ECONOMIC FEASIBILITY STUDY
SANITARY SEWER SYSTEM
ECOLOGY ACRES & WESTERN HEIGHTS SUBDIVISIONS
STODDARD COUNTY, MISSOURI

PREPARED FOR

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I. INTRODUCTION

This report does not contain all of the information necessary for a complete economic feasibility study. Information on the utility company, its description, objectives, and service area, is presented elsewhere. Detailed design information on the proposed facilities is presented in the Engineer's Report, Engineer's Report Supplement, and plan sheet. Plans for financing the utility company and plans to protect the financial integrity of the utility company during the development years are presented elsewhere. This report is intended as a supplement to the complete economic feasibility study. It must be used in conjunction with the other information mentioned to form the complete study.

This report contains information that justifies the proposed rate structure. A plat of the proposed system and detailed cost estimates of all the proposed facilities are presented first. A narrative description of the proposed facilities to be constructed both immediately and in each of the next three years is presented, and cost estimates of each construction phase are listed. Present and future customer information is discussed, and an estimate of operating expenses is presented. Two rate-structure alternatives are evaluated, either of which would be acceptable to the utility company.

II. SYSTEM LAYOUT AND COST ESTIMATES

A general layout of the proposed system is shown on the following page. This small layout sheet is included so that it can be conveniently referred to; the full-size layout sheet should be used for obtaining detailed information.

The following is a detailed estimate of the cost of the proposed sanitary sewer facilities. The quantities listed in the estimate are based on the preliminary design of the facilities, and prices are based on current equipment and construction costs in the area.

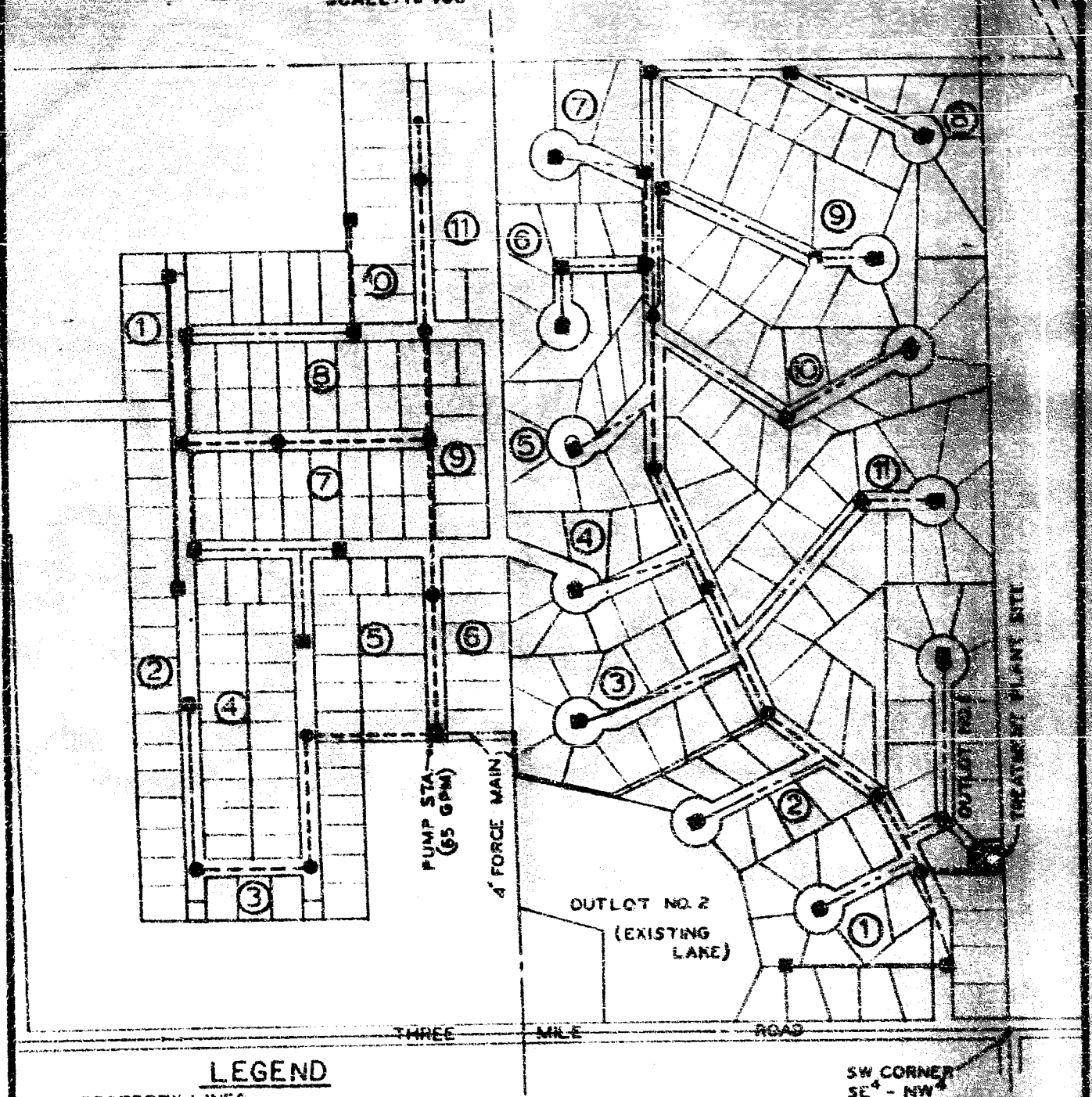
ITEM	DESCRIPTION	QUANTITY	UNIT PRICE	SUB-TOTAL
1.	8" Clay Gravity Line	5,255 ft.	$ 8.00	$ 42,040
2.	2" Plastic Pressure Line	11,405 ft.	1.00	11,405
3.	Manholes on Gravity Line	15 ea.	425.00	6,375
4.	Lampholes on Gravity Line	1 ea.	100.00	100
5.	Cleanouts on Pressure Line	33 ea	50.00	1,650
6.	Pump Station w/sp. M.H.	1 ea.	Lump Sum	12,000
7.	4" Plastic Force Main	1,000 ft.	2.00	2,000
8.	Grinder Pumps	20 ea.	1,400.00	28,000
9.	Mechanical Treatment Plant	1 ea.	Lump Sum	35,000
	CONSTRUCTION COST			$ 138,570
	CONSTRUCTION CONTINGENCY @ 5%			6,928
	TOTAL CONSTRUCTION COST			145,498
	ENGINEERING FEE @ 10%			14,550
	LEGAL & ADMINISTRATIVE @ 5%			7,275
	LAND & RIGHT-OF-WAY			1,000
	TOTAL COST			$ 168,323

For convenience, a total construction cost of $168,000 will be used elsewhere in this report.

GENERAL LAYOUT

WESTERN HEIGHTS AND ECOLOGY ACRES
PROPOSED SEWER COLLECTION SYSTEM

SCALE: 1" = 400'



LEGEND

PROPERTY LINES
FORCE MAIN SEWER LINE
GRAVITY SEWER LINE
PRESSURE SEWER LINE
MANHOLE
CLEANOUT
BLOCK NUMBERS (1)

III. DESCRIPTION OF PROPOSED FACILITIES

The proposed facilities include a collection system and a central treatment plant. A combination gravity-pressure collection system will be used. Gravity-flow collection lines will be installed to serve as major trunk lines. Smaller pressure lines will branch off the gravity lines to serve individual areas. Due to the rugged terrain, a complete gravity system is not feasible; and due to the potential maintenance problems, a complete pressure system is not desirable. Therefore, the combination system was designed to provide gravity lines where the terrain allows and pressure lines elsewhere. Such a design combines the economy of a pressure system with the dependability of a gravity system.

The gravity trunk lines will be eight inch vitrified clay pipe. Manholes will be provided at all changes in grade or alignment. The pressure lateral lines will be two inch plastic pipe. Cleanouts will be provided at critical points, and flushing ports will be provided at the ends. The entire collection system was designed in accordance with state guidelines and good engineering practice.

Grinder pumps will be used to serve clusters of houses along the pressure lines. The wastewater from the individual houses will flow to the grinder pumps, the solids will be ground, and the mixture will be pumped into the system.

All of the wastewater from Western Heights will flow to a single pump station, and it will be pumped through 1,000 feet of four inch plastic force main to the treatment plant. The pump station will contain duplex pumps and automatic controls.

An extended aeration treatment plant will be used to stabilize the wastewater to acceptable effluent limitations. Either a prefabricated unit or one requiring little field assembly will be installed. In either case, the plant will be designed in accordance with State guidelines. Since a biological treatment facility will not function properly if greatly underloaded, only one-third of the plant will be built initially. Provisions will be made for plant expansion in accordance with future treatment needs.

The proposed facilities are described in detail in the Engineer's Report and Supplement. The layout of the system is shown on the preliminary design sheet. Quantities of construction are listed in the detailed cost estimates.

FACILITIES TO BE CONSTRUCTED IMMEDIATELY

All of the facilities discussed will be constructed immediately. Therefore, the detailed cost estimate previously listed is an estimate of immediate construction cost.

FACILITIES TO BE CONSTRUCTED IN THE FUTURE

Some future construction will be required. The capacity of the treatment plant will have to be increased in approximately five years and again in approximately ten years. As mentioned previously, one-third of the ultimate plant capacity will be provided with immediate construction. Some grinder pumps will also be required as the subdivisions fill; however, the number listed should be sufficient for three to four years.

Since future construction is not anticipated during the next three years, the cost of it will not be considered in this report.

IV. CUSTOMER INFORMATION

There are a total of 278 lots in both subdivisions; 144 in Ecology Acres and 134 in Western Heights. Only single-family residences are being built, and a total of 75 now exists in both subdivisions. It is estimated that 190 to 270 residences will eventually be built in both subdivisions. A population density of 3.30 persons per residence is expected, therefore, the total population would eventually reach 627 to 891. It is very difficult to predict the ultimate population of a new development because there is no way of knowing how many lots will remain vacant and how many people will live on each lot. However, the estimates listed are typical.

Sixty customers are expected to hook on to the sewer system immediately upon its completion, and fifteen new customers are expected in each of the next ten years. This means the sewer facilities would eventually serve a total of 210 customers. As with population, it is very difficult to predict the number of new customers that will be served each year; however, the numbers listed are reasonable and are comparable with the population predictions.

All of the sanitary sewer facilities are designed for a per capita flow of 100 gallons per day (GPD). Therefore, the immediate wastewater flow will be 19,800 GPD, and the eventual flow will 69,300 GPD. These flow figures were obtained by multiplying the number of customers times the estimated number of persons per residence (3.30) times the per capita flow of 100 GPD.

More detailed information on population predictions and flows is presented in the Engineer's Report and Supplement.

V. OPERATING EXPENSES

The following is a detailed estimate of the operating expenses that are expected for each of the first three years after the facilites are constructed.

ITEM	DESCRIPTION	COST PER YEAR
1.	Labor	$ 6,000
2.	Testing	1,000
3.	Power	3,000
4.	Materials & Supplies	2,000
	TOTAL	$ 12,000

The labor cost listed is for a part-time employee whose duties will include: servicing of the equipment; periodic flushing of the pressure lines; repairing leaks, broken parts, etc.; billing and record keeping; collection of effluent samples; filing of effluent reports with the Department of Natural Resources; hooking new customers to the system; and miscellaneous other duties.

The testing cost is for effluent monitoring in accordance with the National Pollutant Discharge Elimination System(NPDES) permit that will be issued to the utility by the Department of Natural Resources. Periodic sampling and testing of the wastewater flow will be required.

The power cost is for operating the treatment plant, the pump station that will serve Western Heights, and all the grinder pumps.

The materials and supplies cost is for replacement parts, flushing water, billing expenses, and maintenance equipment.

VI. RATE STRUCTURE

Two proposed rate structures will be presented, either of which would be acceptable to the Utility Company. The first alternative is based on recovering the capital costs with a hook-on fee and the operating costs with a monthly service charge. The second alternative is based on recovering both the capital and operating costs with a monthly service charge. Interest will be computed at 10%, which is the current rate for commercial loans. No profit will be considered.

ALTERNATIVE 1

The hook-on fee needed to recover $168,000 can be determined with the following equation:

$$60(x) + 6.144(15)(x) = \$168,000$$

where: x = the hook-on fee,
60 = the number of immediate customers,
15 = the number of new customers in each of the next ten years,
6.144 = the present worth factor of a uniform series of payments over a ten year period at 10% interest.

Solving for "x" gives a hook-on fee of approximately $1,100 ($1,104.10). This amount is needed to recover the immediate capital costs of the system.

The monthly user charge needed to recover the yearly operating costs of $12,000 can be determined with the following equation:

$$\frac{60(y)12 + 75(y)12 + 90(y)12}{3} = \$12,000$$

where: y = the monthly user charge,
60 = the number of customers in the first year,
75 = the number of customers in the second year,
90 = the number of customers in the third year,
12 = the number of months in a year,
3 = the number of years the charge will apply.

Solving for "y" gives a monthly user charge of $13.33. This user charge will produce $9,597.60 the first year, $11,997.00 the second year, and $14,396.40 the third year, making a total over the three-year period of approximately $36,000. The equation does not consider interest; however, interest expenses would amount to only a few hundred dollars.

Therefore, with Alternative 1, a hook-on fee of $1,100 and a monthly user charge of $13.33 would be required to recover the direct costs of the utility company.

ALTERNATIVE 2

If no hook-on fee is charged, both capital and operating costs would have to be recovered with a monthly user charge. The user charge needed to

recover operating costs has already been determined. To determine the user charge needed to recover capital costs, a twenty-year recovery period will be used. This length of time was chosen because it is a normal financing period, and it will produce lower rates than a shorter period. The user charge needed to recover $168,000 can be determined with the following equation:

$$60(z)12(0.9091) + 75(z)12(0.08264) + 90(z)12(0.7513) + 105(z)12(0.6830) + 120(z)12(0.06209) + 135(z)12(0.5645) + 150(z)12(0.5132) + 165(z)12(0.4665) + 180(z)12(0.4241) + 195(z)12(0.3855) + 210(z)12(0.3855)(6.144) = \$168,000$$

where: z = the monthly user charge,
each of the first ten quantities on the left side of the equation represents the present worth of the income for the first through tenth years,
the last quantity on the left side of the equation represents the present worth of the income for the eleventh through twentieth years,
the first number of each quantity = the number of customers in that year,
12= the number of months in a year,
the third number in each quantity = the present worth factor for that year,
the fourth number in the last quantity on the left side of the equation = the present worth factor of a uniform series of payments over a ten year period,
all of the present worth factors are for interest at 10%.

Solving for "z" gives a monthly user charge of $11.58. This user charge will produce the following income over the twenty-year period:

YEAR	NO. OF CUSTOMERS	INCOME	PRESENT WORTH OF INCOME
1	60	$ 8,337.60	$ 7,579.71
2	75	10,422.00	8,612.74
3	90	12,506.40	9,396.06
4	105	14,590.80	9,965.52
5	120	16,675.20	10,353.63
6	135	18,759.60	10,589.79
7	150	20,844.00	10,697.14
8	165	22,928.40	10,696.10
9	180	25,012.80	10,607.93
10	195	27,097.20	10,445.97
11 thru 20	210	29,181.60	69,116.97
		TOTAL PRESENT WORTH	$ 168,061.56

Therefore, with Alternative 2, a total monthly user charge of $24.91 (11.58 + 13.33) would be required to recover the direct costs of the utility company.

VII. SUMMARY

This economic feasibility study contains general information which supports two proposed rate structures. Specific information on parts of this report can be found elsewhere. The two rate structures developed include:

ALTERNATIVE 1

$1,100.00 hook-on fee and $13.33 monthly user charge.

ALTERNATIVE 2

$24.91 monthly user charge.

The following details were considered in developing the rate structures:

1. No profit for the utility company was figured in the rates.
2. Interest was figured at 10% compounded annually because this is the current rate for commercial loans in this area.
3. Capital costs would be recovered in 10 years with Alternative 1 and 20 years with Alternative 2. The 10 year recovery period was used in Alternative 1 because all customers are expected to be hooked to the system by that time. The 20 year recovery period was used in Alternative 2 to reduce the user charge by spreading it over a reasonable finance period.
4. No future capital expenditures were considered even though it was pointed out that more grinder pumps would be needed and the treatment plant would have to be expanded. These expenditures were not considered because they are more than three years away. Reliable cost estimates could not be made. When the expenditures are needed, the rate structure will have to be re-examined.
5. No increase in operating expenses was considered even though inflation will cause an increase. The estimated operating expenses are expected to apply for at least three years, after which the rate structure will have to be re-examined.

ADDENDUM NO. 1

ECONOMIC FEASIBILITY STUDY
SANITARY SEWER SYSTEM
ECOLOGY ACRES & WESTERN HEIGHTS SUBDIVISIONS
STODDARD COUNTY, MISSOURI

The purpose of this addendum is to provide more detailed information about operating expenses associated with the above stated sewer system. The Economic Feasibility Study prepared in July, 1978, by Trotter Associates of Dexter, Missouri, for Stoddard County Sewer Company, Inc., of Dexter, Missouri, contains an estimate of the operating expenses. Labor costs, testing costs, power costs, and materials costs are included in the estimate. The individual costs reported in the feasibility study were estimated as follows:

LABOR:

One employee will be used to operate and maintain all of the facilities. The labor cost of $6,000 per year will pay for a part-time employee who works approximately 1,500 hours per year at $4.00 per hour. This is considered adequate for this size of system.

TESTING:

It is estimated that samples of the treated effluent will have to be collected and tested monthly. The results will have to be reported to the appropriate regulatory agencies. The cost of sampling, testing, and reporting will be approximately $80 per month, or $960 per year. This figure was rounded to $1,000 per year.

POWER:

Power costs were estimated at $3,000 per year as follows:

1. A 5.0 horsepower (HP) motor will run continuously at the treatment plant to power the aeration equipment. The total kilowatt-hours (KWH) used per year will be = 5 HP x 0.746 KW/HP x 8760 Hr./Yr. = 32,675 KWH/Yr.
2. A 5.0 HP motor will run approximately one-third of the time to power the pumps at the pump station. The total KWH used per year will be approximately = 1/3 x 32,675 = 10,892 KWH/Yr.
3. A 1.0 HP motor will run approximately ten percent of the time to power each of the 20 grinder pumps. The total KWH used per year will be approximately = 20 x 1.0 HP x 0.746 KW/HP x 8760 Hr./Yr. x 10% = 13,070 KWH/Yr.

The total power used will be approximately 56,637 KWH/Yr. Power rates vary, but the utility company that will be supplying the power indicated that power costs are approximately five cents per KWH. At this rate the yearly power costs will be = 56,637 KWH x $0.05 = $2,831.85. This figure was then rounded to $3,000 per year, because rates may increase over the three-year period.

MATERIALS AND SUPPLIES:

There is no way to accurately estimate the amount of materials and supplies that will be needed; however, the $2,000 is conservative for a system of this size. One major breakdown could necessitate expenditures exceeding this amount.

This addendum was prepared in September, 1978, by Trotter Associates, Consulting Engineers, 100 Ridgetop Drive, Dexter, Missouri 63841.

Gary L. Gaines, P.E.