INTERIM REPORT — ENGINEERING/FINANCIAL

SEVERANCE, COLORADO

PLAN FOR WASTEWATER TREATMENT WORKS

Water Quality Management Plan

LARIMER-WELD REGIONAL COUNCIL OF GOVERNMENTS
LOVELAND, COLORADO

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PREPARED BY BRISCOE, MAPHIS, MURRAY & LAMONT, INC.
BOULDER, COLORADO
AND TOUPS CORPORATION
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208 AREAWIDE WATER QUALITY MANAGEMENT PLAN

TECHNICAL PLANNING REPORT
WASTEWATER TREATMENT WORKS
SEVERANCE, COLORADO

Prepared For

Larimer-Weld Regional
Council of Governments

201 East Fourth Street
Loveland, Colorado 80537

F. A. Eidsness, Jr., 208 Program Director
Terrence L. Trembly, Assistant Director

Technical Planning By:

W. Tom Pitts, P.E., Project Director
W. R. Everest, P.E., Project Manager
W. B. Heller, P.E., Project Engineer

TOUPS CORPORATION
Loveland, Colorado

Financial Planning By:

James Murray, Ph.D.
E. W. Lewan, P.E.

BRISCOE, MAPHIS, MURRAY, AND LAMONT, INC.
Boulder, Colorado

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1.1 TECHNICAL PLANNING SUMMARY

The septic tank systems currently being used by the Town of Severance for sewerage service are failing, and pose a health hazard to the residents. The Weld County Health Department has a policy of not allowing additional septic tanks in the town. Since other basic municipal services are offered, the lack of a municipal wastewater treatment plant is the major growth constraint in the town.

Several wastewater treatment alternatives available to Severance are evaluated in this report. Considering the Weld County Health Department policy concerning future septic tanks, the results of the technical analysis of these alternatives indicate that it will be necessary to construct a centralized sewerage system if the town desires to grow. The most cost-effective solution is the construction of a wastewater collection system throughout the town, and a treatment facility in the vicinity of Law Reservoir. The treatment plant would consist of a multi-celled aerated stabilization pond system, polishing pond, and chlorination facilities. Total project costs are estimated to be $246,000. Initial operation and maintenance approximate $3,700 annually.

This cost-effective system is based on conformance with EPA-proposed waste discharge standards which contain a relaxed suspended solids limitation for pond systems. If these proposed standards are not adopted by EPA, it would be necessary for the town to construct a mechanical treatment plant. Under this alternative, total system costs would increase to $315,000 capital and $6,400 initial O&M, respectively. These higher costs would result in the project being financially infeasible.

A process has been outlined in the report such that the town can make its own decision concerning financial planning for the project. Specific sources and amounts of financing can be estimated and combined into an overall financial plan and revenue program. The process can be used to refine the program to meet Severance's specific circumstances, and the town's willingness and ability to assume financial committments.

1.2 FINANCIAL PLANNING SUMMARY

Serverance has very limited financial capability for the construction and operation of a central wastewater facility. The tax base is quite small, reflecting the Town's small population. Even though the combined mill levy is not high at 67 mills, each additional mill would produce only $117 for the Town. No Town sales tax is levied. Although this source is a possibility, these funds may be needed for other non-revenue producing facilities desired by the Town's residents. Median family income is quite low as reported in the 1970 census. This indicates a limited capacity for the Town to set user charges to finance a central sewerage system. Severance is not in a favorable position to generate public revenues for any major community project. It will be essential that capital funds are raised from sources outside the community. This may be from grants and/or developer participation.

Problems that will arise as the Town attempts to garner the necessary financing for its wastewater system will demand much attention from the existing residents. However, care should be exercised not to overlook the broader problem at hand which is how a central wastewater system should be managed in the best long-run interests of the citizens. Management policies regarding the utility service area, extensions, and utility operation are equally as important, and closely related to, financial policies on new hookup and service charges. Policies in these areas should be discussed early to gain citizen understanding and to set the stage for the purely financial decisions. To assist in these areas, the Town should obtain a copy of the Utility Management Handbook (1977) available from the LWRCOG.

Assuming outside assistance can be obtained to cover the system capital costs, the most critical financial variable will be the Town's success in securing hookups from among the existing residents. A maximum of 50 taps appears to be potentially possible. Because this group of system users will bear most of the costs (over that which can be charged to new growth) a maximum number agreeing to hookup initially will lower the individual burden to each. For this reason, incentives (or advance agreement) to hookup immediately are highly desirable. This suggests the plant investment fee (PIF) charged the existing residents should be lower than what might be charged new growth.

If the Town can secure all 50 potential hookups, and obtain 100 percent outside capital funding, annual user charges of $86 would cover the system's operational costs, even with no growth beyond the first 50 taps. Growth would lower this charge per user so long as no additional operating or capital costs are incurred. If there is a developer in the picture, the possibility that the developer might cover service charges on prepaid taps should be explored.

Of utmost importance is that Severance is sure of its residents' desire for a central system, and their understanding of, and willingness to bear the associated costs. If there is agreement to proceed, the management policies should be discussed and sources for outside financial assistance contacted.

2.0 INTRODUCTION

2.1 AREAWIDE WATER QUALITY MANAGEMENT PLANNING PROCESS

This Technical Planning Report has been prepared as part of an overall Areawide Water Quality Management Plan (208) for the Larimer-Weld region begin developed by Toups Corporation and Briscoe, Maphis, Murray, and Lamont, Inc., for the Larimer-Weld Regional Council of Governments (LWRCOG). The purpose of the Technical Planning component of the 208 plan is to assist various communities in the Larimer-Weld region in solving particular wastewater management problems by developing the best alternative project for waste treatment and disposal.

This Technical Planning Report has been prepared to provide near-term guidance for the Town of Severance. This report (along with appropriate modifications) will be incorporated into the LWRCOG Areawide Waste Treatment Management Plan following review and approval by all governmental agencies involved.

2.2 PURPOSE AND SCOPE OF TECHNICAL PLAN

The residents of the Town of Severance currently use septic tanks for wastewater disposal. These systems have not performed satisfactorily in recent years due to a high water table. The Weld County Health Department (1976) has expressed concern for groundwater quality degradation in the area, and they have indicated that existing septic tanks are inadequate. Development of a recently proposed 115-unit subdivision has been prevented due to lack of community sewerage facilities. An engineering study was prepared for the Town of Severance in 1975 to investigate the feasibility of installing a community wastewater treatment system. The report was not approved by the Colorado Department of Local Affairs or by the Colorado Department of Health. A site application submitted to the Colorado Water Quality Control Commission has been tabled for more than a year pending satisfactory completion of a feasibility study.

2.2.1 Purpose

The purpose of this Technical Plan is to reanalyze all wastewater treatment and disposal options available to the Town of Severance, recommend the best alternative project, and fully describe that project. Upon completion of the report, the town may submit an application for a governmental grant to assist in project implementation and solve the problems discussed above.

2.2.2 Scope

The scope of this Technical Plan includes the following phases:

- Describe the planning area characteristics;
- Determine wastewater characteristics;
- Analyze waste treatment and discharge requirements;
- Develop, analyze, and screen alternative plans;
- Prepare a detailed description of the best alternative project, including engineering, financial and institutional programs;
- Prepare a Technical Planning Report presenting all data, and outlining a wastewater management program for the 20-year planning period.
- Assessment of current financial capabilities;
- Development of a procedure for establishing a financial program;
- Analysis of the ability (and risks involved) in financing the proposed wastewater treatment program.

3.0 PLANNING AREA CHARACTERISTICS

The Town of Severance is located in west-central Weld County approximately six miles northeast of Windsor. Severance was founded in 1906 and incorporated in 1920. Severance is primarily a residential community; however, there are presently some limited commercial and industrial activities within the town. The location and current town boundary of Severance is shown on Figure 3.0-A.

3.1 EXISTING AND PROJECTED POPULATION

The population of Severance at the time of the 1970 Census was 52 people. The present population is estimated to be about 100 people. The proposed 115-unit subdivision will increase the population by slightly more than 400 when fully developed.

Projection of future population for a town such as Severance is difficult. The development of a single subdivision can drastically alter any projections that are made. Past projections have indicated only minimal growth, primarily because of a lack of a community sewerage system. However, the town is centrally located, easily accessible, has a relatively low tax structure, and served with other required utility services. Based on these factors, and assuming a wastewater treatment and disposal system can be developed in the town, moderate growth will occur.

Previous population projections developed for the Town of Severance [NHPQ-1975] indicate an estimated 777 people by 1997. A population of 800 by the year 2000 is utilized for planning purposes in this report. It is estimated that the 1983 population of the town will be approximately 600, assuming full development of the presently proposed subdivision by that time.

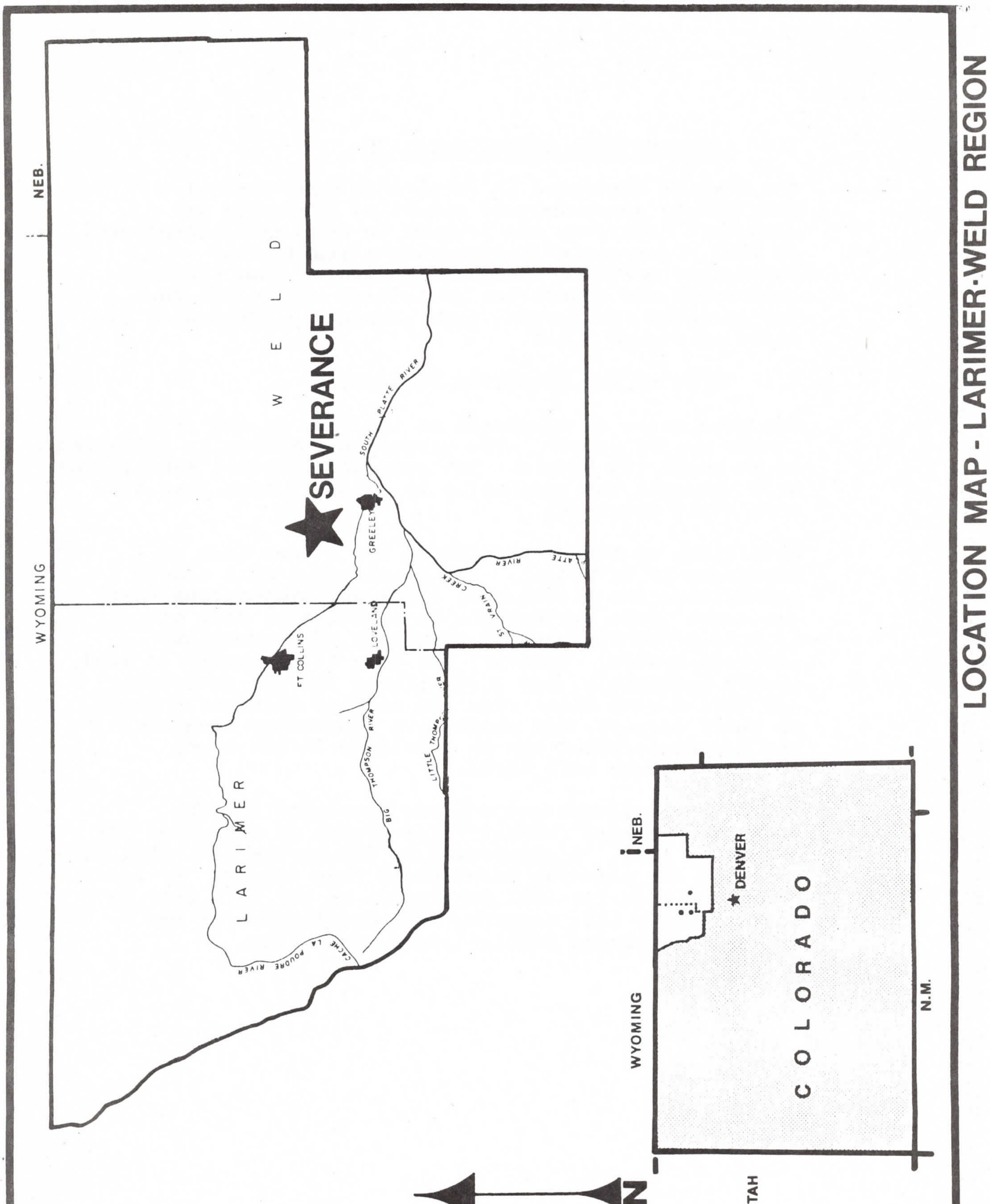

FIGURE 3.0-A. LOCATION OF SEVERANCE

4.0 WASTEWATER CHARACTERISTICS

Because no treatment system presently exists in Severance, wastewater characteristics will be estimated based on historical data, results of a regional wastewater quality sampling program recently conducted by Toups, and on recommended design criteria published by the Colorado Department of Health (CDH). Wasteload projections will be developed based on waste characteristics and population projections.

4.1 ESTIMATED CHARACTERISTICS

In analyzing wastewater characteristics, it is necessary to investigate components affecting both the amount of wastewater and its strength and composition.

4.1.1 Flow

Since Severance is predominately a residential community and will probably continue as such, a unit average flow of 100 gallons per capita per day (gcd) is a realistic value for design purposes and will be utilized in this report. This value represents typical domestic waste, including residential and normal commercial contributions, together with infiltration/inflow (I/I) expected even from well-designed and constructed sewerage systems. Peak flow will be calculated based upon 250 percent of the average flow. These two values are also recommended by CDH.

4.1.2 Composition

Wastewater strength is generally measured in terms of biochemical oxygen demand (BOD_5) and suspended solids (SS). Evaluation of other constituents such as chemical oxygen demand (COD), ammonia (NH_3), temperature and pH are necessary in particular situations.

Based on past analyses of waste characteristics in the area, and the results of a sampling program conducted by Toups Corporation in the Larimer-Weld region as part of the Technical Planning component of the 208 Plan, the following unit values are appropriate for design purposes: 200 milligrams per liter (mg/l) BOD_5, 200 mg/l SS, and 15 mg/l ammonia. Based on a unit flow of 100 gcd, the unit strength of wastewater is 0.18 pounds per capita per day (pcd) BOD_5 and 0.18 pcd SS.

4.1.3 Design Factors

A summary of unit design factors for sizing various components of the wastewater system is presented in Table 4.1.3-A.

4.2 WASTELOAD PROJECTIONS

Wasteload projections have been developed by applying the unit design factors shown in Table 4.1.3-A to the projected population of 800. Resulting wasteload projections are summarized in Table 4.2-A.

TABLE 4.1.3-A. UNIT DESIGN FACTORS

ITEM	FACTOR
Wastewater Flow	
Average flow (gcd)	100 (a)
Peak flow (% of average)	250
Wastewater Composition	
BOD_5 (pcd)	0.18
SS (pcd)	0.18
Ammonia (mg/l)	15

gcd = gallons per capita per day
pcd = pounds per capita per day
(a) Includes minimum I/I contributions.

TABLE 4.2-A. WASTELOAD PROJECTIONS

CONSTITUENT	WASTELOAD
Flow (gd)	
Average flow	80,000
Peak flow	200,000
Average Composition (lbs/day)	
BOD_5	150
SS	150
Ammonia	10

gd = gallons per day

5.0 DISCHARGE AND TREATMENT REQUIREMENTS

Wastewater must be disposed of in a manner which will protect the public health, maintain receiving water quality consistent with its beneficial uses, and prevent nuisance at the site of disposal. These conditions, along with economic considerations, determine the degree and type of wastewater treatment necessary prior to disposal or reuse. In this section, discharge standards are delineated, treatment requirements are outlined, and an overview of alternative treatment processes are presented.

5.1 WASTE DISCHARGE STANDARDS

Standards promulgated by the U.S. Environmental Protection Agency (EPA) and the Colorado Water Quality Control Commission (WQCC) for the discharge of wastes to receiving waters have been extensively discussed in the South Platte River Water Quality Management Plan [Toups-1974]. Current standards have been refined, and further changes are presently being proposed.

5.1.1 Existing Requirements

As a minimum, planning of publically-owned wastewater treatment facilities must provide for secondary treatment by 1977 or as soon as possible thereafter, and for application of Best Practicable Waste Treatment Technology (BPWTT) prior to 1983. The levels of BPWTT and various waste management techniques available to meet those levels have been defined [EPA-1975]. Secondary treatment and BPWTT requirements apply to discharges to all surface waters of the State. The WQCC has ruled that these standards also apply to discharges to privately-owned irrigation supply waters. More stringent standards apply to discharges to water quality limited segments of State receiving waters; however, no such segments are located in the vicinity of the Town of Severance. Table 5.1.1-A summarizes current EPA secondary treatment requirements as promulgated under the Federal Water Pollution Control Act Amendments (PL 92-500), together with current standards of the Colorado WQCC.

5.1.2 Proposed Requirements

EPA has recently proposed a relaxation of suspended solids limitations in discharge standards of communities which utilize stabilization pond systems (Federal Register, September 2, 1976).

The proposed standards recognize the need to retain pond systems for many smaller communities because of their inherent economical and functional advantages. Adoption of the regulations would allow the EPA Regional Administrator or state agency to grant a variance with respect to suspended solids limitations of secondary treatment requirements defined in NPDES permits, providing the community can show that: (1) waste stabilization ponds are used as the process for secondary treatment; (2) the treatment facilities have a design capacity of 1 mgd or less; and (3) performance data indicates that the facilities cannot comply with present suspended solids limitations, even if properly operated, without the addition of treatment systems not historically considered as secondary treatment (i.e., filtration systems for algae removal).

Pond systems would still be required to meet an effluent quality achievable by "Best Waste Stabilization Pond Technology" (BWSPT). BWSPT is defined as a suspended solids value which is equal to the effluent concentration achieved 90 percent of the time within a state or appropriate contiguous geographical area, by waste stabilization ponds that are achieving the levels of effluent quality established for BOD (30/45 mg/l).

TABLE 5.1.1-A. CURRENT WASTE DISCHARGE REQUIREMENTS

Parameter	Federal PL 92-500		State WQCC		
	30-day Average	7-day Average	30-day Average	7-day Average	Single Sample
BOD_5 (mg/l)	30(a)	45	ns	ns	ns
SS (mg/l)	30(a,d)	45(d)	ns	ns	ns
pH	ns	ns	ns	ns	(b)
Total Residual Chlorine (mg/l)	ns	ns	ns	ns	0.5
Fecal Coliform (MPN/100 ml)	ns	ns	6,000	12,000	ns
Oil and Grease (mg/l)	ns	ns	ns	ns	10(c)

ns = none specified

(a) Shall not exceed 15 percent of 30-day average influent concentration.

(b) Within the limits of 6.0 to 9.0 unless it can be demonstrated that: (1) inorganic chemicals are not added to the waste stream as part of the treatment process; and (2) contributions from industrial sources do not cause the pH to exceed the 6.0 to 9.0 limits (EPA requirements).

(c) Nor shall there be a visible sheen.

(d) Conditional relaxation of these standards now proposed by EPA for communities utilizing stabilization ponds systems with a design capacity of 1 mgd or less.

5.2 OVERVIEW OF ALTERNATIVE TREATMENT METHODS

There are three general classes of treatment systems available today: land treatment, treatment and reuse, and treatment and discharge. The first two alternatives will be discussed in general while the third--treatment and discharge--will be developed in detail.

5.2.1 Land Treatment

Land treatment must be distinguished from treatment and reuse by agriculture. While these two alternatives may involve identical processes, land treatment refers to the situation where the municipal agency is responsible for ownership, operation and maintenance for all treatment facilities involved with pretreatment (stabilization ponds, primary sedimentation, etc.), disinfection, land application, crop harvesting, etc. In contrast is treatment and agriculture reuse where the municipality enters into an agreement with a second party who accepts the treated wastewater and uses it for irrigation purposes. In this second alternative, the municipality generally assumes no responsibility for the distribution of the wastewater or for the harvesting of the crops.

The factors which affect the cost of a land system most directly is the area of land required for the design flowrate of the community. Both the size of the application equipment and the land capital costs are directly related to the required area which is determined by the allowable hydraulic loading rate. The allowable hydralic loading rate for a high-rate irrigation process is dependent only upon the soils' capacity for transmitting water and not on crop irrigation requirements. The maximum hydraulic loading rate is the sum of soil moisture depletion plus the quantity which can be transmitted through the root zone. The soil moisture depletion for the local climatic conditions is approximately 12 inches for the season while the soil transmission rate can range between 10 and 600 inches per year depending on soil type and surficial geology. Total hydraulic loading rates can therefore range between 22 and 612 inches per year which correspond to area requirements of 610 acres/million gallons and 20 acres/million gallons respectively.

The suspended solids concentration of the water also affects the hydraulic loading rate by clogging the soil. The rates discussed above must be considered maximum. There is also a "buffer area" requirement which increases the necessary amount of land.

The estimated cost of a land treatment system designed for a flowrate of 81,000 gpd is $333,000. Corresponding annual cost is about $31,000 per year.

A crop revenue of $5,000 per year has been estimated based on alfalfa having a net profit of $25.00 per ton and a yield of 4.5 tons per acre. The primary basis for this cost analysis is the Boulder, Colorado, Land Treatment Project which has similar climatic, geological, and soil characteristics.

The cost of this system is about $258,000 more than the treatment and discharge cost (which will be shown later). The revenue derived from crop production does not justify the cost.

5.2.2 Treatment and Reuse

Four factors prerequisite to wastewater reuse of treated wastewater are: 1) the availability of a wastewater reuser (industry or irrigation operation located in close proximity to source of treated wastewater); 2) storage facilities or alternate disposal site for wastewater during periods of non-reuse; 3) capability of producing treated wastewater effluent of required quality; and 4) legal ownership of the wastewater by the municipality.

The State of Colorado currently does not have water quality standards for reuse of wastewater for irrigation purposes. Assuming that the applicable standards will be no less stringent than the existing recommended Federal standards, it will be necessary for the plant effluent to satisfy a 30-30 standard. Since this standard is identical with the quality requirements for discharge, no additional treatment facilities would be required for agricultural reuse than if the water were discharged directly as is the current practice. The identical discharge standard also eliminate the requirement for effluent storage during non-irrigation periods. If it is desired to maximize the amount of wastewater reuse, a reservoir would be required to store water seasonally. This alternative will be further discussed later in the report.

5.2.3 Treatment and Discharge

There are many methods of treating municipal wastewater to a quality at which it can be discharged. Since the reuse of wastewater requires that water be treated to at least the same quality that a discharge would necessitate, treatment methods will be discussed in detail in Chapter 7.

6.0 BASIS OF PROJECT DEVELOPMENT

In subsequent chapters, specific treatment alternatives and costs will be discussed. A best alternative and recommended course of action will be derived from those discussions.

The treatment processes discussed will be evaluated in accordance with the Colorado Health Department's design criteria.

The cost of constructing and maintaining the facilities required for each of the alternative plans considered in this report includes the capital outlay necessary for initial funding plus continued expenditures for operation throughout the lifetime of the project. The data presented in the following sections will provide sufficient information for comparison of alternative plans.

7.0 ALTERNATIVE PLANS FOR TREATMENT AND DISPOSAL

This section includes a discussion of process selection criteria and a discussion of alternative treatment processes.

7.1 PROCESS SELECTION CRITERIA

The selection of the optimum process for an individual community should not be based exclusively on the economics of the individual processes capable of satisfying discharge requirements. Many of the technical and social factors should be considered in evaluation of viable alternatives. Community characteristics such as growth rate, land cost and availability, proximity of treatment facilities to residential or commercial areas, available operator capabilities, and treatment facility aesthetics affects (visual and odor) on the community, all have a bearing on the treatment facilities best suited for a given community.

There are a great number of alternative treatment processes capable of satisfying BOD_5 and suspended solids (SS) discharge requirements. The alternatives discussed in the following sections are those which have been found suitable for small communities. Processes requiring extremely sophisticated operator capabilities generally unavailable in small communities, such as continuous operator monitoring, are not considered in this report.

There are two major treatment plant classifications: biological and physical/chemical. Both types of processes have the same objective--removal of dissolved and particulate organic material. Biological treatment processes, some of which have been used since the turn of the century, depend on microorganisms to convert putrescible substances to less noxious chemical forms which are compatible with the environment. Controlled biological processes are those such as activated sludge or biofilters in which the biological growth conditions are artificially controlled; stabilization ponds or aerated lagoons are considered uncontrolled biological processes. Although the biofiltration process will produce a relatively high degree of treatment, it is difficult to consistently produce biofilter effluent quality that meets the 30 mg/l suspended solids limitation of the secondary treatment requirement. Therefore, the biofiltration process will not be considered further in this report. Physical/chemical treatment consists of the addition of various chemicals to aggregate and to aid settling particulate matter and to oxidize organic substances.

Depending on the particular effluent quality goals, physical/chemical plants may employ multimedia filtration, activated carbon adsorption, ozonation or any one of several other processes. While there are several small physical/chemical package plants currently on the market, none will be considered in view of their stringent operational requirements.

At Severance, the wastewater treatment process chosen must have the flexibility of being operable at extremely low percentage loading rates. It must also be easily expandable. This capability is necessary as protection against an enormous but unexpected growth rate.

7.2 ALTERNATIVE TREATMENT PROCESSES

The treatment processes that will be considered as alternatives in this report are shown in Table 7.2-A. Each is described below.

TABLE 7.2-A. ALTERNATIVE TREATMENT PROCESSES

DESIGNATION	PROCESS
	Pond Systems
1	Stabilization Ponds
2	Aerated Lagoons
3	Aerated Lagoons with Algae Removal
4	Total Evaporation System
	Mechanical Systems
5	Extended Aeration
6	Oxidation Ditch
7	Rotating Biological Contactor
8	Land Disposal
9	Septic Tank Systems

7.2.1 Pond Systems

According to the EPA, 25 percent of the wastewater treatment plants in this country are lagoons (Fed. Reg. 10/2/76). Nearly 90 percent of these wastewater treatment ponds serve communities of 5,000 population or less [ibid]. The reason they are so popular with small communities is because initial installation costs and operation and maintenance costs are relatively low. Because of the fairly long detention time in lagoons, they are less susceptible to slug shock loads or breakdown than are mechanical plants.

7.2.1.1 Stabilization Ponds

Stabilization ponds are lagoons with no mechanical aeration or mixing. These ponds generally range in depth from 3 to about 7 feet. Algae growing in the ponds supply dissolved oxygen. Because oxygen is only produced when algae is active, the ponds normally are anaerobic (no dissolved oxygen) at night and during the winter months. Odors are produced during anaerobic conditions. These odors can be especially bad in the spring right after the ice melts off the ponds. Unless the ponds are located quite a distance from inhabited buildings, the aesthetic effects make them undesirable. Further, it is stated in Colorado's manual of design criteria that "It is very doubtful that unaerated waste stabilization ponds can meet the effluent standards for discharge." [Rozich, 1973].

7.2.1.2 Aerated Lagoons

Aerated lagoons are similar to stabilization ponds. The only difference is that one or more of these ponds are aerated and mixed mechanically. This virtually eliminates periods of zero dissolved oxygen, and therefore odors are controlled. Since the addition of energy is required, operation and maintenance (O & M) costs are higher than for stabilization ponds, but not as high as for mechanical plants. These plants are normally designed with two or more cells in series. The final cell must be a quiescent pond to settle heavy particles. The weight of algae is so close to the weight of water that it remains suspended in the water and will not settle. It is for this reason that EPA is considering changing the suspended solids standard for lagoons.

7.2.1.3 Aerated Lagoons with Algae Removal

Many processes have recently been tested which could be added to lagoons to remove algae. These include rapid sand filters, intermittent sand filters, rock filters, air flotation, and chemical addition which aids settling. Chemical costs and/or operational costs for several of these processes are so high that the advantages of using lagoons are eliminated. Rock filters showed a great deal of promise. Several have been installed in Colorado recently. Evaluation of these indicates that about 50 percent of the algae is removed. Unfortunately, suspended solids concentrations due to algae frequently exceeds 90 mg/l in the summer, indicating the 30 mg/l effluent standard cannot be consistently met. The other process which has low O & M costs is the intermittent sand filter. Sand beds are installed with underdrains. Lagoon effluent is poured on the beds intermittently, allowed to percolate, and dry out. Periodically the sand is scarified and eventually replaced after it becomes thoroughly plugged.

7.2.1.4 Total Evaporation System

In Colorado the evaporation rate exceeds the precipitation rate by about 33 inches per year. This phenomenon can be put to work by designing ponds large enough to store water during periods of low evaporation and to totally evaporate when the rate is high. Since no discharge occurs, the need to meet standards is nullified.

7.2.2 <u>Mechanical Systems</u>

As previously stated, only biological mechanical plants will be evaluated.

7.2.2.1 Extended Aeration

Extended aeration is a modified activated sludge process suitable for use by small communities. Basically, raw wastewater is aerated for 24 hours in a tank containing a high concentration of activated sludge microorganisms which break down the waste substances. The mixture of water and sludge is then sent to a clarifier or settling tank where the activated sludge organisms are separated from the liquid phase. The settled sludge is returned to the aeration tank and the clear wastewater is discharged. Depending on the discharge quality requirements, disinfection of the final outflow may be required.

The major mechanical equipment required for an extended aeration plant are aerators (diffused or mechanical) and sludge return pumps. External separate sludge digestion facilities are not required since digestion occurs while the sludge is in the aeration circuit (internal digestion). A relatively small aerated sludge holding tank enabling uniform wasting of sludge from the aeration circuit would be required in Colorado. Depending on local conditions, sludge is generally pumped to sludge drying beds for dewatering and subsequent trucking to sanitary landfills, disposed of by land treatment, or trucked as a liquid to an appropriate disposal site.

The primary advantage of extended aeration over conventional activated sludge is that extended aeration is more stable biologically and thus requires less operation and maintenance. Proper operation will require the services of a relatively highly-trained operator for several hours each day. It has generally been found that a well-operated plant does not result in any odor problems.

7.2.2.2 Oxidation Ditch

The oxidation ditch is a modification of the extended aeration-activated sludge process which utilizes a closed loop channel as an aeration chamber. The process was originally intended to be a low-cost system requiring non-sophisticated construction methods and mechanical equipment. The process flow scheme consists of aeration of raw wastewater in the loop channel followed by the sedimentation of the activated sludge in a clarifier. The activated sludge (active microorganisms) is returned from the clarifier back to the aeration tank. Brush aerators are used to supply oxygen and to retain solids in suspension in the aeration channel.

Internal sludge digestion occurs and eliminates the requirements for external sludge digestion facilities. Depending on land availability for sludge drying beds, it may be cost-effective to provide for external sludge digestion in plants having design flowrates greater than 0.5 mgd. Sludge also can be disposed of by other methods such as land treatment or liquid sanitary landfill.

The biological stability of the oxidation ditch process causes it to have one of the lowest operation and maintenance requirements of any of the controlled biological treatment processes such as activated sludge or bio-filters. This is a significant advantage for small communities where highly-trained operators might not be readily available. Land requirements are typical of controlled biological processes.

7.2.2.3 Rotating Biological Contactor

A rotating biological contactor is similar in operation to a trickling filter plant. It is available in package form and can therefore be installed by a small community for much less money than can a trickling filter plant. This plant uses a rotating drum on which a biological slime layer grows. This slime layer is the BOD_5 removal mechanism. Remaining solids are settled in a clarifier prior to discharge.

7.2.3 <u>Land Disposal</u>

Land disposal can follow any of the previously mentioned alternatives. The most common land disposal technique is irrigation of a crop used as cattle feed, such as corn or alfalfa. Sufficient capacity to store the flow for 120 to 180 days is required for good irrigation systems.

Less storage capacity is required if the goal is merely to dispose of the water on land. There are many warm winter days when irrigation equipment can be used without fear of freezing. Colorado water laws must be given serious attention while evaluating this alternative.

7.2.4 Septic Tank Systems

More dwellings in this region use septic tanks for wastewater disposal than all of the rest of the processes combined. Wastewater goes through the tank, where solids are settled, to a leach field. Wastewater is leached, or filtered, through the soil where impurities are removed.

7.3 OPERATION AND MAINTENANCE

The State of Colorado requires that all wastewater treatment plants be operated by a certified operator. Different degrees of skill are required for various sizes and complexities of treatment plants.

At Severance, any of the lagoon alternatives would require a "D" operator, which is the lowest operator classification. Any mechanical plant would require a Class C operator, which is a more skilled class of operator.

The Larimer-Weld Regional COG is presently considering applying for an EPA demonstration grant to establish an O & M agency for a short period of time. It is visualized that this agency would provide technical assistance to the town's operator. The agency could also satisfy the certification requirements for the duration of the agency.

Since this agency is still in the concept stage, O & M costs presented in Table 7.3-A assume that no aid will come from outside the community.

If Severance decides to keep using septic tanks, they could provide municipal O & M services by purchasing a pumping truck and contracting with a nearby community for permission to dump the wastes. The town could hire a part-time driver for the truck. In this manner, some of the detrimental health effects could be partially controlled, although some groundwater contamination would still occur. No certified plant operator would be required to perform this function.

7.4 SCREENING OF ALTERNATIVE PLANS

The alternatives discussed above are presented in large part to give the reader a better understanding of the decisions involved in choosing a best alternative. Table 7.3-A indicates the capital costs and the capital plus O & M costs for the applicable alternatives discussed. Some costs, such as for septic tanks, are not presented for reasons discussed below.

Septic tanks are currently being used in Severance. In recent years many septic tank failures have occurred due to a high groundwater. The water table at Severance has risen because of the irrigation ditches. The Weld County Health Department has expressed serious concern for the health and safety of residents due to the septic tank failures. Any significant growth will not be allowed to occur as long as there is no municipal wastewater treatment plant. Because of the immenent health hazard, the continued use of septic tanks is not recommended.

If a municipal sewage treatment plant is to be built in Severance, it is logical that it should be located topographically below the present and proposed residences. An interceptor sewer line costs $10.00 per foot installed, so the plant should not be too far below these residences. The land immediately below the proposed subdivision is owned by the Felte Brothers. Mr. Felte indicates that if more than two or three acres of land are taken out of production, he could lose his water right. Because of this, no alternative should be chosen which requires more than two acres of land.

The total evaporation system is very effective at many communities the size of Severance. At Severance, however, there is a problem with high groundwater. It is very difficult to effectively seal the lagoon so that groundwater cannot seep into the lagoon. In addition, area required for a total evaporation system is relatively high.

Algae removal from a lagoon system appears to be an unneeded element in light of the proposed EPA regulations. It will not be further considered.

The extended aeration treatment method was used extensively in Colorado until a few years ago. One of the advantages is that it can be delivered in package form. Another is that it is one of the more easily operated of the activated sludge processes. Unfortunately, activated sludge facilities require a great deal of skill and time to properly operate compared to other treatment techniques.

Because of this, the communities using extended aeration treatment have not been consistently meeting effluent standards, and the Colorado Health Department has discouraged its use.

The oxidation ditch has performed well in Colorado. However, the capital costs are prohibitively high, as they are with rotating biological contactors. Table 7-3A presents capital and annual costs for all alternatives considered in detail.

TABLE 7-3-A. ESTIMATED COSTS OF ALTERNATIVE PLANS

PROCESS	CAPITAL COST	CAPITAL & O & M COSTS ($/1000 Gal.)
Aerated Lagoon	$ 75,000	0.60
Extended Aeration	114,000	1.05
Oxidation Ditch	145,000	1.00
Rotating Biological Filter	214,000	1.30
Aerated Lagoon with Intermittent Filter	166,000	1.10

NOTE: The capital cost figures are estimates based on today's prices, and include 30 percent for engineering, legal fees, and contingencies.

The land disposal alternative was discussed extensively with the Mayor of Severance, Mr. Richard Tallman. The use of the land in the area lends itself well to irrigation with effluent. In order to store 180 days supply and stay within a two-acre area, a lagoon would have to be built which is at least 25 feet deep. It was decided that Severance could pursue this alternative on their own with the Felte Brothers. If the Felte's are interested in using this source of water, Severance would certainly have no objection.

The aerated lagoon alternative meets all the requirements desired. The capital costs and O & M costs are low. It has the flexibility of being operational at very low influent flow rates, and capacity can be easily expanded. Its reliability makes it very attractive. This alternative will be further expanded.

8.0 BEST ALTERNATIVE PROJECT

The health hazards associated with the existing septic tanks indicate that they should be eliminated by installation of a municipal wastewater treatment facility. The above analysis of treatment alternatives indicates that the best solution is treatment and discharge using an aerated lagoon system.

8.1 RECOMMENDED PLANT LOCATION

The recommended site for a sewage treatment plant is immediately below the dam on Law Reservoir on the west side of Law Ditch. This location was chosen to keep the number of feet of interceptor sewer line at a minimum and to be able to serve all existing and proposed development by gravity. It is not anticipated that a lift station would be required at this site.

8.2 RECOMMENDED FACILITIES DESCRIPTION

All facilities must be designed and constructed such that they would meet minimum design criteria published by the Colorado Department of Health. A cost estimate of the recommended alternative is detailed in Table 8.2-A.

8.2.1 Collection and Interceptor Facilities

Some of the minimum standards required by the Colorado Department of Health are as follows [Rozich, 1973]:

1. Average daily per capita flow = 100 gpd
2. Minimum per capita carrying capacity of collection sewers = 400 gpd
3. Minimum per capita carrying capacity of interceptor sewers = 250 gpd
4. Minimum diameter = 8 inches
5. Average sewage velocity = 2 ft. per second (fps)
6. Minimum slope of lines = 0.4 percent
7. Maximum distance between manholes = 400 feet.
8. Lines should be placed deep enough to drain basements.

The cost of the sewer line in Table 8.2-A assumes the use of 8,900 feet of vitrified clay pipe, 40 manholes, and miscellaneous items. Another type of sewer line may be recommended during design.

8.2.2 Treatment and Disposal Facilities

A two-cell lagoon system is proposed. The first cell should be aerated and have a detention time of at least 15 days. It is proposed that two five-horsepower floating aerators be installed to supply sufficient dissolved oxygen and to provide adequate mixing. This cell should be lined to prevent groundwater contamination. The second cell should have a detention time of no more than 5 days. This pond should not be aerated as it is to be used as a settling pond.

Disinfection is to be accomplished with chlorination equipment. A chlorine contact basin should be provided with a detention time of 30 minutes. Treated effluent will be discharged to Law Ditch.

It is estimated that the annual O & M costs will be $3,700 per year at 1977 prices.

The layout and location of project facilities is shown on Figure 8.2.2-A.

TABLE 8.2-A. COST ESTIMATE FOR BEST ALTERNATIVE PROJECT

ITEM	COST
Lagoon Construction, including earth work, clay liner, rip-rap, piping, structures, and (2) 5 HP aerators	$ 37,600
Land (2 acres at $4,000/acre)	8,000
Chlorination facilities	10,000
Fencing and dock	1,700
Subtotal - Treatment Facilities	$ 57,300
Collection and interceptor sewers	$114,700
Total Construction Cost	$172,000
Construction Contingencies and Engineering Fees - 30 percent	$ 52,000
Total Project Cost - 1976 Prices	$224,000
Estimate Inflation - 11% per year	$ 22,000
Total Project Cost - 1977 Prices	$246,000

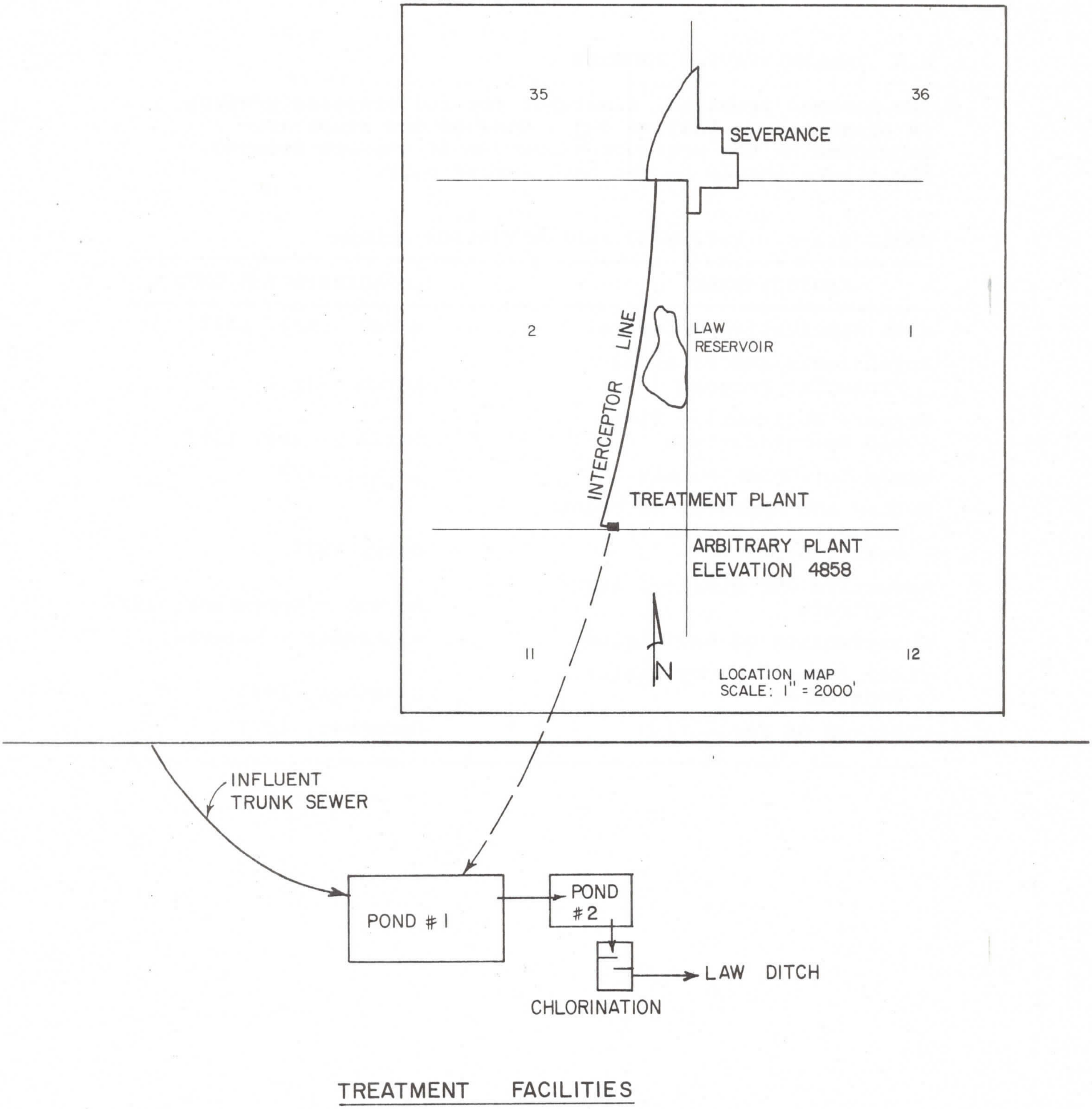

FIGURE 8.2.2-A. LOCATION OF PROPOSED FACILITIES
SEVERANCE TECH PLAN

8.3 IMPLEMENTATION PROGRAM

The minimum practical timetable for the proposed project is presented in Table 8.3-A. Many of the steps are dependent on the previous steps, so if any are delayed, the others should be set back accordingly.

TABLE 8.3-A. ESTIMATED IMPLEMENTATION PROGRAM

PROJECT TASK	IMPLEMENTATION DATE
Site Application Submittal	March - May, 1977
Investigate and Finalize Financial Program	March - June, 1977
Prepare Engineering Plans and Specifications	April - June, 1977
Apply for NPDES Permit	April, 1977
Review and Approval of Plans and Specifications by Health Department	July, 1977
Advertise for Bids and Award Contract	August - September, 1977
Construction of Facilities	September - December, 1977
Final Inspection by Health Department	December, 1977
Start-up of Facilities	December, 1977

9.0 FINANCIAL PROGRAM

9.1 EXISTING CONDITIONS IN SEVERANCE

9.1.1 Financial Capabilities

The 1975 estimated population of Severance is 81.

The community's current (1977) financial picture can be summarized as follows:

- Assessed Valuation: $117,390
- Anticipated Town Revenue from Property Tax (1977): $1,760
- Combined Mill Levy on Severance Taxpayers: 66.68 Mills

Town	15.00 Mills
County	21.13 Mills
School District	30.55 Mills

- Total Sales Tax: 3% (State only)
- Additional Sales Tax Capability (Town and County): 4%
- Town's Bonded Indebtedness (January 1, 1977): None
- Town's Unused General Obligation Bond Capacity (10% of Assessed Valuation): $11,740
- Median Family Income: $3,429

Severance's tax base is quite small, reflecting its small population. Even though the combined mill levy is low at roughly 67 mills, only $117.40 per mill would be raised with its further use. No sales tax is levied. From State figures (which are high estimates due to State inclusion of sales made outside of Town), a penny of Severance sales tax would raise less than $2,300. All in all, Severance is not in a position to generate public tax funds for major community projects.

The median family income figure of $3,429 for Severance (according to the 1970 census) is extremely low, in comparison to medians of $8,000 - $10,000 for other Larimer-Weld communities. This indicates a possible error in figure, or some special condition (such as a majority of elderly and/or residents living alone) which might make the figure of questionable validity. Because median family income is a primary determinant of reasonable annual user fees, this figure may need to be investigated during the utility planning process. (See 9.3.1.2).

9.1.2 Sewage Handling Facilities and Proposed Improvements

The Town of Severance has no central sewage facilities. All sewage disposal is on individual systems. According to the County Health Department, some of the septic systems are having problems and pose a potential health hazard.

The technical analysis for Severance estimates a need for $246,000 in capital investment to provide the minimum central treatment facility for wastewater. This facility would serve the Town and a proposed 115 unit subdivision, and will require an annual operations and maintenance cost of $3,700. Inflation is expected to increase the operations and maintenance cost to $4,285 by 1981, a 5% annual increase from 1978, the base year used in this estimate.

An alternative which excludes the proposed subdivision would require a capital investment of $145,000; but operations and maintenance costs for the smaller facility are estimated to be the same, $4,285, by 1981. There are a total of 50 existing units that could potentially hook up to a central system.

9.2 RECOMMENDATIONS FOR SEWER UTILITY MANAGEMENT

The following are suggested general principles for a balanced utility program. This management process has proven successful in preventing construction and operation of sewer systems from posing an unreasonable burden on residents of growing communities, and is the basis for determining optimum financing capabilities.

9.2.1 Utility Service Area

The community should lead, not merely follow, development. The community should decide where it is most economical and efficient to provide services, and make known where it prefers growth to take place. By not annexing or extending utility lines outside the Town into areas it does not want to see grow, it can avoid having to serve those areas. Conversely, for those areas in which it wishes to encourage growth, it can build trunk lines into them and save potential developers that front end cost. This approach must be tied to other community goals, programs, and strategies in order to be successful.

9.2.2 Financial Policies

Utility financing for growing communities should be designed so that "he who benefits pays". This approach may be tempered by other community policies, such as a desire to keep or attract an industry unable to pay its fair share, or to assist development of low income housing which could not be built if a full tap fee were required.

This philosophy can be implemented by applying the following policies:

- Establish service fees based on all costs of operation including employees' wages and benefits, maintenance, depreciation. Additional costs may be included, such as a <u>reasonable</u> fee paid into the General Fund for services or facilities, provided to the sewer utility by other municipal departments, such as office space and vehicles.

- Establish plant investment or tap fees (PIF) for all new customers or expansions of service, proportionate to treatment plant and trunk capacities the customer is expected to use. (See 9.3.1.1)

- Charge all direct costs of attaching to the system directly to the customer; e.g., costs of tapping into the line, and laterals and pipe from the street to the building.

9.2.3 Service for New Developments

Internal or lateral lines or pumps required to serve new developments should be provided by the developers. They may directly finance and build them, passing on costs to future occupants; or, where occupancy is relatively assured, the community may permit a special improvement district to be formed with the bonds paid back over an extended period of years through added mill levies on the properties benefiting. The cost of these localized facilities should not be borne by the community at large.

All extensions of lines past undeveloped areas to a development should be financed by the development seeking the service. Some of these costs can be paid back as intervening property is developed and attached to the system. The community should not be committed to providing such lines on request.

9.3 ANALYSIS OF SEVERANCE'S ABILITY TO CONSTRUCT A CENTRAL SEWAGE SYSTEM

The major questions a community must ask itself when considering its capabilities to finance and operate a sewer utility are:

- Can the community raise enough money to cover capital cost requirements?

- Can the community support the system on a continuing basis (operating and maintenance costs)?

- What are the utility financing implications of whether or not the population in the community increases?

In developing a financing program, sewer utility needs for financing should always be placed in the context of total community funding needs. Because locally generated funds all come from the same taxpayer or user, a more moderate commitment to sewer costs may be necessary in order to achieve other community goals. Considering that there are many ways to accomplish funding goals, financing strategy must be used to develop the most equitable system for the users with a minimum of future risk.

Tables 9.3-A and 9.3-B illustrate the basic financial problem. The residents of Severance will have to pay an estimated $4,285 annually by 1981 to maintain the central system, plus some amount to retire whatever borrowing is required for the system's construction. Table 9.3-A shows how much cost for these two items would fall upon each system user (tap) annually under various assumptions about future growth, and required borrowing for construction, given that 25 hookups at $750 each would occur immediately. Table 9.3-B shows the same information under the assumption of 50 immediate hookups.

The remainder of this section addresses questions of how capital and operating funds for the system might be raised and, in particular, the implications of various population growth rates.

9.3.1 Financing the Proposed Capital Improvements

Total capital investments of either $145,000 or $246,000 would be required to implement the improvements proposed in the engineering analysis. Major sources of capital funding are plant investment fees (PIF's), grants, and borrowing.

9.3.1.1 Plant Investment Fees

A plant investment fee is normally set by dividing the total capital cost of the system by its capacity, and determining the pro rata share. For example, a $100,000 system to serve 100 units would indicate a PIF of $1,000 per unit. Where a community is large and wealthy enough to generate proportionate shares of the capital cost, PIF's could fully finance its system.

In the case of Severance, it is unlikely that PIF revenue can be counted on as the sole source of capital fundings. For example, even if all 50 existing units in Severance chose to hook up to the smaller system, PIF's of $2,900 each would be required to fully finance capital costs. This is clearly an unreasonable amount. In fact, it is quite likely that not all existing units would hook up immediately should a significant PIF (or perhaps any PIF) be charged. Severance's experience with a central water system demonstrated that people are not likely to move to central service without an incentive.

TABLE 9.3-A*

TYPICAL ANNUAL COST FOR EACH UNIT ON THE SYSTEM**

Annual Growth Every Year Through 1996

Growth Rate Relative to 1975 Population	New Population Each Year	New Taps	Funds Borrowed by Town for Sewer System Improvements			
			0	$50,000	$100,000	$150,000
0%		0	$171	368	564	760
5	4	1	126	301	477	652
9	7	2	90	248	406	565
14	11	3	60	204	348	493
17	14	4	35	167	300	433
22	18	5	14	136	259	381
43	35	10	Surplus	31	120	209
65	53	15		Surplus	41	111
87	70	20			Surplus	47
ANNUAL COSTS:						
O & M			4,285	4,285	4,285	4,285
Old Debt			0	0	0	0
New Debt			0	4,906	9,812	14,718
TOTAL			4,285	9,191	14,097	19,003

* See note on page 32.

** Based on 25 immediate (1978) hookups at $750 each. Therefore, $18,750 would be available as local funds that could be used to contribute to initial capital costs. Although these funds might also be used to reduce the annual charges, the figures shown above do not reflect such a policy.

Source: Murray; Briscoe, Maphis, Murray & Lamont, Inc. March, 1977

TABLE 9.3-B *

TYPICAL ANNUAL COST FOR EACH UNIT ON THE SYSTEM* *

Annual Growth Every Year Through 1996

Growth Rate Relative to 1975 Population	New Population Each Year	New Taps	Funds Borrowed by Town for Sewer System Improvements			
			0	$50,000	$100,000	$150,000
0%		0	$ 86	184	282	380
5	4	1	67	159	252	344
9	7	2	50	137	225	313
14	11	3	34	118	201	284
17	14	4	21	100	179	258
22	18	5	8	84	159	235
43	35	10	Surplus	21	82	144
65	53	15		Surplus	30	82
87	70	20			Surplus	36

ANNUAL COSTS:				
O & M	4,285	4,285	4,285	4,285
Old Debt	0	0	0	0
New Debt	0	4,906	9,812	14,718
TOTAL	4,285	9,191	14,097	19,003

* See note on page 32.

** Based on 50 immediate hookups at $750 each. Therefore, $37,500 would be available as local funds that could be used to contribute to initial capital costs. Although these funds might also be used to reduce the annual charges, the figures shown above do not reflect such a policy.

Source: Murray; Briscoe, Maphis, Murray & Lamont, Inc., March, 1977

NOTES ON TABLES 9.3-A AND 9.3-B

- All costs are calculated for 1981, but nevertheless are close enough estimates of any year through 1996.

- The operation and maintenance (O & M) costs are inflated for price and wage increases to 1981. In 1978 dollars the total operations and maintenance cost would be $3,700. Inflated at 5% annually, this would rise to $4,285 by 1981.

- New debt is figured at being retired in 20 years and paying an interest rate of 7-1/2%. Actual terms will be closely related to local financial conditions and bond market conditions upon issue.

- Tap or Plant Investment Fees are used to retire as much new debt as possible. For instance, with the addition of 10 taps at $750 each, $7,500 in new debt could be retired. In some cases where the growth rate is high and borrowing low, tap fees are applied to the cost of old debt and/or O & M costs.

- The yearly growth rate necessary to achieve the annual costs shown on the chart would have to occur every year. For example, if $50,000 were borrowed, 10 new taps would have to be added every year for the next five years (or a total of 50 new taps added to the system over the five-year period) for the annual cost to be $21 per unit by 1981. To maintain that annual charge, the growth would have to continue by that rate beyond 1981.

- The source of revenue to pay the annual costs is a local decision. The tables simply indicate the amount needed.

- The tables may be adjusted as new information becomes available by using the following basic formula:

$$\text{Annual Cost Per Unit} = \frac{\text{Annual O\&M} + \text{Annual Debt Service} - \text{Tap Fees}}{\text{Number of Units on System}}$$

- Note that the tables show the remaining cost, over and above that paid by tap fees, to be shouldered by system users. It may be determined that the maximum or "worst case" figure shown in the top row of the table is not unreasonable in terms of user's ability to pay. This is the case if no growth occurs and only current residents are available to pay the full cost. If the figure is unreasonable (and it would be considered so in Severance's case unless all 50 units hook up), funds from other sources should be sought to cover the total cost. An alternative would be initially to scale down the amount of borrowing, if possible.

One option open to the community is to try to require hookup for health reasons, or should 100% financing assistance be obtained, to offer immediate hookup free to existing residents. It appears evident that the smaller system cannot expect major financing support from payment of PIF's.

Choosing the larger system alternative will give Severance the opportunity to raise at least some capital funds through PIF's prepaid by the developer. The amount can vary according to funding from other sources, the number of Town residents who choose to hook up (and the amount of PIF charged them), and agreement by the Town and the developer as to a reasonable fee.

9.3.1.2 Grants and Subsidized Loans

Grant funds are likely to be available to assist with the costs of capital construction. Because the availability of such funds will be important in figuring the remaining burden on the local residents, this source of funding should be investigated early in the process of deciding if and how the Town should proceed.

Determine the approximate amount of grants (and/or subsidized loans) available from various government sources. For smaller communities such as Severance, these are the most likely sources at this time:

- Farmers Home Administration
- The Colorado Department of Local Affairs
- HUD Community Development discretionary funds for service lines

In order to gauge a community's eligibility, these funding agencies typically evaluate the locality's ability and efforts to finance its own system. For example, the Colorado Department of Local Affairs takes into consideration for each community requesting assistance the following:

- Legal ability to tax
- Assessed valuation
- Median family income
- Current bonded indebtedness
- Total tax effort
- Number of people on fixed incomes
- Level of user charges

The key element considered by the Department of Local Affairs and the Farmers Home Administration, other factors being equal, is the state guideline that a community's annual user charge for sewer service should be at least 1-1/2% of the median family income. This guide is used to determine if a community is doing its fair share to pay for the system. The figure can be lowered for a number of reasons: for example, if a town is in a weak financial condition, or has a large number of people on fixed incomes. But as a general guide, this tells a community how it will stand in potential aid levels from the various funding sources.

The state guideline that 1-1/2% of a community's median family income represents a reasonable annual user fee, indicates that Severance's minimum fee level would be $51.43 per tap per year (1-1/2% of $3,429). Comparing this figure with annual costs projected in Tables 9.3-A and 9.3-B on pages 30 and 31 indicates that Severance would clearly qualify for some grant assistance. How much assistance might be received will depend on funding agencies' priorities and fund availability. It is unlikely that a 100% grant would be received from any given agency.

All potential sources should be checked for assistance. A summary of sources of financial aid can be found in Table 9.3.1-A. Funding availability varies from month to month as new revenues are made available or previously obligated funds are returned for redistribution.

9.3.1.3 Town Borrowing

To determine estimated borrowing needs, deduct anticipated grant amounts and any immediate local funds that might be allocated to the project from the capital cost estimates for the proposed system.

Whenever possible, revenue bonds should be used to finance sewer system improvements. If a community must borrow to finance utility improvements, it is desirable to protect its general obligation bonding capacity (tied by state law to assessed valuation) for uses where revenue bonding is not feasible. This is because numerous community needs usually cannot be financed from revenue bonds (e.g., parks, libraries, or police facilities). Therefore, any revenue generating operation, such as a sewer system, should borrow on the direct ability of the system to retire the debt.

There are limitations to this financing method; i.e., cases where the cost of the system exceeds its ability to generate revenue, or where general obligation bonds are not limited by state statute (e.g., bonds for water improvements). Even in these cases, the maximum reasonable revenues should be raised from PIF and user fees to retire at least a portion of the debt. Other sources must then supplement system revenues if the project is to occur.

Severance's borrowing capacity for general obligation bonds is limited, due to its low assessed valuation. One mill raises only $117.40, hardly enough to refund a sizeable loan without a major mill levy increase.

TABLE 9.3.1-A
SOURCES OF POTENTIAL FINANCIAL AID

	FHA COMMUNITY FACILITY LOANS/GRANTS - FEDERAL	CONSTRUCTION GRANTS FOR SEWERAGE WORKS (STATE OF COLORADO) STATE	FOUR CORNERS REGIONAL COMMISSION, SUPPLEMENTAL GRANT-REGIONAL	COMMUNITY DEVELOPMENT ACT (HUD)-DISCRETIONARY FUNDS FEDERAL	EPA CONSTRUCTION GRANTS - FEDERAL	PREDESIGN ENGINEERING GRANTS (STATE OF COLORADO) STATE	ECONOMIC DEVELOPMENT-ADMINISTRATION (EDA) - FEDERAL
PROGRAM DESCRIPTION							
FUND USAGE	TO CONSTRUCT, ENLARGE, EXTEND, OR IMPROVE SEWERAGE SYSTEMS.	TO CONSTRUCT, EXPAND, OR MODERNIZE SEWAGE TREATMENT FACILITIES	PROGRAM IS GEARED FOR ECONOMIC DEVELOPMENT TYPE PROJECTS. HOWEVER ECONOMIC DEVELOPMENT HAS A VERY BROAD DEFINITION.	TO CONSTRUCT SEWAGE COLLECTION LINES NOT TREATMENT FACILITIES.	TO PLAN, DESIGN, AND CONSTRUCT SEWERAGE COLLECTION AND TREATMENT FACILITIES.	PREDESIGN ENGINEERING FOR THE EXPANSION, CONSTRUCTION, OR MODERNIZATION OF SEWAGE TREATMENT SYSTEMS INCLUDING COLLECTION OF FACILITIES	THE PROGRAM IS CURRENTLY BEING RECONSIDERED BY THE CONGRESS. IT IS ANTICIPATED THAT THE QUALIFICATION REQUIREMENTS WILL NOT CHANGE. THE BASIC REQUIREMENT BEING HIGH UNEMPLOYMENT RATE AND HIGH NUMBER OF UNEMPLOYED.
FORM OF ASSISTANCE	MAY BE EITHER LOAN OR GRANT. GRANT OR LOAN 50% OF PROJECT, LOAN 40 YEARS AT 5%.	ASSISTANCE IS GIVEN IN THE FORM OF A GRANT. THE AMOUNT VARIES UPON THE FINANCIAL NEED OF THE COMMUNITY	ASSISTANCE IS IN THE FORM OF A GRANT. MAXIMUM SUPPLEMENTAL GRANT IS 60% OF OTHER FEDERAL FUNDING OR $150,000.	GRANT FROM DISCRETIONARY FUNDS FOR ALL PORTION OF PROJECT.	ASSISTANCE IS IN THE FORM OF A 75% GRANT.	NORMAL STATE GRANT OF 80%, APPLICANT MATCHING FUNDS OF 20%. THE APPLICANTS SHARE IS VARIABLE DEPENDING UPON FINANCIAL NEED.	
AMOUNT OF ASSISTANCE	LOAN/GRANT RANGE: $20,000-$200,000.	AVG. GRANT: $50,000 MAX. GRANT: $500,000	AVG. GRANT: $75,000	AVG. GRANT: $100,000 GRANT RANGE: $50,000-$300,000	AVG. GRANT: N/A GRANT RANGE:	AVG. GRANT: $3,000	
CURRENT FISCAL YEAR APPROPRIATION	$4.8 MIL LOANS, .9 MIL GRANTS	$2.3 MIL	$2.5 MIL	$2.5 MIL FISCAL YEAR 1977 (COLORADO NONMETROPOLITAN)		$200,000	
ANTICIPATED APPROPRIATION NEXT FISCAL YEAR	ABOUT THE SAME AS PRIOR YEAR.	$2.0 MIL	$1.7 MIL	MINOR INCREASE FOR FY 1978		$200,000	
ELIGIBILITY REQUIREMENTS							
ELIGIBLE ENTITIES	MUNICIPALITIES AND DISTRICTS	ANY MUNICIPALITY OR SPECIAL DISTRICT	ANYONE WHO CAN GET FEDERAL BASIC FUNDING	A FORM OF GENERAL PURPOSE GOVERNMENT, E.G. INCORPORATED MUNICIPALITIES, COUNTIES, THE STATE OR INDIAN TRIBES.	SEE ATTACHED NOTICE OF FINAL ADOPTION OF FEDERAL CONSTRUCTION GRANT PRIORITY SYSTEM, DATED AUG. 20, 1975.	ANY MUNICIPALITY OR SPECIAL DISTRICT.	
ELIGIBILITY REQUIREMENTS	MUST NOT HAVE THE CAPABILITY TO FINANCE THE PROJECT THROUGH AVAILABLE COMMUNITY RESOURCES. HAVE POP. LESS THAN 10,000 AS OF LAST CENSUS	APPLICANT'S POPULATION MUST BE 5,000 OR LESS, AS OF THE LATEST CENSUS.	MUST HAVE RECEIVED ANOTHER SOURCE OF FEDERAL AID.	N/A	N/A	APPLICANT'S POPULATION MSUT BE 5,000 OR LESS, AS OF THE LATEST CENSUS.	
DISCRIMINATING FACTORS	FINANCIAL NEED. THE ENTITY MUST BE AT OR NEAR THEIR LIMIT ON BONDING INDEBTEDNESS.	FINANCIAL NEED, BONDED INDEBTEDNESS, ASSESSED VALUATION, MEDIAN INCOME, ETC.	THE PROJECT MUST PROMOTE ECONOMIC DEVELOPMENT.	EXTENT TO WHICH: COMMUNITY HAS POVERTY, SUBSTANDARD HOUSING, BENEFITS LOW-MODERATE INCOME HOUSING, NEEDED FOR HOUSING STOCK, ALLEVIATING HEALTH, SAFETY, & WELFARE PROBLEMS AND GRANTS FROM OTHER AGENCIES.	N/A	FINANCIAL NEED, SERIOUSNESS OF POLLUTION PROBLEM.	
APPLICATION MECHANICS							
APPLICATION PROCESS	BEGIN WITH COUNTY FHA REPRESENTATIVE.	A. SUBMIT GRANT APPLICATION TO DIRECTOR OF LOCAL GOVERNMENTS AND APPLY FOR SITE APPROVAL FROM THE COLORADO WATER POLLUTION CONTROL COMMISSION. B. DIVISION OF LOCAL GOVT. THEN ISSUE A CERTIFICATE OF FINANCIAL NEED STATING AMOUNT OF GRANT AND THAT THE APPLICANT MUST OBTAIN SITE APPROVAL. C. SUBMIT SITE APPROVAL, FINAL PLANS AND SPECIFICATIONS TO THE DIVISION OF LOCAL GOVERNMENTS. D. SUBMIT TWO SETS OF FINAL PLANS AND SPECIFICATIONS TO COLORADO DEPARTMENT OF HEALTH.	DETERMINE A SOURCE OF FEDERAL FUNDING OR POSSIBILITY THEREOF. ARRANGE A PRE-APPLICATION CONFERENCE WITH THE FOUR CORNERS REGIONAL COMMISSION REPRESENTATIVE. ARRANGE FOR AN A-95 REVIEW OF PROJECT.	APPLICATION PROCESS WAS PUBLISHED IN THE FEDERAL REGISTER ON OCT. 13, 1976. COMPETITION IS VERY STIFF FOR THESE FUNDS.	THE STATE HEALTH DEPARTMENT WILL CONTACT THE MUNICIPALITY WHEN FUNDING BECOMES AVAILABLE.	A. OBTAIN LETTER FROM LOCAL HEALTH DEPARTMENT OFFICIAL CERTIFYING THAT SYSTEM IS CURRENTLY IN VIOLATION OF STATE STANDARDS. B. OBTAIN ENGINEERS PROPOSAL FOR WORK. C. OBTAIN APPLICATION FORM LG-PS275. SUBMIT ALL OF THE ABOVE TO THE DIVISION OF LOCAL GOVERNMENTS.	
APPLICATION DEADLINES	FIRST COME, FIRST SERVED UNTIL APPROPRIATION RUNS OUT.	FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	NO DEADLINES. FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	TO BE DETERMINED	N/A	FUNDING IS ON A FIRST COME, FIRST SERVE BASIS.	
TIME REQUIRED TO EVALUATE APPLICATION	3 MONTHS	1-3 MONTHS. THIS INCLUDES TIME REQUIRED FOR HEALTH DEPARTMENT REVIEW OF PLANS AND SPECIFICATIONS.	VERY FAST, AS FUNDING IS TIED TO ALREADY APPROVED FEDERAL FUNDING.	TO BE DETERMINED 5-6 MONTHS, EXCEPT FOR EMERGENCY SITUATIONS	N/A	2 MONTHS	
MISCELLANEOUS		IF FUNDING IS NOT RECEIVED UPON INITIAL APPLICATION, IT IS REVIEWED MONTHLY UNTIL IS IS FUNDED OR THE APPROPRIATION IS EXHAUSTED. THESE FUNDS MAY BE USED IN CONJUNCTION WITH OTHER LOANS OR GRANTS. THE COMMUNITY MUST BE PREPARED TO USE 1.5% OF ITS MEDIAN FAMILY INCOME PER CUSTOMER PER ANNUM TO OPERATE ITS EXISTING SYSTEM AND/OR PAY FOR ITS SHARE OF THE NEW PROJECT.			CURRENTLY THERE IS A LARGE EMPHASIS ON STEP 1 AND 2 GRANTS. HOWEVER, AS COMMUNITIES BECOME READY FOR STEP 3 GRANTS, THE AMOUNTS AVAILABLE FOR STEP 1 AND 2 GRANTS WILL BE GREATLY DIMINISHED.	THESE FUNDS MAY BE USED IN COMBINATION WITH OTHER LOANS/ GRANTS.	
CONTACTS	JOHN MEIKLE, FHA, 337-4717	BILL PEED, STATE OF COLORADO, DIVISION OF LOCAL GOVERNMENTS 392-2156 JEB LOVE, STATE HEALTH DEPT. 388-6111	IVO ROOSPOLD, DEPT. OF LOCAL AFFAIRS, RURAL DEVELOPMENT 392-2631	ARMAND SEDGELEY, HUD-DENVER 837-4666	RON SCHUYLER, STATE DEPT. OF HEALTH, 388-6111 JERRY BURKE, SAM BERMAN FEDERAL EPA, 837-3961	BILL PEED, STATE OF COLORADO DIVISION OF LOCAL GOVERNMENTS 392-2156	PAUL RENNE, ALL PROGRAMS, JOHN ZENDER LOCAL PUBLIC WORKS ACT, 337-4714

BRISCOE, MAPHIS, MURRAY & LAMONT, INC. MARCH 3, 1976

9.3.2 Sources for Financing System Operating Costs

Funds to pay annual operating costs can be obtained from a number of sources. Most typically, these sources are service or user rates, property taxes and sometimes other general fund revenues.

Service or user rates can be the most equitable source of funds. The beneficiary pays in proportion to the amount of benefit received. Rates should be pegged to reflect the full cost of operation, maintenance, and depreciation, and perhaps some portion of debt service where borrowing to provide a plant for existing customers remains unpaid. Tap or plant investment fees can also be used if necessary, but this is not considered a desirable practice for paying operating costs, as it defeats the purpose of the tap fee. Rather, tap fees should be applied to repay bonds issued to finance the added plant capacity serving the new taps.

Because of historical precedent, many communities do not charge users in proportion to their use, but keep a low user rate by subsidizing costs with mill levies on property. This is particularly true in special districts where high user rates would discourage potential hookups. The argument against this use of property tax revenues is that it depletes an important source of funding general purpose, non-revenue producing facilities.

A community can choose to subsidize rates from its general fund monies. These might be composed, for example, of revenue sharing funds, sales tax, fees or licenses, or cigarette taxes. The same drawback as with using property taxes applies.

Most generally, however, operations and maintenance costs are covered by annual user rates. To determine if a community can generate sufficient user rate revenue to support the system, the state guideline of 1-1/2% of the median family income can be used as a general guide. While a community can certainly charge more than 1-1/2%, anticipated user fees far in excess of this figure may indicate that the residents of the community will find the sewer utility extremely difficult to support.

$51.43 represents a reasonable annual user fee level, according to the state guidelines. This indicates that meeting annual maintenance and operations costs of $3,700 (as of 1978) would require 72 user fees in the first year of operation, should the guideline be followed. The equivalent tap fee (ETF) is more precise as a measure of financial capability, but for Severance this is insignificant. The ETF is used for large dischargers such as industry which is not a factor in Severance. It is simply the amount of discharge converted to the equivalent number of single family users; i.e., one ETF for six single family taps.

Severance's 50 existing units--the service population for the smaller system proposed--fall significantly below the 72 user requirement above. However, the state guideline is not an absolute and a town may choose to charge a higher fee. For example, if all 50 units hook up and agree to pay $7.40 per month, or $88.80 annually, $3,700 could be generated. It may be a possibility that hookups could be assured by legally requiring them or charging no plant investment fee (a possibility if a 100% capital grant could be obtained).

An additional consideration is that the median family income figure for Severance may be incorrect, or that, due to Severance's particular conditions, 1-1/2% of the median income is an inaccurate measure of what residents could actually pay without the fee becoming a burden.

The larger system proposed will provide substantial assistance in carrying annual costs, both through initial developer payments and through increased population when the development is occupied.

In lieu of the 72 user taps (an impossibility with the number of existing units) or a higher annual user fee, the community can require the developer to subsidize annual service fees until the units are actually on the system. How many will have to be subsidized will depend on the amount of the annual user fee (which can be higher than that for residents) and the number of existing units that hook up.

An additional consideration is that as the development is occupied, Severance's median income will likely rise, so higher user rates can eventually be obtained. This could be a problem for the existing residents and should be carefully considered before such action is taken.

Neither property taxes or miscellaneous fees present a viable means of raising operating revenue, as Severance's tax base is very small.

9.3.3 Effects of Population Growth

Consider the implications of population growth. Increased population can provide increased revenue through PIF's, user fees, and taxes, all of which can ease the burden of supporting the sewer utility on existing residents.

A realistic anticipation of growth might encourage the community to borrow more money to finance its system, and will influence the size and/or type of system the community decides to use.

However, bear in mind that increased population may also generate needs for system expansion (necessitating further borrowing) and that projected growth which does not occur on schedule may seriously burden existing residents with higher annual payments than had been planned. Recognizing the possibility for growth--without counting on it to carry the community's financing needs--is a necessary component of evaluating the community's capabilities to support the sewer utility.

Tables 9.3-A and 9.3-B illustrate impacts for Severance of various combinations of borrowing levels, growth rates, and immediate hookups to the system. They can be used to evaluate risk and anticipated cost per user should the Town borrow money to develop a system.

9.4 CONCLUSIONS AND RECOMMENDATIONS FROM FINANCIAL ANALYSIS

9.4.1 Conclusions

A combination of funding sources will be required to finance costs identified by the engineering analysis as essential to create central collection and treatment facilities. The community should follow the process previously outlined in this chapter to decide if it can develop a financial program suited to Severance's capabilities and circumstances.

Either engineering alternative is potentially feasible. But both are financially questionable. Severance should be assured of the necessary combination of grant assistance, developer participation (for the larger system), and citizen commitment to the system (particularly for the smaller alternative), before committing itself to such a costly item.

Severance should seek a full grant to finance its system, whether the Town chooses to build the smaller or the larger system proposed by the engineers. As stated earlier, the key element in grant request evaluation is the state guideline that 1-1/2% of the median family income represents a reasonable level for annual user fees. Comparing Severance's figure of $51.43 with the annual cost tables indicates that Severance is clearly in need of significant grant assistance to build its system.

The smaller system alternative can probably be financed only by a 100% total grant from state and federal sources. A 100% grant would allow the Town to offer free hook up (no plant investment fee charged) to existing residents, a significant factor because full participation by residents is essential to pay annual operations and maintenance costs. The Town may also be able to legally require residents to hook up. This would be a local decision and would depend on the strength of Severance's desire for a central system plus political considerations.

Even with 100% hookups, supporting the smaller system on a continuing basis will require annual user fees higher than the state guideline. Choosing to charge higher user fees is a local decision. The Town should be sure of citizen support before adopting this mode of action, and should carefully consider residents' ability to pay for the system without suffering financial hardship.

Full grant assistance should also be sought for the larger system. However, 100% government funding is very ususual and therefore, might need to be supplemented by assistance from the proposed development, through prepaid PIF's. In this event, the way the local financing package is developed becomes much more important. Longer term borrowing or ballooning the loan so there are smaller payments in the near term with larger payments later so that growth will help to provide a base, become considerations. Tables 9.3-A and 9.3-B can show what to expect in this regard.

For instance, if 50 immediate hookups at $750 each can be assured ($37,500) and a grant of $158,500 were available, the Town could build the $246,000 system by borrowing $50,000. If no growth occurs, the average system user would have to pay $184 annually (in rates, taxes, or some combination) in order to maintain the system and retire the $50,000 debt. With growth equal to 5 new taps annually, the average cost would be spread among a growing population and reduced to about $84.

9.4.2 <u>Summary of Major Problems</u>

The financial analysis has identified several problem areas for Severance in financing either system proposed.

For the smaller system, problems break down as follows:

- A 100% grant will have to be sought, and possibly participation by the developer in the case of the larger system.

- All 50 existing units will be needed to support the system. Ensuring 100% hookup at the outset will be essential.

- Annual user fees will have to be higher than the state guideline. This may place an excessive burden on residents on fixed incomes, and may also lose residential support for a central system.

- Severance's small tax base limits the Town's borrowing power and its ability to generate sewer system funding through taxes.

The larger system, based on working with a developer, will provide more immediate funding and a potentially larger service population. Major problems with this alternative are:

- A significant grant will still be needed for capital financing.

- The system's financial stability relies on growth occurring. Should anticipated growth not occur on schedule, a significant financial burden may fall on the residents of the Town.

9.4.3 Recommendations

It is recommended that Severance not build the smaller system proposed unless it is overwhelmingly desired by the community and 100 percent grant assistance and community participation are assured. The magnitude of risk involved in the smaller alternative appears to make correcting problems in the septic systems a more viable choice for the Town.

In the case of the larger system, there clearly must be a substantial grant and a major commitment by the developer of the proposed subdivision if a central system is to be constructed. This includes an annual subsidy of user fees as well as prepaid PIF's. A central system is a costly item per unit when the base is so small to begin with. If the purpose is primarily to accommodate growth, risk must be put on the proposed developments. Expected growth can be affected by many factors beyond local control so existing residents should be sheltered from an excessive financial burden in the event the rate or number of new units fails to occur as projected.

APPENDIX A

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