involves several discrete individual projects. The first project planned is to supply both water and sewer service to 250 families in Big Creek. The wastewater treatment system, as proposed, does not contemplate the use of individual systems but will use a combination of gravity and pressure lines and a single central treatment facility. While this would appear to be a central system the necessity of a pump at each residence or group of residences served by the pressure sewers tends to put this facility under the rubric of non-central facilities. Ownership, maintenance and operation of these pumps located at individual residences, is best handled by a central management entity making it similar to individual on-site systems.

The entity used to manage the facility at Big Creek is a public service district as provided for by West Virginia law. Other public service districts have been approved for additional projects in the Guyandotte area with the GWSDA Association contracting to provide operation and maintenance services to each of the public service districts. It is this central management provision for operation and maintenance that makes this program of such interest. In effect, what is proposed is the provision of central management services to a group of discrete, separate central systems.

(b) Lee County Cooperative Clinic. This program is administered by a rural health facility. There are 4 development areas in the current plan. The Poplar Grove area is a community which is experiencing a severe health problem due to septic tank failures. A sewer improvement

district, a public central management entity, has been formed to administer the Poplar Grove project. At this time, the improvement district hopes to qualify for an EPA grant in aid of construction as the district plans to construct a conventional system. Again, despite the fact that the program proposes to use a central system, it is still of interest since the Lee County Co-op apparently will provide central management services to several discrete, separate albeit conventional central systems.

- (c) Cooperatives Water and Sewer Association (CWSA). This association consists of a partnership of 4 rural electric cooperatives which serve 18 counties in the northwest Florida panhandle. A recent amendment to the Florida statutes permits these co-ops to own and operate both water and sanitary sewer systems. The advantages of extending the vast experience of the co-ops in the field of rural electrification to managing water and sewer systems is obvious. For example, they already have the managerial talent to bill for services and supply operation and maintenance services so, in most cases, the addition of these other utilities to their basic responsibility of supplying electricity would be the most cost-effective method of providing water and sewer services to the rural areas.

As noted in a previous section, rural electric cooperatives might not have the authority to perform the necessary management functions. The state law in the state in question must be examined. This CWSA program certainly warrants further attention due to the natural meld of sewer and water supply with the existing co-ops.

If a municipality is given statutory power to construct sewers, this authority is generally viewed as a grant of power to adopt plans, to acquire land and easements and to perform other functions necessary for implementation of its basic authority to construct sewers. Also, the right to use the public facility is typically subject to reasonable regulation by the municipality. Connections to the public sewer often can be required by the municipal regulatory authorities.

Special purpose agencies or districts are generally regarded as a governmental corporation of limited power similar to a municipal corporation (1). The powers of these districts, however, are determined by the terms of the statutes under which it is organized. They do not have the broad general authority of a municipal corporation. Usually the districts have no authority that has not been specifically granted, but they are authorized to sue and be sued, to enter into contracts, to borrow money and issue bonds, to levy special assessments and to exercise the power of eminent domain (1).

A more complete discussion of the statutory authority that each of these entities has in Michigan, Minnesota and Wisconsin is given in Appendix A.

#### DEMONSTRATION OF A NON-CENTRAL WASTEWATER FACILITY FOR WESTBORO, WISCONSIN

To determine if a non-central wastewater facility could significantly reduce the total annual costs from those of a conventional central facility, a small community was sought for a demonstration study. The unincorporated community of Westboro in Taylor County Wisconsin was selected because it is typical of hundreds of small rural communities in the Midwest that are in need of improved wastewater treatment and disposal facilities but are unable to afford conventional sewerage.

Possible Management Entities Available in Michigan, Minnesota and Wisconsin

The authority to manage public wastewater facilities may be exercised directly by the state without calling on any of its subordinate agencies of government. However, the state may delegate this authority to one or more of its political subdivisions (municipalities) or to special agencies (districts) created for the purpose of dealing with sewerage. Statutes permitting such delegation of authority have frequently been upheld and are not usually an unconstitutional delegation of the legislature's power (1).

The entities most likely to be used in Michigan, Minnesota and Wisconsin for management of non-central systems are (1) incorporated cities and villages, (2) unincorporated units of local government, i.e., townships and counties, and (3) special purpose districts. Each of these entities have adequate authority to effectively manage a non-central system in any of the three states; however, the special purpose district would probably be the preferred entity.

Clearly, one function of any municipal corporation (a term typically meaning cities and villages but probably including counties and sometimes towns as quasi-municipal corporations) is the construction and maintenance of sewers. (Note that much of the statutory language uses the generic term "sewers" but in almost all states the courts have construed sewers to encompass the treatment and disposal facilities as well.) Statutory authority to construct a public sewer does not generally require that the sewer be available to the entire municipality. Nor does the mere fact that the facility is publicly owned waive the limitations imposed by the constitution or other statutory language. For example, the municipal corporation has no right to locate sewers on private property unless that right is obtained by contract or by the use of its granted power of eminent domain. This authority to enter into such contracts or to use condemnation must be granted by direct authorization or implication, however.

### Description of Westboro

Westboro is located in Taylor County, Wisconsin within the upper Chippewa River Drainage Basin. (See Figure 1) It is approximately 45 miles northwest of Wausau, Wisconsin and 16 miles north of Medford, Wisconsin at the intersection of County Trunk D and Old State Trunk Highway 13. The New State Trunk Highway 13 by-pass lies approximately 1/2 mile to the west. Silver Creek flows southward to the east of the town center and then turns westward along the southern edge of Westboro. (See Figure 2)

The soils in and around Westboro are primarily loams and silt loams of the Amery, Freer, Santiago and Comstock series (17). These are deep, well to somewhat poorly drained soils lying over sandy glacial till. Along the western bank of Silver Creek just north of County Trunk Highway D thick deposits of well graded sand exist. These lie within a bench approximately 25 feet above the creek. South of CTH D the land is low with mucky peat soils predominating. Similar soils are found to the southwest. (See Figure 3)

Westboro was established as a permanent community in the late 1850's as a result of the lumber industry. The Wisconsin Central Railroad reached Westboro on its way north in 1873 and by 1900 the population had grown to about 900. With the decline of the lumber industry the population also declined. The present population is 200 persons. A cheese factory, a small machine tool company and a sawmill employing a total of 10 to 15 people remain in town.

The 1970 census showed that the population of the township had declined 40 percent during the previous ten years, but since that time, there have been signs of growth and stability. A proposed church, new ballfield facilities, new sidewalks and a recently reopened grocery store all indicate community stability. The population of Taylor County on the whole has been increasing at a rate above that of Wisconsin in general and above the U.S. average (24). Westboro will certainly feel the effects of this located close to Medford, the county seat of Taylor County.

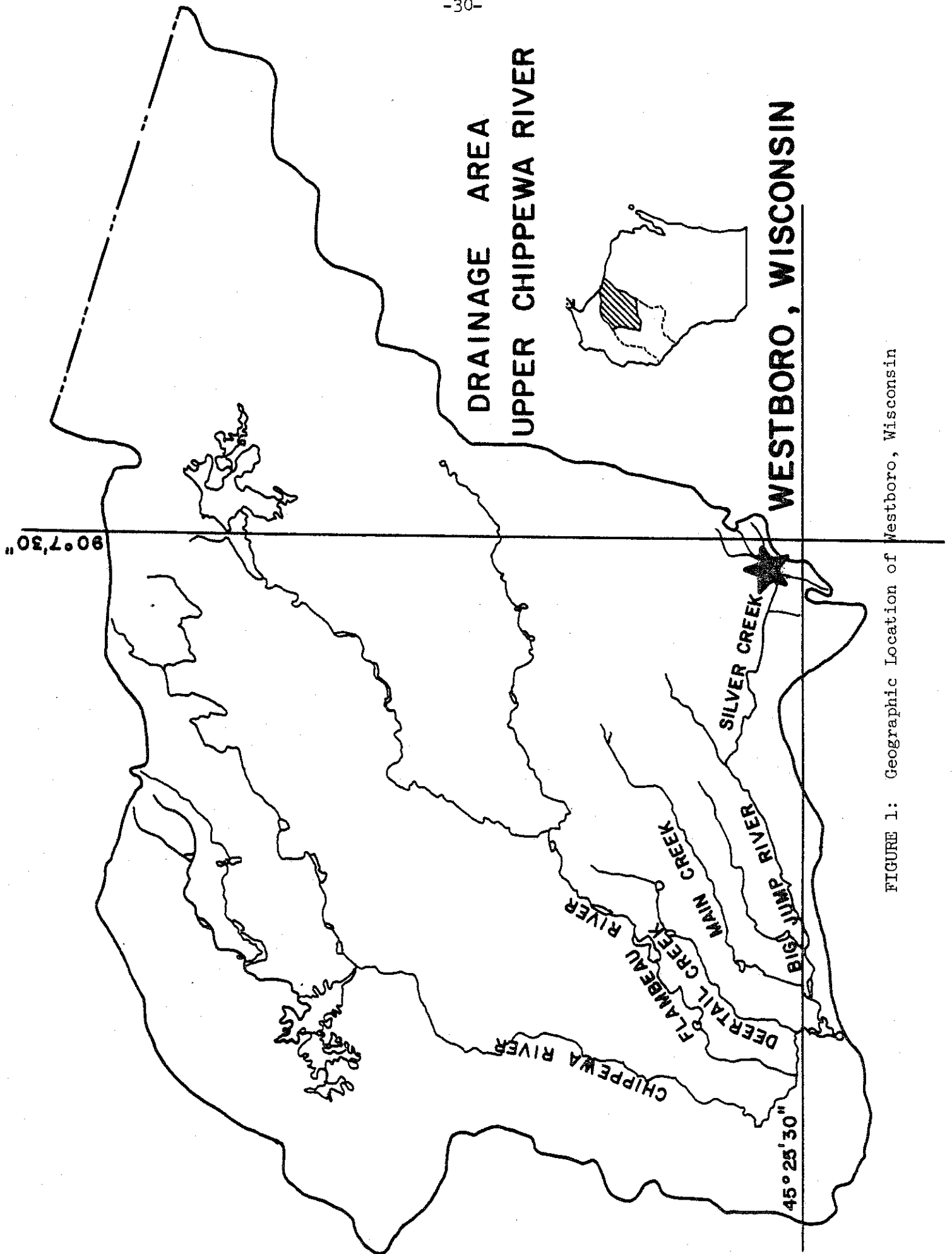


FIGURE 1: Geographic Location of Westboro, Wisconsin

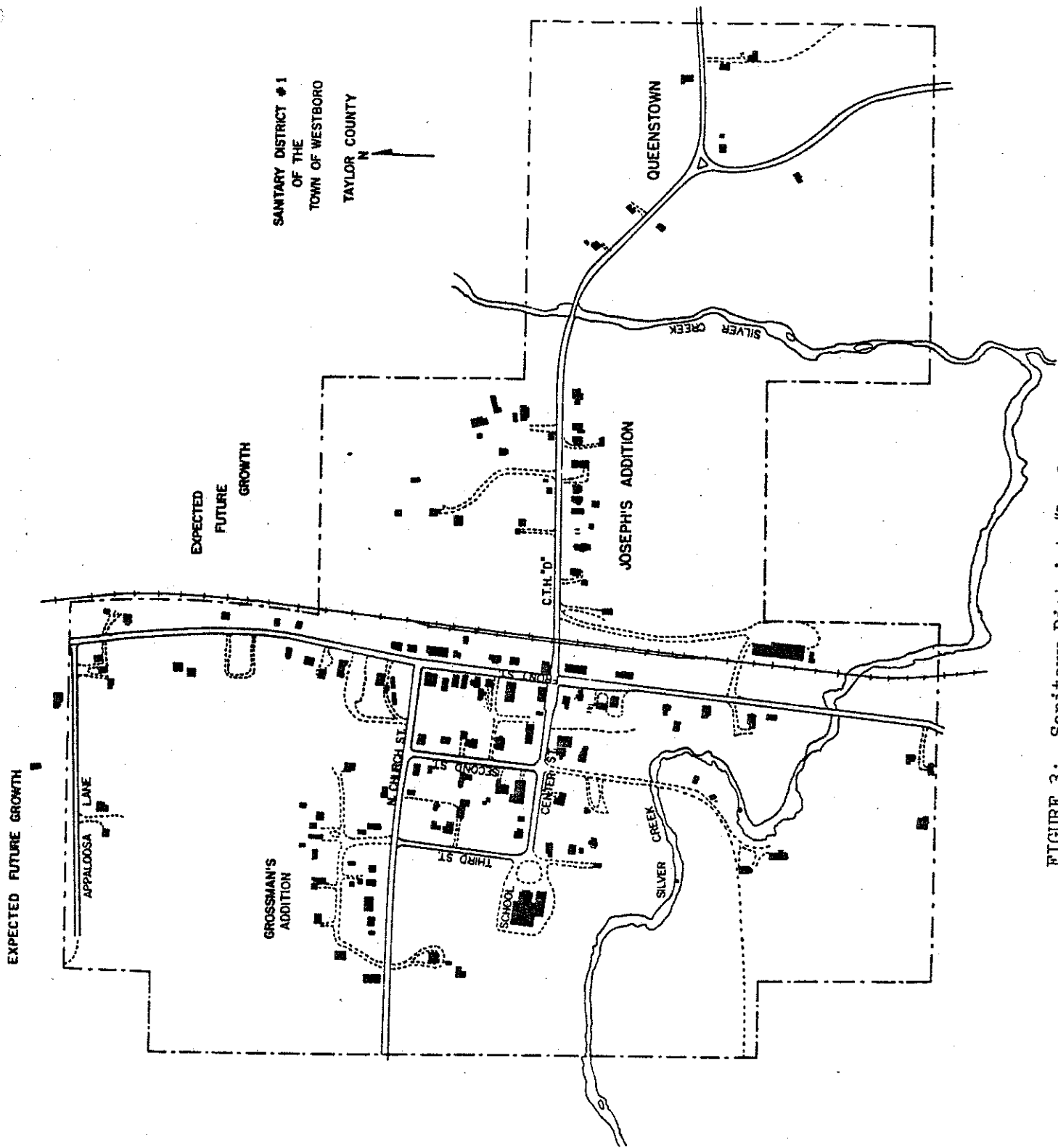


FIGURE 3: Sanitary District #1 of the Town of Westboro





### Wastewater Facilities in Westboro

The community of Westboro has no municipal wastewater collection or treatment facility. There are 94 buildings located in the community, of which 69 are occupied, including a school, four churches and several commercial establishments. All are served by private wastewater disposal systems. A 1971 survey by the Wisconsin Department of Natural Resources showed that 80% of the septic tank systems were discharging wastes above ground. Many of the systems were found to be interconnected by drains which discharged directly into Silver Creek (5). This situation was declared a nuisance and a menace to health and comfort, as well as the public rights in the Upper Chippewa River Basin. Consequently, DNR issued an order to Westboro to construct a community collection and treatment system or to stop all private homes from discharging wastes into Silver Creek (27).

Subsequent well monitoring since March, 1975 has shown some groundwater contamination to be occurring. Of approximately 30 wells sampled seven were shown to be bacteriologically unsafe, one of which has consistently high nitrate concentrations above 10 mgN/l. While the source of contamination has not been traced directly to improperly functioning septic tank systems they are suspected.

### Proposed Central Sewerage

Because the soils and lot sizes prevent the replacement of most of the failing septic tank systems, a public facility is needed. Westboro Township contracted with an engineering firm to complete a facilities plan to abate the water pollution problem within the unincorporated community. The firm investigated two alternatives, gravity collection to an extended aeration package treatment plant and gravity collection to a two cell lagoon. Both plans would serve only 60 of the 69 occupied buildings. Homes to the north of town near Appaloosa Lane and those east of Silver Creek in Queenstown would not be served. (See Figures 4 & 5) The construction costs estimated in 1967 were \$124,900 for the collection system required for both alter-

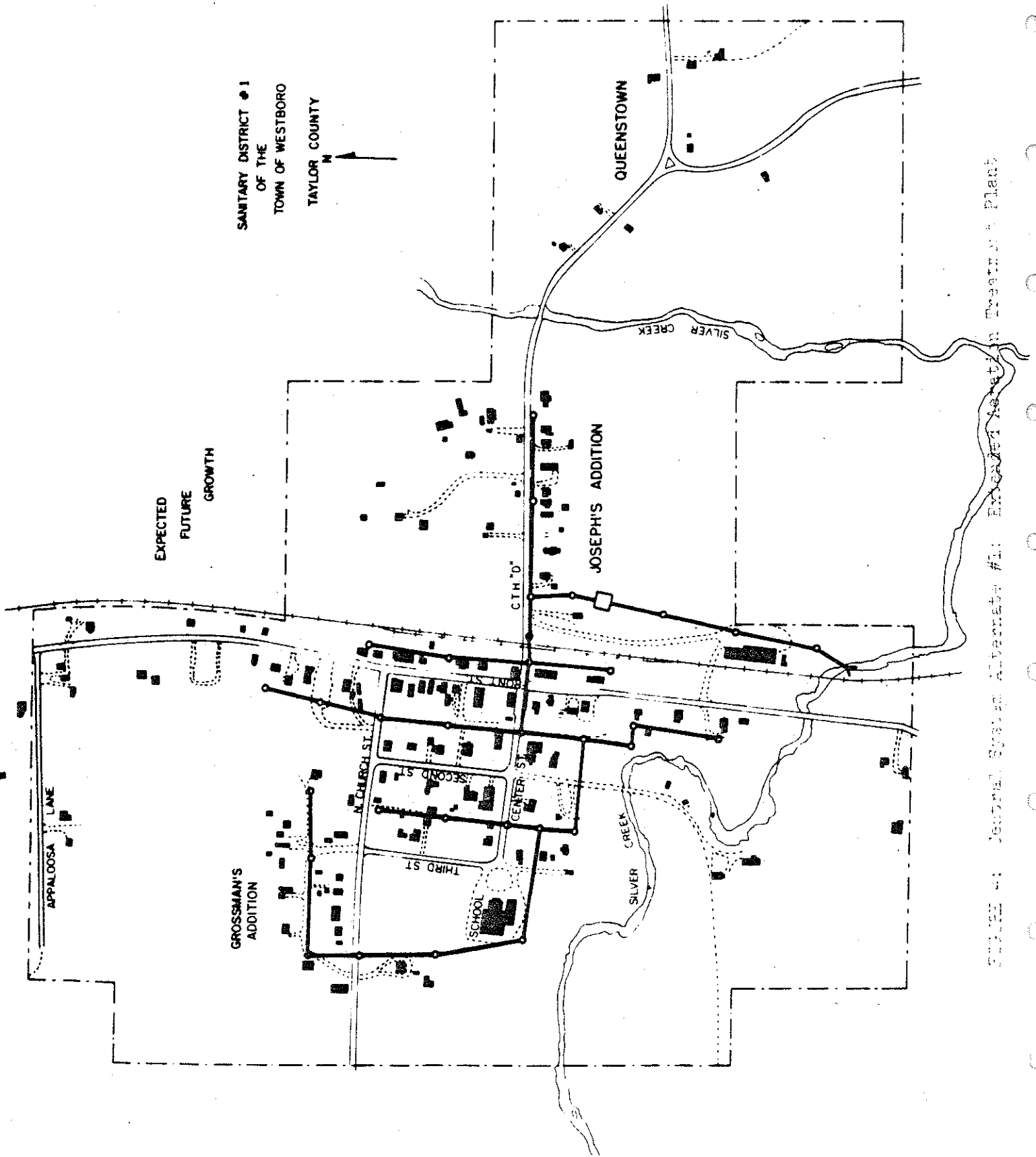


FIGURE 4: General System Alternative #1: Extended Sewerage Treatment Plant

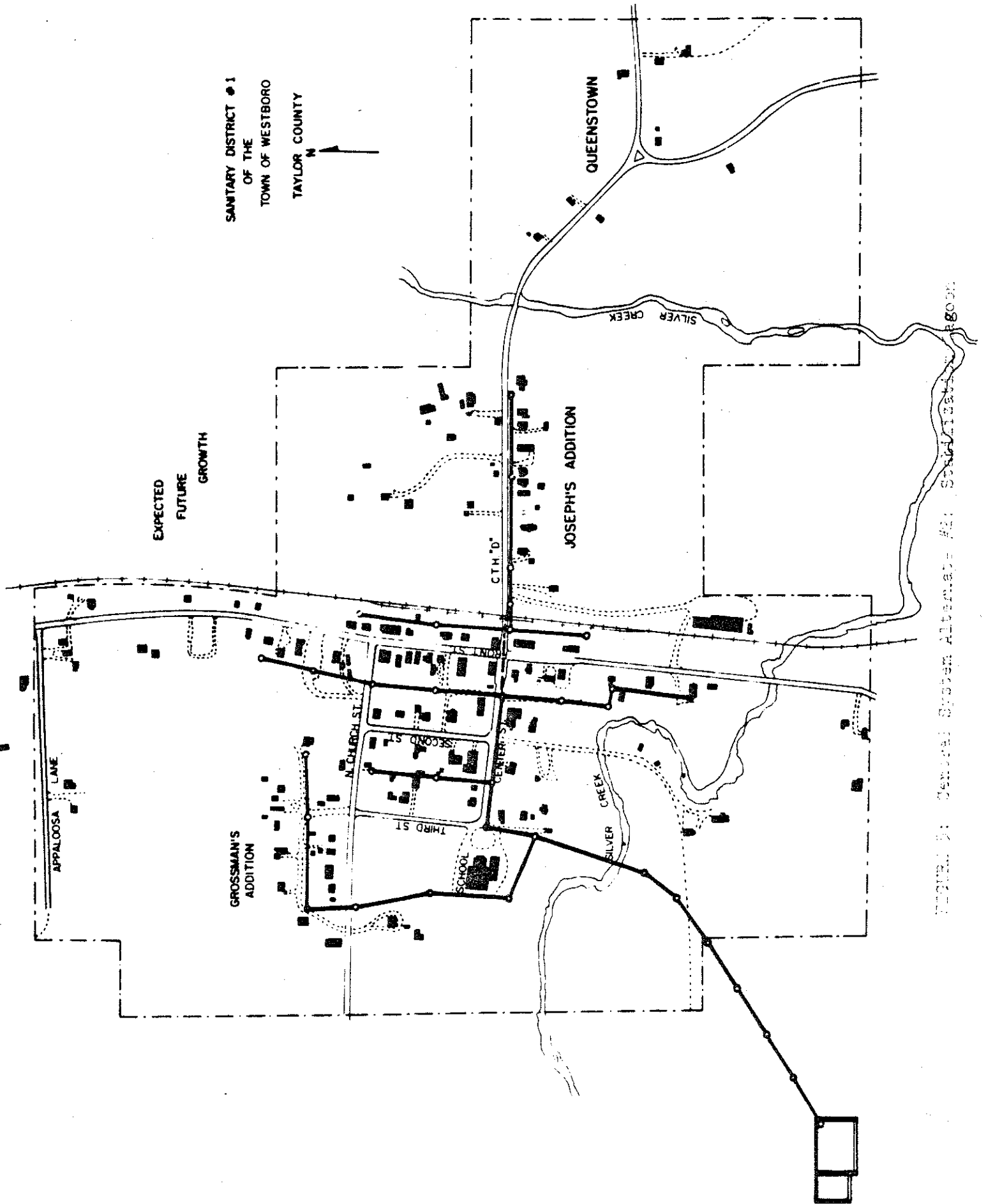


FIGURE 2: General System Alternative #2: Sanitary District #1

nates, \$59,400 for the package plant for the first alternate excluding costs of a 30 day effluent holding pond required by DNR and \$109,900 for the stabilization lagoon for the second alternate.

Considering the waste stabilization pond as the more feasible alternative the total project cost updated to 1975 dollars is \$245,313 or approximately 4,088 per building served (excludes engineering fees and contingencies). Hookup costs estimated to be \$450 per building would be additional. The community found these costs to be beyond their means so the residents formed a sanitary district, "Sanitary District No. 1 of the Town of Westboro" and applied for Federal EPA grants in aid of construction. (See Figure 2) Their priority for receiving funding, however, is very low. As of February 1976 Westboro was 318 on the list of 420 to receive 75 percent of eligible costs of construction of the treatment plant and interceptors and 398 to receive similar funding for the sewers. This virtually rules out the possibility of obtaining a community facility for several years (13).

#### Alternative Non-Central Facilities Evaluated

Having a sincere interest in abating their problem the residents of the Westboro Sanitary District agreed to cooperate with the Small Scale Waste Management Project to develop an alternate plan which might be a more cost-effective facility. The commissioners agreed to seriously consider implementing such a plan if it did prove to be less expensive.

To reduce the size or eliminate the collection system, the community was divided into natural groupings of buildings for the consideration of various alternatives. Five groupings were made: (1) Front Street area, extending from Silver Creek north to the cemetery and from Second Street to the railroad tracks, (2) Grossman's Addition including the area west of Second Street and the school, (3) Joseph's Addition, (4) Queenstown and (5) Appaloosa Lane including the scattered houses north of the

Front Street area. (See Figure 6) Each area was considered separately and in combination with adjacent areas to develop the most cost-effective system.

Collection systems were considered to be the best alternatives for the Front Street area which includes the business district. This area is primarily divided into small 150' x 50' lots. Most of the lots are developed leaving little area to construct new individual septic tank systems. Joseph's Addition is a low lying area with poorly drained soils. Individual mound systems could be installed but a common system would be more cost-effective. A similar condition occurs in Grossman's Addition area where individual systems could be installed but because of the density of homes, a common system offers the greatest advantage.

Several alternatives were considered for these areas. Because of the limited disposal sites available, it was appropriate to combine the Front Street and Joseph's Addition areas, with disposal to the sand bench along Silver Creek east of town. Both pressure and small diameter gravity sewers collecting septic tank effluents were evaluated for these combined areas. Four alternatives were evaluated for Grossman's Addition. Because of topography, gravity collection to a point southwest of the school is well suited for this area. Disposal alternatives considered were soil absorption, sand filtration with chlorination before discharge to Silver Creek and pumping to the Front Street and Joseph's Addition gravity system. The fourth alternative was a pressure collection system, also combined with the Front Street and Joseph's Addition pressure system.

The remaining Appaloosa Lane and Queenstown areas are too sparsely developed to warrant collection systems. At present, individual systems are the best alternative. Homeowners in these areas have large holdings with soils that are suitable for either a conventional or mound disposal system.

In summary, the non-central alternatives evaluated were:

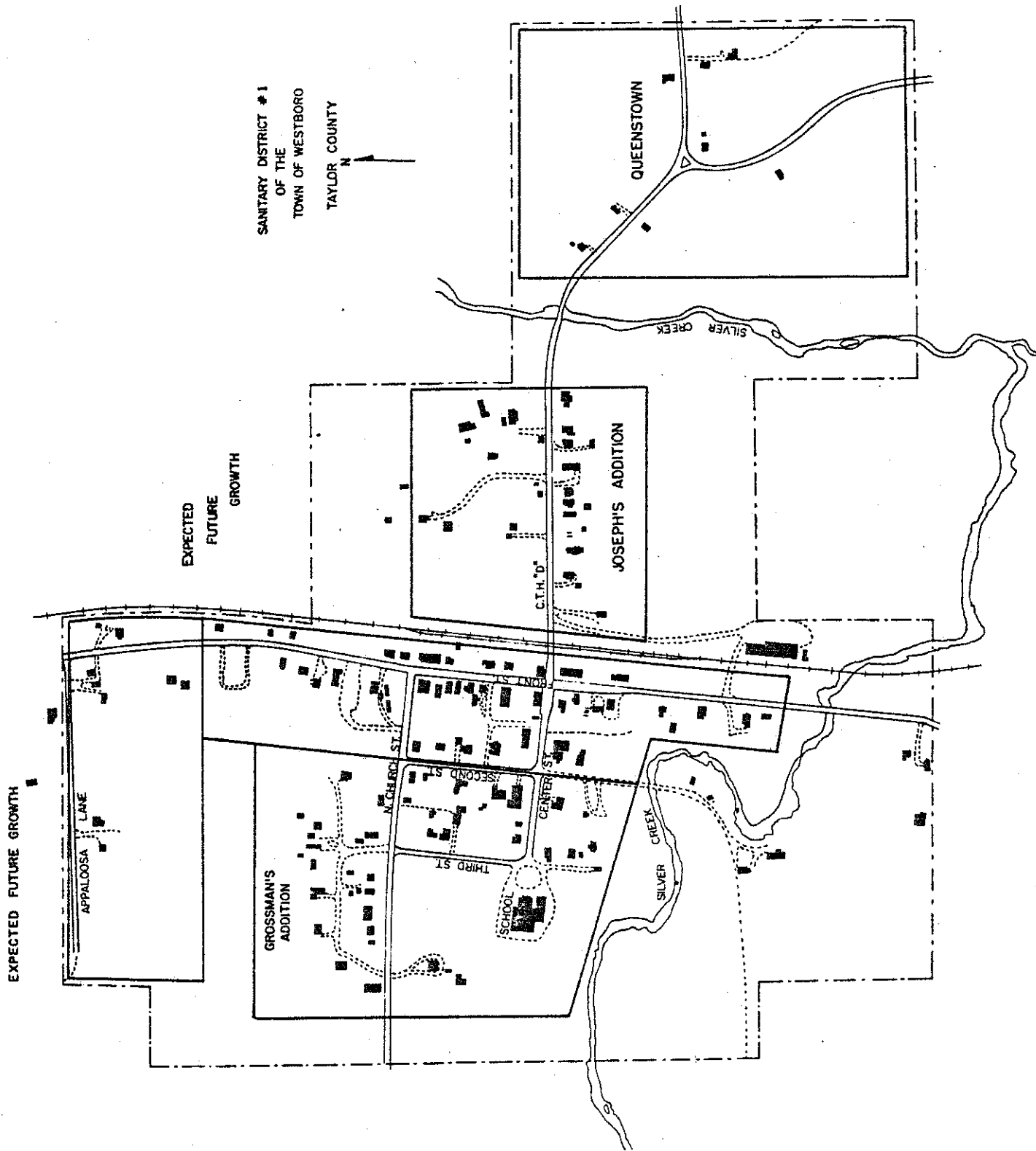
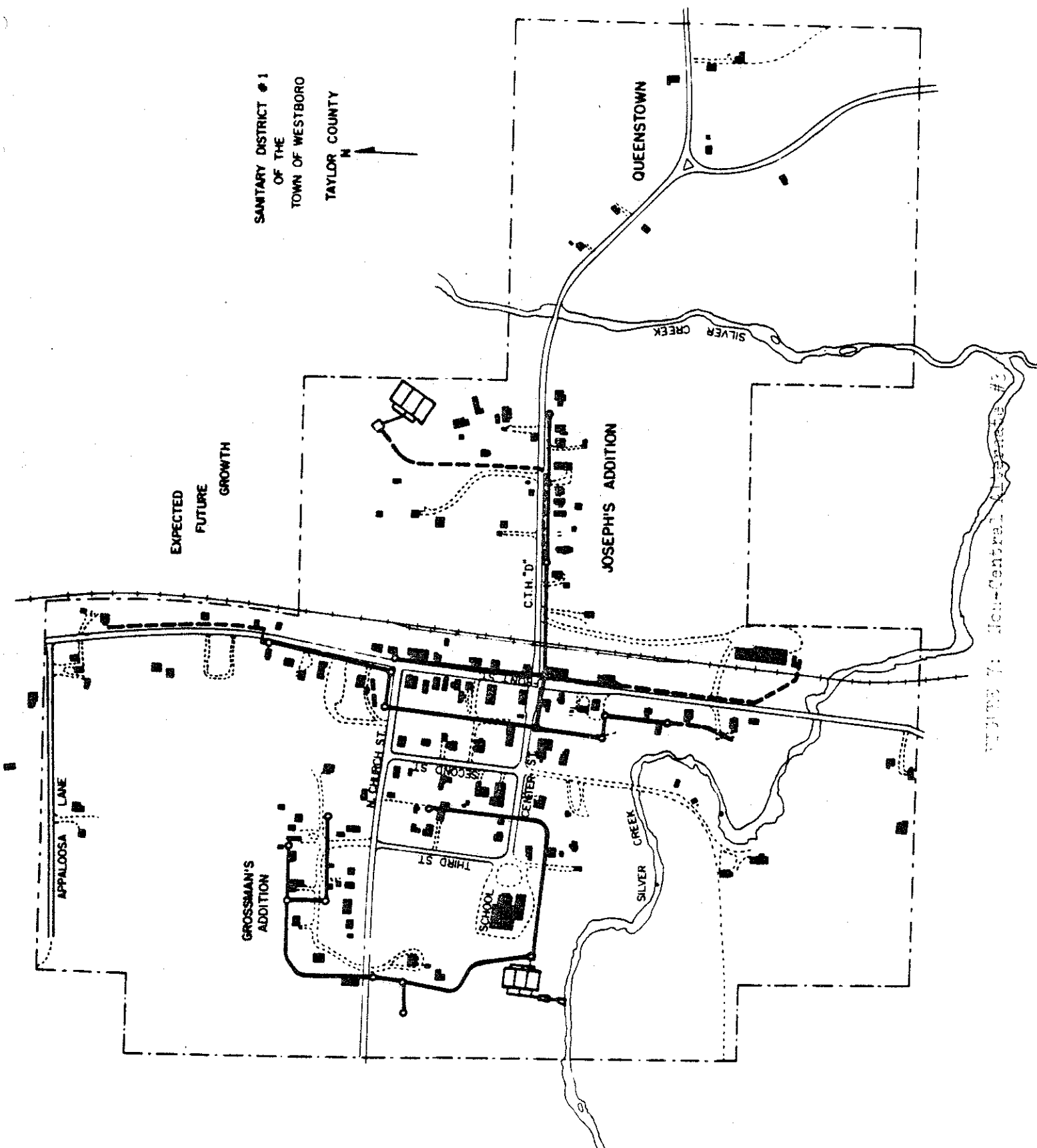


FIGURE 6: Grouping of Homes Made for Evaluation of Alternatives



SANITARY DISTRICT #1  
OF THE  
TOWN OF WESTBORO  
TAYLOR COUNTY

N

EXPECTED  
FUTURE  
GROWTH

JOSEPH'S ADDITION

GROSSMAN'S  
ADDITION

QUEENSTOWN

SILVER CREEK

SILVER CREEK

THIRD ST.

C.H. "D" ST.

N. CHURCH ST.

THIRD ST.

SECOND ST.

SCHOOL

APPALOOSA LANE

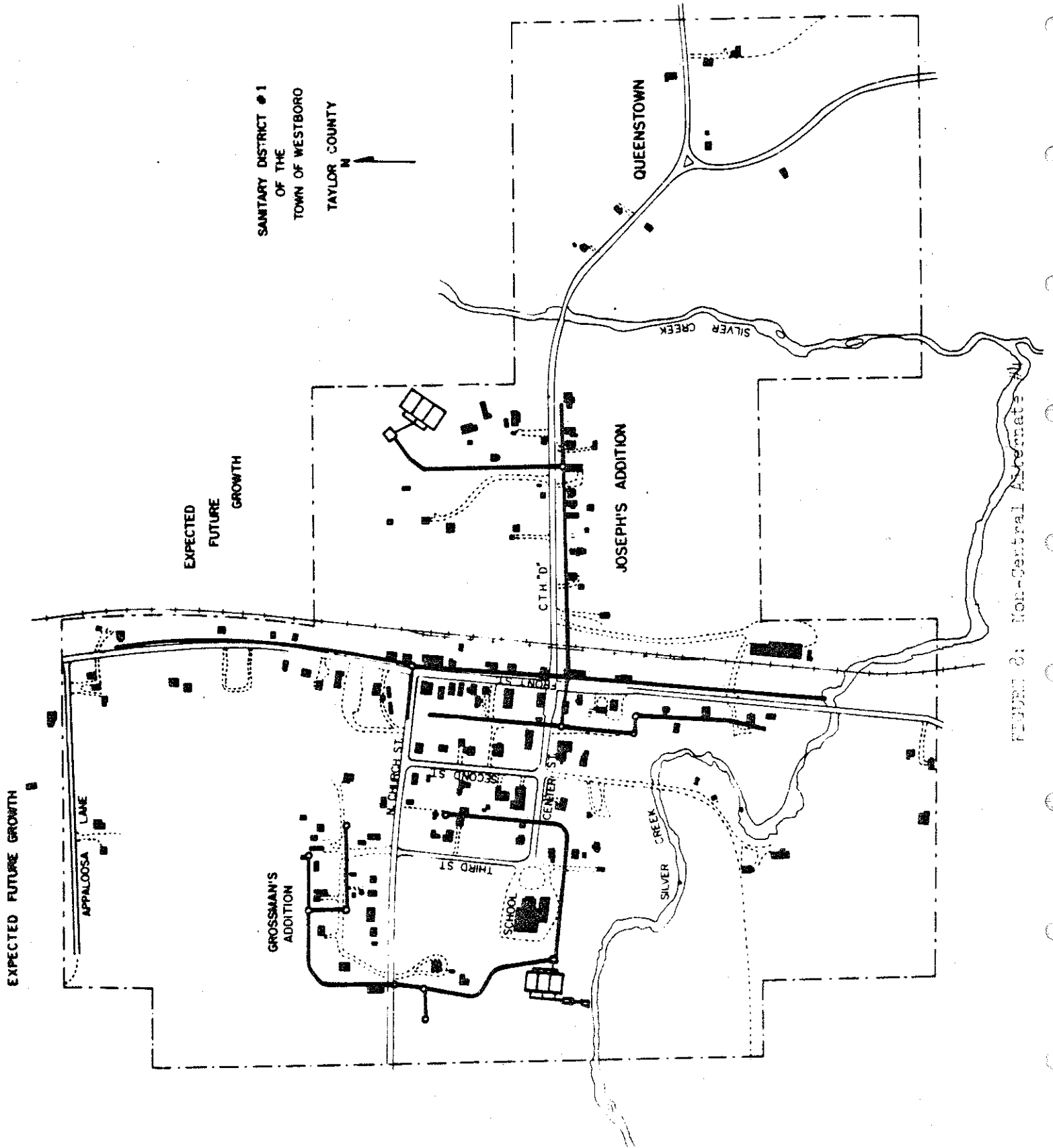


FIGURE 2: Non-Central Alternative #1



Alternate 1

Part A: Grossman's Addition - Small diameter gravity sewers discharging to a soil absorption field west of the school (design load of 10,000 gpd).

Part B: Front Street and Joseph's Addition - Small diameter gravity sewers discharging to a soil absorption field northeast of Joseph's Addition (design load of 20,000 gpd).

Alternate 2

Part A: Grossman's Addition - Small diameter gravity sewers discharging to a soil absorption field west of school (design load of 10,000 gpd).

Part B: Front Street and Joseph's Addition - Pressure sewer discharging to a soil absorption field northeast of Joseph's Addition (design load of 20,000 gpd).

Alternate 3 (Figure 7)

Part A: Grossman's Addition - Small diameter gravity sewers discharging to intermittent sand filters west of the school with chlorine disinfection before disposal into Silver Creek downstream from the community (design load of 10,000 gpd).

Part B: Front Street and Joseph's Addition - Small diameter gravity sewers discharging to a soil absorption field northeast of Joseph's Addition (design load of 20,000 gpd).

Alternate 4 (Figure 8)

Part A: Grossman's Addition - Small diameter gravity sewers discharging onto intermittent sand filters west of the school with chlorine disinfection before disposal into Silver Creek downstream from the community (design load 10,000 gpd).

Part B: Front Street and Joseph's Addition - Pressure sewers discharging to a soil absorption field northeast of Joseph's Addition (design load of 20,000 gpd).

Alternate 5 (Figure 9)

Small diameter gravity sewers serving all areas to a soil absorption field northeast of Joseph's Addition (design load of 30,000 gpd).

Alternate 6 (Figure 10)

Pressure sewers serving all areas discharging to a soil absorption field northeast of Joseph's Addition (design load of 30,000 gpd).

Facility Selection

Final selection of one alternative over several others depends on three criteria: environmental impact, total cost and system reliability. The first two are obvious since it is the goal of the engineer to design a facility which will protect the environment for the least cost. Judgments must be made as to whether additional environmental protection warrants added facility costs but much of this can be decided objectively. System reliability is less objective, however, and is influenced by the engineer's past experience. It is often more a confidence factor, which will eliminate some alternatives from consideration because they are not felt to be viable. This factor is what usually eliminates septic tank systems from consideration. Each of these must be weighed in the final selection.

The "Non-Central" Alternate #5 was selected as the best facility after weighing each criterium, though some assumptions made in the analysis must be proven through experience. This facility is a system of small diameter gravity sewers with final effluent disposal in a single soil absorption field. (Figure 9) Pretreatment would be provided by individual septic tanks at each home. Homes outside the collection system would be served by individual septic tank systems. This facility appears to be the least costly and more environmentally sound than the other alternatives evaluated. The reliability of this type of facility has not been established, but its selection is warranted because it is designed from extensive experience

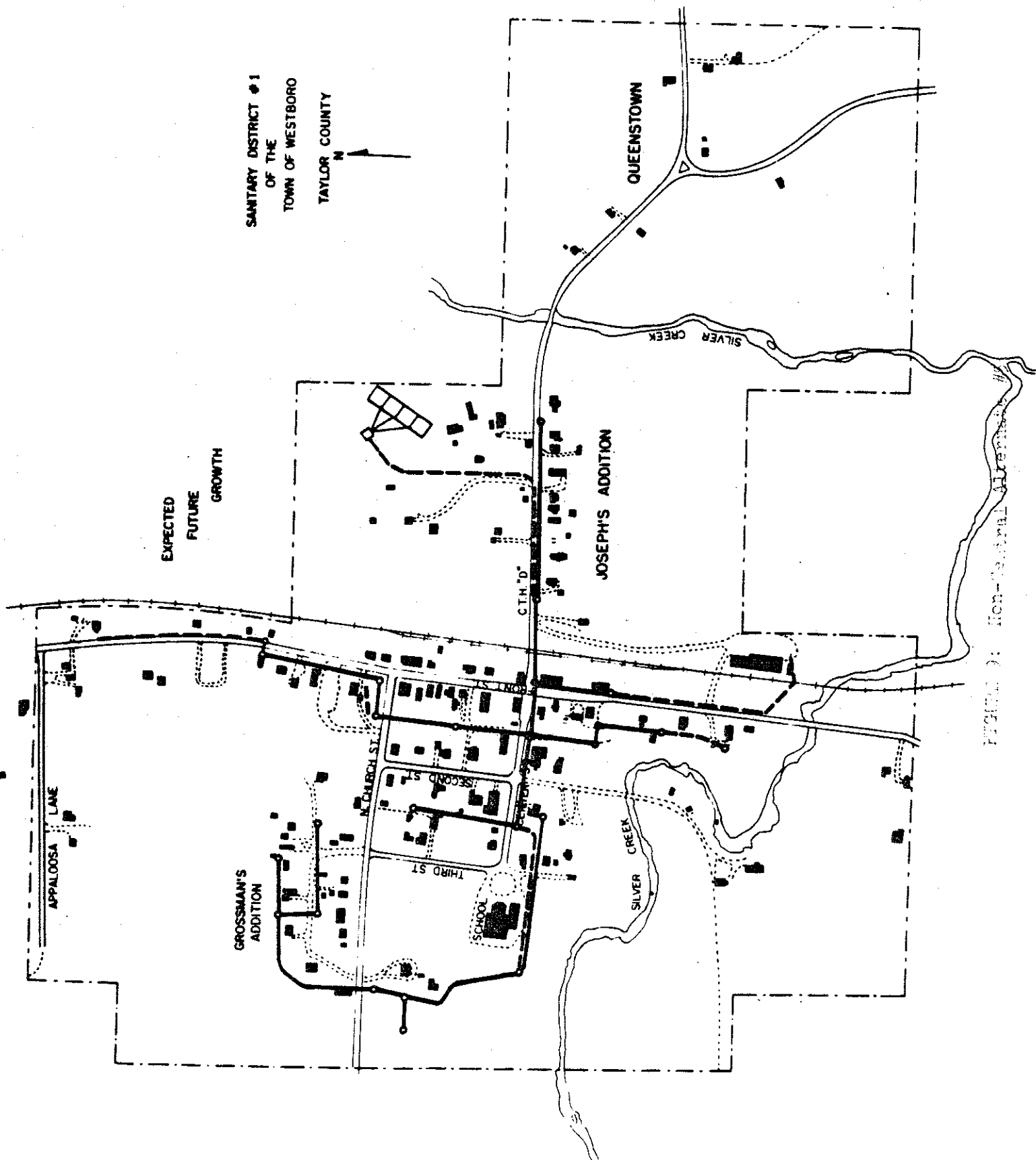
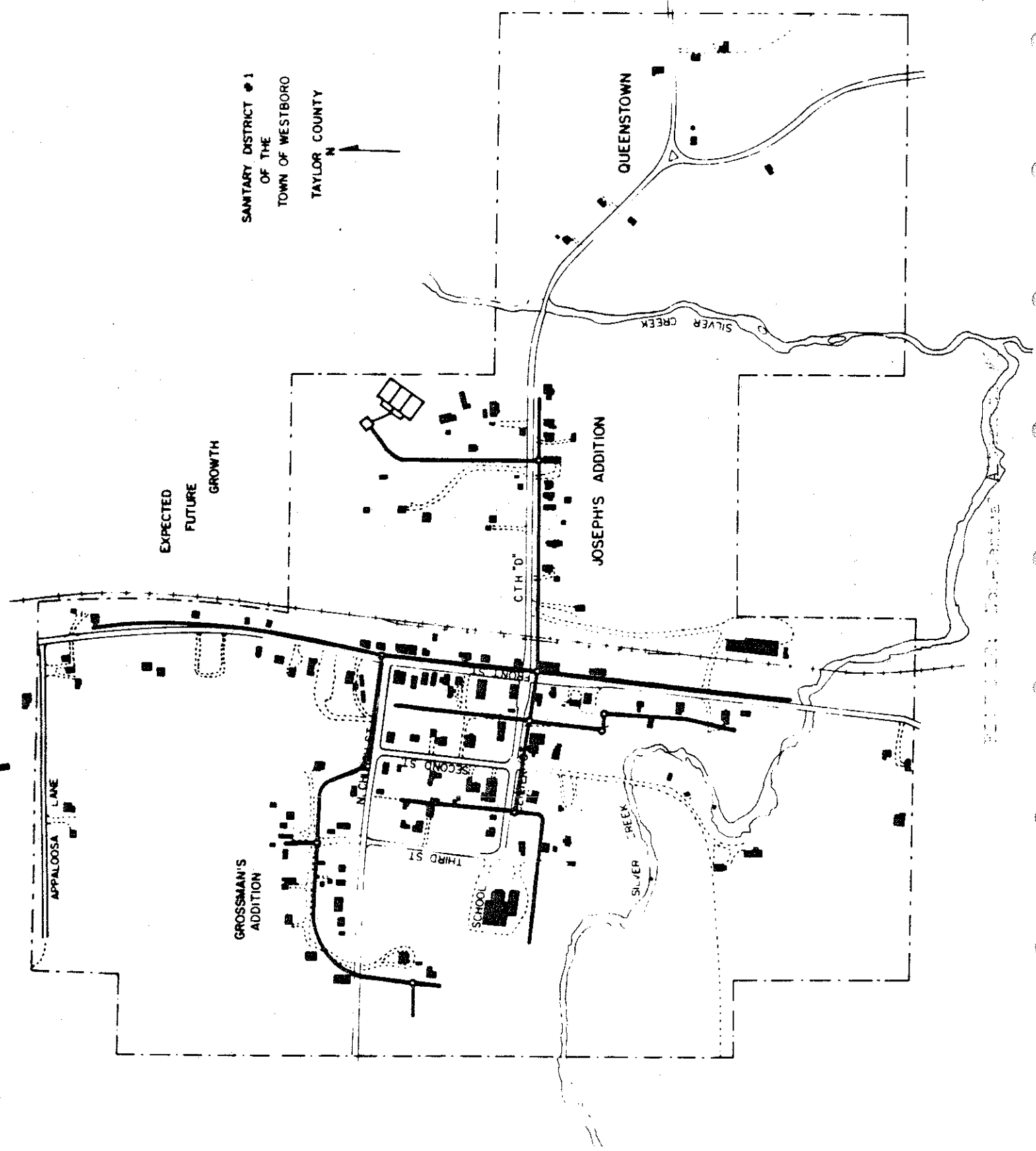


FIGURE 1: Non-Central Urban Area



SANITARY DISTRICT #1  
OF THE  
TOWN OF WESTBORO  
TAYLOR COUNTY

EXPECTED  
FUTURE  
GROWTH

QUEENSTOWN

JOSEPH'S ADDITION

GROSSMAN'S  
ADDITION

APPALOOSA LAKE

THIRD ST  
SECOND ST  
FRONT ST

SCHOOL

SILVER CREEK

SILVER CREEK

CTH "D"

with smaller systems and its cost and environmental impact are a significant improvement over the conventional central facilities. Cost comparisons were made using present worth analysis. Present worth is equal to the initial cost plus the amount of money which must be invested at the present time to cover the costs of operation and maintenance over the life of the system. A lifetime of 20 years with an annual interest rate of 7 percent was used in these computations.

A summary of the estimated present worth of each alternate is presented in Table VII. To make a fair comparison of costs, the conventional central facility alternates were redesigned to conform with present regulations and site conditions. Private individual system construction estimates were also included for those homes not served by the conventional alternates. While the cost of replacing these septic tank systems would not be borne by the District in the case of the conventional system their inclusion provides a fairer comparison between the "Central" and "Non-Central" alternates. Hookup costs are not included, however. They are estimated to be \$450 per service connection for the "Central" alternates and no more than \$100 per connection for the "Non-Central" alternates. This savings must not be overlooked.

"Non-Central" Alternate #5 is estimated to be the least costly of all the alternatives evaluated. The present worth of Alternate #5 is \$266,416 or approximately \$3861 per household, as compared to \$318,336 or \$4614 per household and \$333,799 or \$4838 per household for the "Central" Alternates #1 and #2 respectively. Thus, the non-central system results in a 17 to 20 percent savings over the conventional facilities.

The environmental impact of "Non-Central" Alternate #5 should be minimal. Only nitrogen in the form of nitrate is expected to leach through the soil to the groundwater in amounts that may be significant. With the field's location near Silver Creek much of the nitrate will probably flow into Silver Creek increasing its nitro-

TABLE VII. SUMMARY OF PRESENT WORTH COSTS OF ALTERNATE FACILITIES

"CENTRAL" SYSTEM ALTERNATE #1

Extended Aeration Treatment Plant

Collection	\$136,295.00
Treatment	170,065.17
Individual Systems	<u>11,976.23</u>

\$318,336.40

"CENTRAL" SYSTEM ALTERNATE #2

Raw Sewage Stabilization Pond

Collection	\$136,295.00
Treatment	185,528.00
Individual Systems	<u>11,976.23</u>

\$333,799.23

"NON-CENTRAL" SYSTEM ALTERNATE #1

Part A: Grossman's Add. - S.D. Gravity Sewers  
to Soil Absorption

Part B: Front St. & Joseph's Add. - S.D.  
Gravity Sewers to Soil Absorption

Part A	\$124,454.64
Part B	145,229.00
Individual Systems	<u>11,976.23</u>

\$281,659.87

"NON-CENTRAL" SYSTEM ALTERNATE #2

Part A: Grossman's Add. - S.D. Gravity Sewers  
to Soil Absorption

Part B: Front St. & Joseph's Add. - Press.  
Sewers to Soil Absorption

Part A	\$124,454.64
Part B	185,308.00
Individual Systems	<u>11,976.23</u>

\$321,738.87

"NON-CENTRAL" SYSTEM ALTERNATE #3

Part A: Grossman's Add. - S.D. Gravity Sewers  
to Sand Filters

Part B: Front St. & Joseph's Add. - S.D.  
Gravity Sewers to Soil Absorption

Part A	\$148,038.00
Part B	145,229.00
Individual Systems	<u>11,976.23</u>

\$305,243.23

## SUMMARY

The demand for less costly wastewater facilities for small communities or fringe areas is increasing. Regulatory officials and engineers are realizing that if the goals of the Federal Water Pollution Control Act are to be met more practical facilities must be developed for small communities and subdivisions.

The objective of this study supported by the Upper Great Lakes Regional Commission is to develop a more cost-effective facility for the unincorporated community of Westboro, Wisconsin. The plan developed indicates that up to a 20 percent savings can be realized over a conventional collection and treatment facility. The proposed system utilizes on-site techniques under central management by Westboro Sanitary District to achieve this savings. This plan has been accepted by the Westboro Sanitary District and construction is scheduled to begin in Fall, 1976.

A three-year monitoring program is proposed to determine the capabilities and limitations of this system. Funds have been granted by the Upper Great Lakes Regional Commission to construct monitoring stations and perform sampling for the first year. Preconstruction background environmental data and post-construction monitoring will be done. The mechanical performance, as well as the management entity functioning, will be observed.

Though the results of this study indicate that significant savings can be made by investigating other alternatives to conventional sewerage there are several deterrents to their widespread acceptance. Biases of engineers, regulatory agencies and funding agencies favor central gravity sewers and treatment plants. Probably one of the greatest deterrents to the use of such facilities is technical knowledge and experience with the performance of relatively untried techniques. Innovative designs take more time to prepare and have more risk associated with

them. Since engineering fees are usually based upon a percentage of the construction costs there is little incentive to be innovative. The engineer gets paid less for doing more work and at a greater risk. More facilities like this need to be constructed and monitored to gain familiarity with non-central systems.

Regulatory agencies also favor conventional systems, due to confidence in tried and proven methods. Innovative designs take more time to approve. The engineer is then more likely to design a facility that would create fewer stumbling blocks.

Another deterrent to acceptance of such facilities is the question of whether this type of plan would be eligible for federal and local construction grants. Certainly there is bias in favor of conventional sewerage, because of present component eligibility guidelines. Thus, while a conventional facility may be more costly because of its eligibility for construction grants, it becomes less costly to the subscribers. This bias is wasteful of tax dollars, as well as environmentally unsound, for it encourages communities to delay abatement efforts until funding is available.

Obviously, what is needed are additional planning studies of this nature, with several communities each having different characteristics. Such studies would provide a data base to develop planning guidelines to determine the most cost-effective facility. Construction of several facilities would also increase experience with system performance. If it can be demonstrated that non-central facilities are effective, regulatory agencies may see the need for a change in grant eligibility guidelines.



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APPENDIX A

MANAGEMENT ALTERNATIVES FOR NON-CENTRAL SYSTEMS  
IN MICHIGAN, MINNESOTA AND WISCONSIN



## APPENDIX A

MANAGEMENT ALTERNATIVES FOR NON-CENTRAL SYSTEMS  
IN MICHIGAN, MINNESOTA AND WISCONSIN

The entities most likely to be used in Michigan, Minnesota and Wisconsin for management of non-central systems are (1) incorporated cities and villages, (2) unincorporated units of local government, such as townships and counties and (3) special purpose districts. Each of these entities have adequate authority to effectively manage a non-central system in each of the three states; however, the special purpose district would probably be the preferred entity.

The statutes in the three states were reviewed to determine whether or not each entity has sufficient authority to manage non-central systems. Case law was examined to the extent that it might distinguish or limit the entity's underlying enabling statutory language. Powers of each of the three types of entities are discussed, but only one special purpose district from each state is included, though others might exist. The one chosen is felt to be the most appropriate to own and operate non-central systems.

## MICHIGAN

Cities

As a provision of the Michigan Constitution, any city (or village) may acquire, own, operate within or without its corporate limits, facilities for supplying sewage disposal to the inhabitants (Mich. Const. Art. 7, sec. 24). Of course this constitutional provision is not self-executing, and requires implementation by legislative act. Thus there must be statutory authority, as well.

There are several statutory provisions which give cities (and villages, townships and in some instances counties) the authority to acquire sewers and sewerage facilities by gift, grant, purchase or condemnation within or outside their territory (123.201 and 123.241). The definition does not appear to exclude non-central systems.

The city (and village, township and county) appears to be authorized by sec. 123.242 to issue general obligation bonds and mortgage bonds.

These same municipalities are authorized to make all necessary rules to govern the use, operation and control of the sewerage systems (123.243). Inherent in this is the power to control the extension of services, as well. Also, under this same section these municipalities may establish user charges to be paid by each person served.

Lastly, sec. 123.249 provides that the authority given in sections 123.241-.249 shall be in addition to and not in derogation of any power given to counties, cities, villages and townships.

Inherent in each city's status as a body corporate is the legal standing to sue and be sued. Further, there is an implied power to contract because of the status to sue and be sued and because this power is needed to accomplish the expressly granted powers.

Under a new state grant program, cities (and villages, townships and counties) are eligible for state funds for sewers and sewage facilities. Also, it seems certain that cities (and the other units of local government) would be eligible for federal funding under PL92-500.

There remain two unresolved questions for cities. It appears that those with home rule charters may under sec. 117.4b levy special assessments. Also it seems that small cities (of the fourth class) may use special assessment (101.7 et seq. and 110.7). The practical effect of this statutory wording is not known.

## CITIES - MICHIGAN

Necessary/Desired Powers:Express Statutory Authorization

- |  |                     |
|--|---------------------|
| 1. Own, operate and maintain non-central systems | 123.201, 123.241    |
| 2. Power to: Contract                            | inherent            |
| Incur indebtedness                               | 123.242             |
| Sue/be sued                                      | inherent            |
| Condemnation                                     | 123.241             |
| 3. Revenue: User charges                         | 123.241             |
| Special assessments                              | 117.4b              |
| Taxation   | inherent            |
| 4. Control extension of services                 | inherent            |
| 5. Make rules and regulations                    | 123.243             |
| 6. Accept grants                                 | 323.271 and 323.401 |

Villages (and probably charter townships)

The same constitutional provision and the need for legislative enactment, which applies to cities, applies to villages as well. In addition, sec. 67.12 gives village councils the power to lay out, establish or extend any sewer or drain and it further authorizes condemnation of private land, when necessary. Apparently the word "sewer" used in this section is understood to be generic for wastewater collection and treatment because Michigan court has upheld the right of a village to construct both sewers and a sewage disposal plant.\* It is not known whether a non-central system would come within the ambit of "sewers."

Villages also are authorized in sec. 67.25 to levy a general tax upon all taxable property within the village and to defray the costs of the "sewers" by a special assessment upon the lands benefitted.

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\*Robinson v. Village of St. Clair Shores, 267 Mich. 160, 225 N.W. 182(1934).

Subject to recent amendments, villages lost the authority in sec. 62.25 to issue bonds. A new state grant program was initiated to aid in the construction of both sewage treatment facilities, as well as collecting sewers (323.371, 323.401). It is also certain that village systems would be grant eligible for federal funds.

Villages are given clear authority to make rules and regulations. Inherent in this power is the probable authority to control the extension of services.

#### VILLAGES - MICHIGAN

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	sewers - 67.12 and 67.24 123.241 <u>et seq.</u> - see cities
2. Power to: Contract Incur indebtedness Sue/be sued Condemnation	implied 123.241 <u>et seq.</u> - see cities inherent 67.12 and 67.24
3. Revenue: User charges Special assessments Taxation	123.241 <u>et seq.</u> - see cities 67.25 67.25
4. Control extension of services	inherent
5. Make rules and regulations	123.241, 67.24
6. Accept grants	323.371, 323.401

#### Counties and Townships

The provisions of sec. 123.241 et seq. appear to be adequate to permit both counties and townships to own and operate non-central systems. Also, they would probably be eligible for funding under the state grant program (323.371 and 323.401).

The provisions of sec. 123.241 et seq. and sec. 323.37 et seq. are adequately discussed under cities. It should be noted that Michigan is the most populous of the three states being reviewed here, and this fact probably accounts for the abundance of statutory authorizations given to counties to own and operate facilities, as well as requiring hookups, etc. For a good contrast, the analysis of



Wisconsin's County authority should be read.

District, Sewage Disposal and Water Supply

Sec. 323.158 authorizes any sewage disposal and water supply district (SDWSD) to construct and operate sewage disposal systems within its territory and to extend and improve these systems. A sewage disposal system is defined by sec. 323.151 to include all sewers, treatment plants and "all other plants, works, instrumentalities and properties used or useful in connection with the collection, treatment and disposal of sewage and industrial wastes." Clearly, non-central systems would fall within this definition.

Each SDWSD is defined by sec. 323.158 to be a governmental subdivision of Michigan, and a body corporate. As a body corporate the districts can sue and be sued and enter into contracts. Under sec. 323.158(d) the SDWSDS may acquire property by purchase, exchange, lease, gift, grant, or by condemnation. Further provisions under this section permit any district to accept both state and federal grants (323.158(e) and (f), respectively).

Each district is empowered to enter into contracts with any of the municipalities,\* within the district's jurisdiction for the provision of services [323.159(a)]. The municipalities typically finance any system which the district acquires, constructs, etc. This same section permits the municipality to fund its portion of any district system by pledging its full faith and credit for the repayment of indebtedness obligations incurred. Under this same section the municipalities which contract with the district for services are authorized to (1) levy special assessment, (2) levy and collect user charges and (3) levy sufficient taxes to service the bond debt.

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\*Municipality defined by sec. 323.151(c) to be any county, township, charter township, incorporated city or village.

The district is also required to make reasonable users charges to cover operation and maintenance costs. Additionally the district may issue its own self-liquidating revenue bonds payable solely from revenues earned by the systems (323.162). By the authority to operate these systems granted by sec. 323.158, it may be argued that there is implied power to adopt rules and regulations, as well as to control extensions of the system.

#### DISTRICT, SEWAGE DISPOSAL AND WATER SUPPLY - MICHIGAN

##### Necessary/Desired Powers:

##### Express Statutory Authorization

- |  |  |
|--|--|
| 1. Own, operate and maintain non-central systems | 323.158 as defined by 323.151                            |
| 2. Power to: Contract                            | 323.158, 323.160   |
| Incur indebtedness                               | 323.159, 323.162   |
| Sue/be sued                                      | 323.158  |
| Condemnation                                     | 323.158(d)   |
| 3. Revenue: User charges                         | 323.159(a)   |
| Special assessments                              | 323.159(a)(1)  |
| Taxation   | 323.159(a)   |
| 4. Control extension of services                 | inherent   |
| 5. Make rules and regulations                    | inherent   |
| 6. Accept grants                                 | State grants - 323.158(e)<br>Federal grants - 328.158(f) |

#### MINNESOTA

##### Cities

In Minnesota all cities, with a few exceptions, are authorized under sec. 444.085(1), Minn. Stats., to construct, build, operate and maintain sewer systems, sewage treatment works, disposal systems and "other facilities for disposing of sewage" inside or outside their corporate limits. Further, cities are empowered to acquire by purchase or condemnation any necessary land or easements. The broad wording of this enabling language would appear to include non-central systems.

Under subdivision (2) of this section, cities are given the power to incur indebtedness by issuance of general obligation bonds. These may be paid off by taxation, special assessments or from revenues from the operation of the system. Under subdivision (3) cities are given the authority to impose just and equitable user charges and are authorized to control the availability and the connection to these sewage facilities.

Under subdivision (4) the city is authorized to levy special assessments against any property within the city which is benefitted by the sewage facilities. It may also levy taxes upon the property with certain limitations. Under subdivision (5) cities are authorized to control the use of the system by contract with any potential user either within or outside of the city.

While not specifically authorized by this section to accept grants [cities may accept gifts of real property under subdivision (1)], it is apparent that the cities qualify for grants in aid of construction under the federal program established by PL92-500.

Clearly, cities are bodies corporate and inherent in this status is the power to sue and be sued (within possible statutory and constitutional limits) and the power as a corporate entity to enter into contracts (the subject matter areas possibly must be authorized either expressly or by implication in the statutes).

#### Villages and Boroughs

Pursuant to chapter 123, of the laws of 1973, the Minnesota legislature clearly made the provisions of Minn. Stats. sec. 444.075 applicable to villages and boroughs by the substitution of the term "statutory cities" for villages and/or boroughs. This change was effective May 25, 1973. Hence, all the provisions discussed under cities are clearly applicable to villages and boroughs, including those powers that any incorporated unit of government has inherent in the "body corporate" status.

## CITIES - MINNESOTA

(Villages and Counties pursuant to Minn. Stats. sec. 444.075)Necessary/Desired Powers:Express Statutory Authorization

- |  |  |
|--|--|
| 1. Own, operate and maintain non-central systems | 444.075(1)   |
| 2. Power to: Contract                            | Inherent (as an incorporated governmental unit as implied in sec. 444.075) |
| Incur indebtedness                               | 444.075(2)   |
| Sue/be sued                                      | Inherent (within statutory/constitutional limits)                          |
| Condemnation                                     | 444.075(1)   |
| 3. Revenue: User charges                         | 444.075(3)   |
| Special assessments                              | 444.075(4) and 429.051   |
| Taxation   | 444.025(5)   |
| 4. Control extension of services                 | 444.075(3) and (5)   |
| 5. Make rules and regulations                    | 444.075(5)   |
| 6. Accept grants                                 | PL92-500   |

Counties

Counties (except those seven within the twin cities metro area) are given by Minn. Stats. sec. 444.075 all the authority of cities.

Towns

Only certain towns in Minnesota (those having more than 3000 inhabitants and an assessed valuation of taxable property of more than \$10 million) may under sec. 368.50 Minn. Stats. erect, construct, maintain and operate a sewage disposal plant and may lay sewer lines within the platted area of the town. It is not known whether a non-central system would fall within this rather narrow definition.

Under the existing powers granted to all towns in general, these above described towns get the authority to contract and as a body corporate the town may sue and be sued, (sec. 365.02(3) and sec. 365.025; and sec. 365.02(1) respectively). Towns authorized by sec. 368.50 to construct, etc. sewerage systems are authorized to pay

the cost of the systems out of the general fund (taxation). Only if the fund is insufficient to cover the costs may the town issue general obligation bonds to obtain the money necessary to pay the cost of construction, operation and maintenance of the system (sec. 368.51).

These towns do not appear to be given the authority to collect user service charges. It is not known if this is a legislative oversight or if it was intended that those in the town should equally bear the operating costs of the system by paying all costs out of the general fund. However, by definition these towns are municipalities within the meaning of sec. 429.051 and as such are authorized to levy special assessments to reimburse itself for any portion of the cost of the sewerage system.

It appears likely that any of these towns which owned a non-central system and operated it would meet the grant eligibility requirements of PL92-500 and could qualify for a grant. It is not known if the town has the statutory authority to accept such a grant, but it is assumed that it does.

#### TOWNS - MINNESOTA

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	368.50
2. Power to: Contract	365.02(3), 365.025
Incur indebtedness	368.51, 368.52
Sue/be sued	365.02(1)
Condemnation	( )
3. Revenue: User charges	( )
Special assessments	429.051
Taxation	368.51
4. Control extension of services	365.02(4)
5. Make rules and regulations	365.02(4)
6. Accept grants	PL92-500

District, Sewer and Water

Chapter 116A Minn. Stats. provides for the creation of sewer and water districts anywhere in the state except the 7-county twin cities metro area and Mower County. Both unincorporated territory (towns) and incorporated territory (all or part of any city or village) may be included within the district.

Once a district is created the county board(s) of the county in which the district is located may appoint a sewer and water commission. This commission has the same powers as the county boards have (444.075) to do all things necessary to construct, own, operate and maintain a system. These powers are set out in sec. 116A.24.

It is imagined that the district commission has legal standing to sue or be sued; however, it is certain that the counties within the district do have standing. Also, condemnation powers and the power to control and regulate the systems is inherent in the grant of power to construct and operate the systems.

After a contract for the construction of the system is executed, county boards within the district are authorized to issue county general obligation bonds (116A.20 and chapter 475). If the taxes collected to repay these bonds is insufficient, the county board may make appropriations from the general fund sufficient to make up any deficiencies (116A.21).

The statutes clearly authorize the use of special assessment upon benefited property in the district to raise revenue (116A.16). Also, the county board of any county may provide for the collection of service charges for all or any part of the cost of operation of the system (116A.22).

Under sec. 116A.23 any county within the district may apply for and accept grants and loans of money and property from the U.S., a state or an individual. It seems that projects undertaken by the county(ies) for the district should meet the grant eligibility requirements of PL92-500.

DISTRICT, SEWER AND WATER - MINNESOTANecessary/Desired Powers:Express Statutory Authorization

- |   |  |
|---|--|
| 1. Own, operate and maintain<br>non-central systems | County board - 444.075<br>Water and sewer - 116A.24<br>Commissioners |
| 2. Power to: Contract                               | 116A.13  |
| Incur indebtedness                                  | 116A.20 and Chapter 475  |
| Sue/be sued   | inherent   |
| Condemnation  | inherent   |
| 3. Revenue: User charges                            | 116A.22  |
| Special assessments                                 | 116A.16  |
| Taxation  | Bond repayment - 116A.21   |
| 4. Control extension of services                    | inherent   |
| 5. Make rules and regulations                       | inherent   |
| 6. Accept grants                                    | federal and state - 116A.23  |

## WISCONSIN

Cities

In Wisconsin cities are specifically granted the power to construct sewer systems including treatment plants and related facilities and to make additions, alterations and repairs to the system(s) [62.18(1)]. Cities are also given a similar grant of authority in sec. 66.076 which specifically authorizes the city to provide services outside its boundaries and permits the city to obtain sewage service from other entities.

Cities are granted the authority to acquire real or personal property by gift, grant, purchase or condemnation for sewerage [62.22(1) and (1m)]. The city boards of public works are granted the authority to operate and manage sewerage systems (67.14).

Cities in Wisconsin are clearly bodies corporate and as such have the inherent powers to sue and be sued and to contract to implement its power. The contracts must be let according to sec. 62.15. Further, sec. 66.33 authorizes cities to enter into contracts for sewer services with industry.

Cities in Wisconsin may incur indebtedness to fund sewerage by a multitude of financing techniques provided in the statutes. They may issue general obligation bonds (67.04), promissory notes (67.12), mortgage bonds (66.066), and special assessment bonds (66.54), just to name the most important.

Cities may charge user charges (66.076 and 66.60) any may levy special assessments to cover sewerage costs (66.076 and 66.60). Subject to certain constitutional and statutory limitations on indebtedness, amount of levy and percent of annual levy increase, cities are empowered to levy taxes (62.18).

Cities are not specifically granted the power to control the sewage system by refusing to receive wastes. Certain authority over the extension of services, must, however, be implied as a power inherent in the grant of authority to operate a sewage system. This inherent power would lie in the city's board of public works (62.14).

Cities are clearly authorized to accept both federal and state grants under sec. 66.33. Wisconsin does have a limited state grant program available to cities and cities are also clearly grant eligible under PL92-500.

#### CITIES - WISCONSIN

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	62.18(1), 66.076, 62.22, 62.14
2. Power to: Contract	62.15, 66.33, 66.29
Incur indebtedness	67.04, 67.12, 66.066, 66.54
Sue/be sued	Inherent
Condemnation	62.22
3. Revenue: User charges	66.54, 66.60(16)
Special assessments	66.076, 66.60
Taxation	62.18
4. Control Extension of services	62.11, 62.14
5. Make rules and regulations	62.11, 62.14
6. Accept grants	66.33



### Villages

In Wisconsin villages (and towns granted village board powers via 60.18) are granted the same authority that cities have to construct, alter and repair sewage systems (61.36). Also, the provisions of sec. 66.076 are applicable to villages, as well as cities (see discussion under cities).

Villages may acquire real or personal property by gift, grant, purchase or condemnation for any proper purpose under its general grant of power (61.34).

Villages are bodies corporate and as such have the inherent power to sue and be sued and have the legal standing to enter into contracts (implied by 61.34). Of course these contracts must be made pursuant to general statutory safeguards (66.29).

Villages have powers similar to cities in the area of incurring indebtedness, raising revenue, and accepting grants (see discussion of cities). Village taxing power is subject to slightly different limits on the amount of levy but faces identical indebtedness and levy increase limits. Sec. 61.34 gives villages the authority to levy taxes for any authorized purposes.

Villages are not expressly granted the authority to control the sewage system by refusing to receive wastes. However, the authority to regulate must be inherent in the grant to villages which permitted them to own and operate such systems.

Villages are authorized to accept both federal and state grants (66.33).

### Towns

Towns in Wisconsin are bodies corporate and have the power to contract, sue and to acquire real and personal property (60.01). The power of the town is retained by the electors in the town and the town board has very limited power to act without approval of the electors.

## VILLAGES - WISCONSIN

(and towns with village board powers 60.18)

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	61.34, 61.36, 62.18, 66.076, 61.39
2. Power to: Contract Incur indebtedness Sue/be sued Condemnation	66.076, 66.29, 66.33 67.04, 67.12, 66.066, 66.54 inherent 61.34 and chapter 32
3. Revenue: User charges Special assessments Taxation	66.076, 66.60 66.076, 66.60 61.34
4. Control extension of services	( )
5. Make rules and regulations	( )
6. Accept grants	66.33

It appears that the town could construct, acquire, lease, extend or improve sewage facilities subject, of course, to approval by the electors (66.076). Clearly, the town has several means to incur indebtedness, such as borrowing (67.17), town bonds (60.18), general obligation bonds (67.04), mortgage bonds (66.066) and special assessment bonds (66.54). All of these methods are subject to approval by the electors and limited by statute and constitution. The town may raise revenue by collecting user charges (66.076), special assessment (66.60) and taxation (60.18), again subject to approval by the electors.

Control of the extension of services and the ability to make rules and regulations regarding the use of the sewage system must be implied from the fact that the town is authorized to construct it in the first place.

Clearly, towns may accept both federal and state grants (66.33).

## TOWNS - WISCONSIN

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	60.01, 66.076
2. Power to: Contract	60.01
Incur indebtedness	60.18(7), 67.12, 60.18
Sue/be sued	67.04, 66.54, 66.066
Condemnation	60.01
	32.02
3. Revenue: User charges	66.076, 66.60
Special assessments	66.60
Taxation	60.18(1)
4. Control extension of services	(        )
5. Make rules and regulations	(        )
6. Accept grants	66.33

Counties

Counties are bodies corporate and as such are empowered to acquire real and personal property, to sue and to enter into contracts when necessary to exercise the powers which are granted to it. There is some doubt as to whether counties can acquire and operate sewage facilities; but sec. 59.07(1)(d) seems to grant them this power.

Counties are much more limited in the financial methods available to allow them to incur indebtedness; however, they are given the power to use mortgage bonds, and constructors certificates to finance the construction of sewerage (66.066). They may tax (59.07), charge users charges (59.07) and might in some instances be able to levy special assessments. However, the intent of the statutory section seemed to limit the grant of the authority to the construction of solely revenue generating facilities. Because of this limitation, it is felt that under current law, counties in Wisconsin would not be an adequate entity to own and operate non-central systems. This belief is reinforced by the fact that it appears that counties are not authorized to accept grants (66.33).

## COUNTIES - WISCONSIN

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	59.07(1)(d)
2. Power to: Contract	59.01
Incur indebtedness	66.066, 66.54
Sue/be sued	59.01
Condemnation	32.02
3. Revenue: User charges	59.07(1)(d)3
Special assessments	( )
Taxation	59.07
4. Control extension of services	( )
5. Make rules and regulations	( )
6. Accept grants	unclear

Districts, Town Sanitary

Wisconsin Statutes provide for the creation of a special purpose district which appears to be ideally suited to the management of non-central systems. The town sanitary district (TSD) may be created in any unincorporated territory of the state and is authorized to construct and maintain a system of "sewerage works" (60.306). Sewerage works are defined with sufficient breadth to subsume non-central systems, as well as conventional ones.

TSD's are given the authority to enter into contracts (pursuant to certain bid) procedures (60.306). They are given the power to sue and be sued (60.30). However, there is some question whether TSD's can exercise the power of eminent domain. Chapter 32 of the statutes appears to be broadly worded to permit the condemnation by districts; however, indicative of the doubt is the fact that legislation has been introduced to give them this power.

Clearly, the TSD's have more than adequate authority to incur indebtedness for any proper purposes. TSD's may borrow money (67.12 via 60.307), and may issue mortgage bonds (66.066 via 60.305), TSD bonds (60.307), revenue bonds (66.059) and

special improvement bonds (66.54 via 60.309).

TSD's are authorized to collect user charges (60.306), to collect sewer rental or sewerage service charges [66.076 via 60.306(5)], and to levy special assessments (60.309). Also TSD's are authorized to levy a tax upon all taxable property within the district to cover the costs of operation, maintenance, debt service and administration (60.306).

TSD's are authorized to make rules and regulations (60.306) and may issue orders (60.306). They are statutorily required to project and plan sewerage works and are given express authorization to take all proceedings necessary to carry out their powers and duties (60.306). Presumably this could include the control over provision of services.

TSD's are authorized to accept any state or federal grants (66.33) and would be grant eligible for PL92-500 funds.

#### DISTRICTS, TOWN SANITARY - WISCONSIN

<u>Necessary/Desired Powers:</u>	<u>Express Statutory Authorization</u>
1. Own, operate and maintain non-central systems	60.306
2. Power to: Contract	60.305
Incur indebtedness	67.12, 66.066, 60.307, 66.54
Sue/be sued	60.30
Condemnation	Chapter 32
3. Revenue: User charges	60.306
Special assessments	60.309
Taxation	60.306
4. Control extension of services	60.306
5. Make rules and regulations	60.306
6. Accept grants	66.33



APPENDIX B

PROPOSED EASEMENTS





EASEMENT #1For Gaining Necessary Rights of Way for Individual  
Systems of Each Property Owner

An Easement on which to construct, operate and maintain (including replacement) a septic tank and septic tank effluent discharge line to public sanitary sewer, said easement to include that land of the Owner upon which the existing septic tank or proposed septic tank is to be located and an area extending 10 feet each way from said tank. Also said easement includes a strip of land of the Owner 20 feet in width from the discharge of the septic tank to the public sanitary sewer. The actual location of these facilities shall be as indicated on "as-built" drawing of these facilities on file with the secretary of the Westboro Sanitary District. Initially the location of these facilities shall be in accordance with the construction plans on file with said secretary.

(A similar easement description would be written for any septic tank-soil absorption field systems entirely on private property but owned and operated by the district.)

EASEMENT #2For Gaining Necessary Rights of Way for Collector  
Sewers Serving Individual Septic Tanks

An easement on which to construct, operate and maintain a public sanitary sewer.

Said easement is described as follows:

The reference line of the easement is described as follows:

Commencing at \_\_\_\_\_

Said easement includes all that land of the Owner lying between lines parallel to and 10 feet each way from the above-described reference line from the P.O.B. of said reference line \_\_\_\_\_ feet to the end.



"NON-CENTRAL" SYSTEM ALTERNATE #4

Part A: Grossman's Add. - S.D. Gravity Sewers  
to Sand Filters

Part B: Front St. & Joseph's Add. - Press.  
Sewers to Soil Absorption

Part A	\$148,038.00
Part B	185,308.00
Individual Systems	<u>11,976.23</u>

\$345,322.23

"NON-CENTRAL" SYSTEM ALTERNATE #5

Total Gravity Sewers to Soil Absorption

Joint System	\$254,440.00
Individual Systems	<u>11,976.23</u>

\$266,416.23

"NON-CENTRAL" SYSTEM ALTERNATE #6

Total Pressure Sewers to Soil Absorption

Joint System	\$294,154.00
Individual Systems	<u>11,976.23</u>

\$306,130.23

gen content. Phosphorus, however, will have been removed through adsorption and precipitation reactions in the soil (3). Pathogenic bacteria and viruses should also be removed (12, 14). This method of disposal is superior to direct discharge of treated effluent into Silver Creek because such effluents contain phosphorus and pathogenic organisms and viruses, as well as nitrogen.

#### Institutional Arrangements

To properly manage its non-central system the Westboro Town Sanitary District must regulate all individual and jointly used on-site disposal systems operating within its boundaries. While no Town Sanitary District has attempted this in Wisconsin, it is within their power to do so. (See Appendix A) Briefly advantages would arise because the District would be able to better perform the following functions:

1. Design and construct sanitary facilities for existing and future structures.
2. Identify and obtain rights to land with suitable soils for disposal areas setting aside sufficient areas for future growth.
3. Operate and maintain all individual and joint systems within the District, including pumping of all septic tanks.
4. Monitor groundwater and surface water quality to detect failing systems.
5. Repair or reconstruct any failing systems.
6. Establish a fair assessment and rate structure for subscribers to pay for cost of services.
7. Apply for grants in aid of construction for portions of the sanitary facilities that the District will own.

Access to Private Property: Many of the facility components of the recommended non-central facility, such as septic tanks and effluent pumps will be located on private property. Since regular maintenance of these components is necessary for proper functioning of the facility, permanent legal access to the properties must be obtained for purposes of installation, operation and maintenance. These easements are required prior to construction. In most cases, however, the exact location of the existing septic tank is unknown. Therefore, a general easement tied to the location of the septic tank rather than the property line is proposed. (See Appendix B)

Easements must also be obtained for any collection sewers of joint systems which cross private property. It is proposed that easements of this type be tied to a section corner. (See Appendix B)

It is hoped that the necessary easements can be acquired voluntarily from the property owners. Since all property owners within the district will be assessed for the cost of the facility, whether they use the facility or not, the owners might be encouraged to grant the required easements. Another factor which might serve to encourage the property owners to grant easements is the risk of prosecution by the county or state against the continuing use of their failing septic tank system. If the property owner fails to grant the easements voluntarily, however, the District could condemn such easements through eminent domain proceedings. This alternative, of course, is undesirable. The success of the non-central system depends on a strong "community effort."

Subscriber's Responsibilities: The District will be responsible for the operation and maintenance of all components of the facility located on private land commencing from the inlet of the septic tank. The property owner's only responsibility will be to provide and maintain the lateral drain from his home or establishment to the septic tank and any power costs associated with lifting his effluent

into the collection sewer or absorption field, if necessary.

#### Financing of Proposed Plan

Since Westboro's priority for Federal EPA construction grants is very low, other sources of funding were sought for construction of the proposed facility. Tentative commitments were obtained from the Wisconsin Department of Natural Resources (DNR) and the USDA Farmer's Home Administration (FmHA) for grants totaling approximately 50 percent of the construction costs. The DNR grant would be for approximately \$30,000 and the FmHA grant about \$77,000. The remainder of the construction funds would be provided by a FmHA 4 percent, 40 year loan totaling approximately \$105,000. These were based on an initial construction cost of \$229,000.

Special assessments and monthly charges will have to be agreed upon by the commissioners of the sanitary district, though. However, to estimate their grant contribution, FmHA assumed a monthly charge of \$8 per residence, \$15 per commercial establishment and \$1240 for the school and a 0.004 sanitary levy would be sufficient to retire the debt and cover costs for operation and maintenance. Special assessments of \$200 per residence, \$300 per commercial establishment and \$1500 to the school would be the remaining contribution made by the community. (See Tables VIII and IX)

Since those residents who recently constructed new septic tank systems would be reluctant to join the system, credit would be extended to them depending on the age and condition of their septic tank. In most cases the septic tank would be suitable for use by the community system, thereby saving the district the cost of a septic tank. This savings will be returned to the owner inversely proportional to the age of the tank.

New subscribers joining the system after construction of the facility should be expected to pay a larger assessment. A formula might be worked out whereby new residents would pay all costs of hooking to the collection sewer and their share of the absorption field. This is a decision which will have to be made by the district commissioners.

While the costs are within the financial capabilities of the community, the financial grants are not as large as hoped. Biases in funding guidelines prevent agencies from providing more despite the fact that Westboro made efforts to construct a more cost effective facility. The DNR grant from funds provided by the State of Wisconsin is limited to 25 percent of construction costs of grant eligible items. Any portion of the system located on private property, whether or not permanent easements have been given, is not considered eligible. This is unfortunate, since it disallows the septic tanks which provide partial treatment necessary to permit the use of less costly sewers. The savings made by DNR due to the more cost effective facility are not passed on to the community. Land purchase is also excluded, though the soil becomes the final treatment facility in this plan.

The Farmers Home Administration does not distinguish between items for eligibility but rather bases their grant contribution on what they feel is the communities' ability to pay. For the remaining portion paid by the community, a 5 percent, 40 year loan is offered. The amount of the grant portion is determined by assuming a monthly charge and special assessment per residence and a sanitary tax levy according to the wealth of the community. This income is used to retire the debt and pay for operation and maintenance over the 40 year loan period. By back calculating, the amount of the grant is determined but it cannot exceed 50 percent of the total construction costs.

TABLE VIII. FINANCING PLAN FOR  
"NON-CENTRAL" ALTERNATE #5

ITEM	BORROWER CONTRIBUTION	STATE GRANT	FHA GRANT	FHA LOAN	TOTAL
COLLECTION					
Development	\$ 7,000	\$ 5,000	\$51,000	\$ 45,000	\$108,000
Land & Rights					
Legal Services		1,000	1,000	2,000	\$ 3,000
Engr. & Inspect.			3,000	2,000	\$ 6,000
Interest	3,000				\$ 3,000
Contingencies		2,000	5,000	3,000	\$ 10,000
Subtotal	\$10,000	\$ 8,000	\$60,000	\$ 52,000	\$130,000
TREATMENT					
Development		19,000	15,000	44,000	\$ 78,000
Land & Rights	4,000				\$ 4,000
Legal Services				2,000	\$ 2,000
Engr. & Inspect.		1,000	1,000	2,000	\$ 4,000
Interest	3,000				\$ 3,000
Contingencies		2,000	1,000	5,000	\$ 8,000
Subtotal	\$ 7,000	\$22,000	\$17,000	\$ 53,000	\$ 99,000
PROJECT TOTALS	\$17,000	\$30,000	\$77,000	\$105,000	\$229,000



Both of these policies do not provide much incentive for communities to construct more cost effective facilities. The guidelines for the DNR grant program should be reevaluated to see whether or not vital portions of the system located on private property cannot be grant eligible if permanent easements are obtained. If not, the community would be inclined to construct as much of the system on public right of way as possible. This could increase the cost to DNR and the taxpayer, but reduce the cost to the resident.

The FmHA policy provides little more incentive to construct less costly systems. By back calculating from a basic monthly charge and special assessment, regardless of the system used, the cost to the community residents changes little. This policy must be made more flexible to credit communities willing to make an effort to reduce costs.

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TABLE IX. INITIAL OPERATING BUDGET

INCOME

70 homes @ \$8.00/mo.	\$5880.00	
5 commercial est. @ \$15.00/mo.	900.00	
1 school	1240.00	
Sanitary tax levy @ 0.004%	<u>3052.00</u>	
		\$11,072.00

EXPENSES

Operation & Maintenance	\$3350.00	
Capital Improvements	500.00	
Debt Repayment	6225.00	
Reserve	<u>622.00</u>	
		\$10,697.00

BALANCE

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\$ 375.00

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### Monitoring Program

Performance reliability of the proposed facility remains to be proven. Public ownership and management of septic tanks located on each private lot served is rather new. The success of small diameter gravity sewers depends upon proper maintenance of the septic tanks. Further, the effects of a large soil absorption field on groundwater quality have not been established. These items will be monitored by SSWMP for the next three years, pending the availability of funding. For the first year of operation UGLRC has provided the necessary money. The following plan of action will be initiated:

1. Background environmental quality data will be established from soil, surface water and groundwater samples taken prior to the construction of the facility. These samples will be analyzed for pathogenic indicators, virus, nutrients and other quality characteristics.
2. Sampling and analysis will continue throughout the construction and for the first several years of operation of the facility to evaluate its effectiveness in maintaining the environmental quality.
3. Observation stations will be constructed at several locations in the collection networks to evaluate their performance. Flow rates and volumes will be measured and samples collected to help establish sound design criteria and maintenance requirements.
4. The central management entity will be evaluated for its effectiveness to manage dispersed systems. Administrative procedures will be refined as needed.
5. Procedures will be established which can be used for organizing central management entities and for designing, constructing and maintaining alternate facilities in other communities.

The monitoring program would continue under SSWMP supervision for a period of 3 years. At the end of that period those monitoring stations felt to be critical would continue to be maintained by the Westboro Town Sanitary District.