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# EC74-862 Cost of Installing and Operating Irrigation Systems

A. W. Epp

Philip Henderson

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Extension Service, University of Nebraska-Lincoln College of Agriculture Cooperating with the
U.S. Department of Agriculture and the College of Home Economics
J. L. Adams, Director

# Cost of Installing and Operating Irrigation Systems

A. W. Epp and Philip A. Henderson[1/]

Water for irrigation continues to be one of Nebraska's major agricultural resources. Although the total supply of water is limited and the water table has been declining in some areas, there are other areas where further irrigation development is possible. Farmers in these areas must decide whether to develop an irrigation system.

In some areas farmers have a choice between surface water from a public irrigation project or installing their own pumping system. Those who are considering the installation of an irrigation system should consider the total investment and the annual cost of operating alternative systems.

## Study Made in 1972

During the summer of 1972, information regarding costs of installing and operating gravity irrigation systems was obtained from farmers, well drillers, dealers and suppliers of fuel and electricity. Based on this information, average investments and costs of pumping are summarized in Tables 1 through 9.

Prices used are the averages of prices charged in 1972 by the dealers surveyed. Fuel shortages have occurred at times. Fuel prices have increased considerably since 1972 and are continuing to change. Inflation and a heavy demand for irrigation equipment may affect other costs. Anyone considering the installation of irrigation systems should check prices with a local dealer.

## Initial Cost of Well, Pump, and Power Unit

The average cost of drilling a well and casing it with 16 inch, 10-gauge steel casing was $11.15 per foot. This included the drilling of a test well and the gravel pack.

Cost of the pumps varied with the lift and amount of water pumped. Cost of the pump includes the bowl assembly, the pump

1/Professor of Agricultural Economics (Farm Management), University of Nebraska-Lincoln; Extension Economist (Farm Management), University of Nebraska, Lincoln.

column and the pump head. Type and number of stages in the bowl assembly were those recommended by engineers for the specifications of the well and rate of pumping.

Investment in the electric motors includes the proper size of weather resistant starting panel and the additional wiring costs usually paid by the farmer. Investment in the propane, natural gas or diesel engines includes the safety clutches, cooling coils, and the concrete base for mounting the engine. Fuel tanks are also included where required. The cost of the gas line for natural gas is not included because of wide variations in the amount of pipeline needed. Users of natural gas should include interest and depreciation on the investment in the gas line as part of the annual fixed cost.

Investment in the pumping systems is shown in Tables 1 to 5. Total investment varies from about $5,000 for a fairly shallow well to $18,000 for a deep well system powered by a diesel engine. These figures do not include the cost of water distribution equipment. Generally speaking, the initial investment is highest when a diesel engine is used. Systems using propane or natural gas require about the same initial investment; both being lower than systems powered by diesel engines but higher than systems powered by electric motors.

**Cost of Pumping Water**

There are a number of factors that influence the cost of pumping water. The most important variables include the lift, the type of fuel used, and the amount of water pumped. Tables 1 to 8 show the investment and pumping costs for typical gravity irrigation situations in Nebraska.

For the selected conditions, the depth of well varies from 150 to 400 feet and the range in lift is from 60 to 250 feet. These do not include the extremes found in Nebraska but do include the large majority of pumping situations.

The four types of fuel commonly used are electricity, propane, natural gas and diesel fuel. The 1972 prices for fuel were:

Propane—12 cents/gal

Diesel fuel—15 cents/gal

Natural gas—45 cents/1000CF

Electricity—the average cost for the Public Power Districts serving the irrigated area.

Nine hundred hours of pumping was common among farmers surveyed but there was a wide variation. Pumping rates of 1,000 to 1,500 gallons per minute are quite common but again, there are many wells with capacities outside of this range.

Gated pipe has become a very common method of distributing water by gravity, although some farmers still use the open ditch method. The first two columns in Tables 1 to 5 compare the cost of pumping into an open ditch with the cost of pumping into gated pipe. It was assumed that 10 pounds extra pressure was required because of the use of gated pipe. This extra pressure was included in determining the type of pump and size of motor required. The use of gated pipe added from 78 cents to $1.72 per acre foot to the cost of pumping water.

**Table 1. Capital investment and cost of pumping water for irrigation from a 150-foot well, 60-foot lift, 1,000 GPM and 900 hours of pumping annually—1972.**

| *Fuel* | *Electricity* | *Electricity* | *Propane* | *Natural gas*[a/] |
|---|---|---|---|---|
| *Discharge through* | *Open pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* |
| Investment | | | | |
| Well and casing | $1,675 | $1,675 | $1,675 | $1,675 |
| Pump | 1,570 | 1,570 | 1,570 | 1,570 |
| Gear drive | | | 570 | 570 |
| Power unit | 810 | 1,155 | 1,280 | 1,280 |
| Fuel tank | | | 300 | |
| Total investment | $4,055 | $4,400 | $5,395 | $5,095 |
| Annual cost | | | | |
| Fixed cost on investment | $ 369 | $ 398 | $ 588 | $ 559 |
| Fuel | 372 | 472 | 329 | 127 |
| Oil | 2 | 3 | 37 | 37 |
| Repairs | 15 | 15 | 45 | 45 |
| Labor | 15 | 15 | 108 | 108 |
| Total cost | $ 773 | $ 903 | $1,107 | $ 876 |
| Cost/acre foot | $ 4.69 | $ 5.47 | $ 6.71 | $ 5.31 |
| Cost/acre foot lift | .078 | .091 | .112 | .089 |

a/ Does not include cost of the pipeline.

**Table 2. Capital investment and cost of pumping water for irrigation from a 150-foot well, 100-foot lift, 1,000 GPM, and 900 hours of pumping annually—1972.**

| *Fuel* | *Electricity* | *Electricity* | *Propane* | *Natural gas*[a/] |
|---|---|---|---|---|
| *Discharge through* | *Open pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* |
| Investment | | | | |
| Well and casing | $1,675 | $1,675 | $1,675 | $1,675 |
| Pump | 2,000 | 2,000 | 2,000 | 2,000 |
| Gear drive | | | 570 | 570 |
| Power unit | 1,280 | 1,280 | 1,620 | 1,620 |
| Fuel tank | | | 300 | |
| Total investment | $4,955 | $4,955 | $6,165 | $5,865 |
| Annual cost | | | | |
| Fixed cost on investment | $ 452 | $ 452 | $ 680 | $ 652 |
| Fuel | 547 | 829 | 487 | 189 |
| Oil | 4 | 5 | 55 | 55 |
| Repairs | 15 | 15 | 67 | 67 |
| Labor | 15 | 15 | 108 | 108 |
| Total cost | $1,033 | $1,316 | $1,397 | $1,071 |
| Acre feet pumped | 165 | 165 | 165 | 165 |
| Cost/acre foot | $6.26 | $7.98 | $8.47 | $6.49 |
| Cost/acre foot/foot lift | .063 | .080 | .085 | .065 |

[a/] Does not include the cost of the pipeline.

**Table 3. Capital investment and cost of pumping water for irrigation from a 200-foot well, 150-foot lift, 1,200 GPM and 900 hours of pumping annually—1972.**

| *Fuel* | *Electricity* | *Electricity* | *Propane* | *Natural gas*[a/] | *Diesel* |
|---|---|---|---|---|---|
| *Discharge through* | *Open pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* |
| Investment | | | | | |
| Well and casing | $2,200 | $2,200 | $2,200 | $2,200 | $2,200 |
| Pump | 3,260 | 3,260 | 3,260 | 3,260 | 3,260 |
| Gear drive | | | 790 | 790 | 790 |
| Power unit | 1,915 | 2,215 | 2,000 | 2,000 | 4,160 |
| Fuel tank | | | 300 | | 150 |
| Total investment | $7,375 | $7,675 | $8,550 | $8,250 | $10,560 |
| Annual cost | | | | | |
| Fixed cost on investment | $ 678 | $ 703 | $ 935 | $ 906 | $1,164 |
| Fuel | 1,022 | 1,270 | 822 | 318 | 647 |
| Oil | 7 | 8 | 93 | 93 | 93 |
| Repairs | 15 | 15 | 113 | 113 | 175 |
| Labor | 15 | 15 | 108 | 108 | 108 |
| Total cost | $1,737 | $2,011 | $2,071 | $1,538 | $2,187 |
| Acre feet pumped | 198 | 198 | 198 | 198 | 198 |
| Cost/acre foot | $8.77 | $10.16 | $10.46 | $7.77 | $11.04 |
| Cost/acre foot/foot lift | .058 | .067 | .069 | .051 | .073 |

[a/] Does not include the cost of the pipeline.

Table 4. Capital investment and cost of pumping water for irrigation from a 300-foot well, 200-foot lift, 1,200 GPM and 900 hours of pumping annually—1972.

| *Fuel* | *Electricity* | *Electricity* | *Propane* | *Natural gas*[a/] | *Diesel* |
|---|---|---|---|---|---|
| *Discharge through* | *Open pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* | *Gated pipe* |
| Investment | | | | | |
| Well and casing | $3,250 | $3,250 | $ 3,250 | $ 3,250 | $ 3,250 |
| Pump | 3,930 | 3,930 | 3,930 | 3,930 | 3,930 |
| Gear drive | | | 1,040 | 1,040 | 1,040 |
| Power unit | 2,215 | 2,625 | 3,600 | 3,600 | 5,300 |
| Fuel tank | | | 300 | | 150 |
| Total investment | $9,395 | $9,805 | $12,120 | $11,820 | $13,670 |
| Annual cost | | | | | |
| Fixed cost on investment | $ 860 | $ 895 | $1,356 | $1,327 | $1,495 |
| Fuel | 1,469 | 1,647 | 1,059 | 410 | 834 |
| Oil | 10 | 11 | 120 | 120 | 120 |
| Repairs | 15 | 15 | 146 | 146 | 225 |
| Labor | 15 | 15 | 108 | 108 | 108 |
| Total cost | $2,369 | $2,583 | $2,789 | $2,111 | $2,782 |
| Cost/acre foot | $11.96 | $13.04 | $14.08 | $10.66 | $14.05 |
| Cost/acre foot/foot lift | .059 | .065 | .070 | .053 | .070 |

a/ Does not include the cost of the pipeline.

Table 5. Capital investment and cost of pumping water for irrigation from a 400-foot well, 250-foot lift, 1,500 GPM and 900 hours pumped annually—1972.

| *Fuel* | *Electricity* | *Electricity* | *Diesel* |
|---|---|---|---|
| *Discharge through* | *Open pipe* | *Gated pipe* | *Gated pipe* |
| Investment | | | |
| Well and casing | $ 4,300 | $ 4,300 | $ 4,300 |
| Pump | 5,060 | 5,060 | 5,060 |
| Gear drive | | | 1,295 |
| Power unit | 3,755 | 4,235 | 7,200 |
| Fuel tank | | | 150 |
| Total investment | $13,115 | $13,595 | $18,005 |
| Annual cost | | | |
| Fixed cost on investment | $1,194 | $1,235 | $1,979 |
| Fuel | 2,345 | 2,507 | 1,276 |
| Oil | 15 | 17 | 184 |
| Repairs | 15 | 15 | 344 |
| Labor | 15 | 15 | 108 |
| Labor cost | $3,584 | $3,789 | $3,891 |
| Cost/acre foot | $14.45 | $15.28 | $15.69 |
| Cost/acre foot/foot lift | .057 | .061 | .062 |

## Fixed Costs

Fixed costs are those costs which occur regardless of the amount of water pumped. They include depreciation, interest, taxes, and insurance. Depreciation was based on the following estimated life of equipment:

Well—25 years
Pump—18 years
Electric motor—25 years
Diesel engine—12 years
Natural gas or propane engine—10 years
Gear drive—12 years
Fuel tanks—20 years

Interest was charged at 7½ percent on one-half the investment. Taxes and insurance were estimated to be 1 percent of the total initial investment.

Depreciation and interest are the two largest items of fixed costs, and they, like other fixed cost items, vary in amount depending on the total investment. In the situations described in this study, total fixed costs varied from $369 for the shallowest well to $1,979 for the deepest well.

Fixed costs for electrically powered systems are understated because a part of the charge for electricity is a fixed cost in the public power districts. There was so much variation among the districts in the method of figuring this minimum fixed charge that it appeared most practical to include all charges for electricity with the variable operating costs.

## Effect of Type of Fuel on Pumping Costs

The type of fuel to use is an important consideration in selecting an irrigation system. An investment in a power unit is a relatively large and long term investment; thus, it may be costly to make a change. In the past, natural gas has been very economical, but whether it will be in the future is uncertain. Prices of all fuels are rising and are likely to continue to rise in the future.

Using 1972 prices, the effect of type of fuel on the cost of pumping is shown in Tables 6 and 7. In Table 6 the lift of 100 feet and the 900 hours of pumping time are held constant. Fixed costs are higher for the natural gas and propane systems because of the larger investments in pumps and power units. But the higher fixed cost for the natural gas system is more than offset by the low cost of fuel compared to the electric system. The total cost of pumping is lower with natural gas than with either propane or electricity. Diesel fuel is not included in this comparison because diesel engines are commonly used only for heavier loads.

In Table 7 the lift is increased to 200 feet, and the rate of pumping is 1,200 gallons per minute. All four types of fuel are compared. Again the investment in the electrically powered system is lowest. The largest initial investment is required for a system powered by a diesel engine. Fuel cost is high for the electrically powered systems because of high minimum charges based on the horsepower rating of the motor.

The cost of pumping was lowest where natural gas was used. Under the circumstances given and with 1972 prices, the cost was $10.56 per acre foot. Pumping costs were about the same for the propane and diesel systems and both were higher than the cost of pumping with electricity.

### Effect of Lift

The distance water has to be lifted to bring it to the surface has a high impact on the cost of pumping water. To show this effect (Table 8) the rate of pumping, the hours pumped and the type of fuel (electricity) are constant. Depth of well had to be varied with the lift because the lift is typically related to the depth of well. Lifts shown in parentheses in Table 8 include an additional 23 feet of lift because of the 10 pounds of pressure required for the gated pipe system. Ten pounds of pressure is equivalent to a lift of 23 feet.

Pumping cost per acre foot increases with an increase of lift, from $5.41 for the 83-foot lift to $12.00 for the 223-foot lift. The increase in cost is not proportional to the lift as indicated by the cost per acre foot per foot lift. This actually decreases from 9 cents per acre foot per foot of lift for the 83-foot lift to 6 cents for the 223-foot lift. The larger power units are more efficient than the smaller units but it takes much more power as the lift increases.

**Table 6. Effect of type of fuel on the capital investment and cost of pumping water for irrigation from a 150-foot well, 100-foot lift, 1,000 GPM and 900 hours of pumping annually—1972.**

| | *Electric* | *Propane* | *Natural gas* |
|---|---|---|---|
| Investment | | | |
| Well | $1,675 | $1,675 | $1,675 |
| Pump | 2,000 | 2,000 | 2,000 |
| Gear drive | | 570 | 570 |
| Power unit | 1,280 | 1,920 | 1,620 |
| Total | $4,955 | $6,165 | $5,865 |
| Fixed cost | $ 452.37 | $ 680.10 | $ 651.60 |
| Fuel | 810.78 | 486.86 | 188.60 |
| Oil | 4.99 | 55.33 | 55.33 |
| Repairs | 15.00 | 67.09 | 67.09 |
| Labor | 15.00 | 108.00 | 108.00 |
| Total cost | $1,298.14 | $1,396.38 | $1,070.62 |
| Acre foot pumped | 167 | 167 | 167 |
| Cost/acre foot | $7.88 | $8.37 | $6.41 |

Table 7. Effect of type of fuel on the capital investment and cost of pumping water for irrigation from a 300-foot well, 200-foot lift, 1,200 GPM and 900 hours of pumping annually—1972.

| | *Electric* | *Propane* | *Natural gas*[a/] | *Diesel* |
|---|---|---|---|---|
| Investment | | | | |
| Well | $3,250 | $3,250 | $3,250 | $3,250 |
| Pump | 3,930 | 3,930 | 3,930 | 3,930 |
| Gear drive | | 1,040 | 1,040 | 1,040 |
| Power unit | 2,625 | 3,900 | 3,600 | 5,450 |
| Total | $9,805 | $12,120 | $11,820 | $13,670 |
| Fixed cost | $ 894.74 | $1,355.54 | $1,327.04 | $1,495.25 |
| Fuel | 1,646.67 | 1,059.31 | 410.34 | 833.94 |
| Oil | 10.86 | 120.38 | 120.38 | 120.38 |
| Repairs | 15.00 | 145.97 | 145.97 | 225.04 |
| Labor | 15.00 | 108.00 | 108.00 | 108.00 |
| Total cost | $2,582.27 | $2,789.20 | $2,111.73 | $2,782.61 |
| Acre feet pumped | 200 | 200 | 200 | 200 |
| Cost/acre foot | $12.91 | $13.95 | $10.56 | $13.91 |

[a/]Does not include cost of the gas line.

Table 8. Effect of variations in lift on the capital investment and cost of pumping water for irrigation with electric power, 1,000 GPM and 900 hours of pumping annually—1972.

| | *Depth of well—feet* | | | |
|---|---|---|---|---|
| | *150* | *150* | *200* | *300* |
| Lift—feet | 60(83) | 100(123) | 150(173) | 200(223) |
| Investment | $4,400 | $4,955 | $6,815 | $8,840 |
| Fixed cost | 399 | 452 | 669 | 716 |
| Variable cost | 506 | 864 | 1,176 | 1,288 |
| Total cost | $ 905 | $1,316 | $1,845 | $2,004 |
| Acre feet pumped | 167 | 167 | 167 | 167 |
| Cost per acre foot | $ 5.41 | $ 7.88 | $ 11.05 | $ 12.00 |
| Cost per A ft/ft lift | $ .09 | $ .079 | $ .074 | $ .06 |

**Effect of Hours of Use**

The 900 hours of pumping per year is typical in central Nebraska. This would provide 45 days of pumping at 20 hours per day. Pumping would usually come in July and August. In years of abnormally high rainfall the hours pumped may be considerably less and in dry years and in the lower rainfall areas the hours pumped may be considerably higher.

Table 9 shows the effect on pumping cost per acre foot of changes in hours of pumping time. The relatively high fixed costs of owning a pumping system result in high costs of pumping when hours of use are low. The cost per acre-foot decreased from $19.30 for 500 hours of pumping to $12.24 when used for 1,200 hours. The expected hours of use become very important when estimating the cost of pumping water.

**Table 9. Effect of variations in hours of pumping on the cost of pumping water for irrigation from a 300-foot well, 200-foot lift, 1,200 GPM and the use of propane fuel—1972.**

| | *Hours pumped annually* | | | |
|---|---|---|---|---|
| | *500* | *700* | *900* | *1200* |
| Fixed cost | $1,356 | $1,356 | $1,356 | $1,356 |
| Variable cost | $ 796 | $1,115 | $1,434 | $1,912 |
| Total cost | $2,152 | $2,471 | $2,789 | $3,268 |
| Acre feet pumped | 111 | 155 | 200 | 267 |
| Cost per acre foot | $ 19.39 | $ 15.94 | $ 13.95 | $ 12.24 |

## Using the Information to Estimate Required Investments for Particular Situations

Information in Tables 1-5 provides guides for estimating the amount of capital required to put down an irrigation well and equip it with a pump and motor. But there will be farmers who have different circumstances from those described in the tables. For example, they may want to use some kind of sprinkler system for distributing the water. If so, this will require a larger power unit to provide the needed pressure. Therefore, a more flexible tool is provided for estimating approximate capital needs.

**Estimating Water Horsepower**

For practical purposes, water horsepower can be calculated in the following manner:

Multiply rate of pumping (gallons per minute) by total lift (multiply pounds of pressure required in the line by 2.31 and add the product to the vertical lift) and then divide by 3960. In terms of an equation,

$$\text{Water Horsepower} = \frac{(\text{Vertical lift} + (\text{lb pressure} \times 2.31)) \times \text{gpm}}{3{,}960}$$

The rate of discharge (gpm) will not actually be known, of course, until the pump is installed and in working order but the probable rate of pumping can be estimated on the basis of what other irrigation wells in the neighborhood are pumping or on test well information.

About 10 pounds of pressure is required to discharge water through gated pipe. About 40-50 pounds of pressure is required for tow lines, and 65-85 pounds for center-pivot systems.

Thus, if the vertical distance from the pumping level of the water to the surface of the ground is 110 feet, the rate of pumping is 1,000 gpm, and a center-pivot distribution system requiring 75 pounds pressure is to be used, the water horsepower required would be:

$$\frac{(110 + (75 \times 2.31)) \times 1{,}000}{3{,}960} \quad \text{or } 71.5$$

If the water has to be transported through conveyor pipe for a considerable distance before it reaches the point of discharge, an additional allowance for friction should be made. With 8-inch conveyor pipe and 900 gpm, add 1.25 to the total lift for each 100 feet of conveyor pipe. A pumping rate of 1,000 gpm would increase the adjustment figure from 1.25 to 1.49. If 10-inch pipe is used, the necessary adjustments are only 1/3 as large.

## Estimating Needed Investment

Once the approximate water horsepower is determined, the required investment in the pump, power unit, and gearhead can be estimated from the following equations:

*Electric System*
Investment in power unit = (WHP x $38) + $370
Investment in pump = (WHP x $43) + $685
*Propane or Natural Gas Power Unit System*
Investment in power unit = (WHP x $50) + $235
Investment in pump = (WHP x $50) + $510
Investment in gearhead = (WHP x $8.75) + $385
*Diesel Power Unit System*
Investment in power unit = (WHP x $60) + $1,040
Investment in pump = (WHP x $36) + $1,410
Investment in gearhead = (WHP x $8.75) + $385

## Total Investment

The total investment required for irrigation includes more than just the well, pump, power unit. Depending on the type of distribution system, money will be needed for pipe, a center-pivot system or some other kind of sprinkler equipment, and for such things as fuel tanks, natural gas lines, siphon tubes, ditchers, etc. In addition, nearly every would-be irrigator will need to spend something for land leveling. Even sprinkler systems may call for some leveling to assure adequate drainage.

The most accurate estimate of costs for the various items can be obtained by working closely with drillers, soil-moving contractors, and irrigation equipment dealers. Table 10 provides guidelines for estimating the capital needed for certain items and space for assembling all the capital requirement figures. The total investment required is simply the sum of the individual items. Prices shown are subject to change, of course. Continued inflation will cause an increase in the amount of capital required; this should be recognized and taken into account in any estimate made.

**Table 10. Form for estimating the total investment required for irrigation.**

| *Investment Item* | *Cost* |
|---|---|
| Well—total drilling depth x $11.50 a foot | ______ |
| Pump—see preceding discussion | ______ |
| Gear drive—see preceding discussion | ______ |
| Power unit—see preceding discussion | ______ |
| Fuel tank—see your local dealer or figure about $300 | ______ |
| Natural gas line—talk to your natural gas distributor or figure 30 cents per foot | ______ |
| Distribution system (the most accurate estimate can be made if you work with one or more of your local dealers; otherwise, the prices shown here (1973) can be used as a basis for making your estimate) | ______ |
| Conveyor pipe, underground—8" $1.30 per ft.; 10" $1.43 per ft. | ______ |
| Conveyor pipe, above ground—8" $1.00 per ft.; 10" $1.15 per ft. | ______ |
| Gated pipe, 30" gates—8" $.95 per ft.; 10" $1.12 per ft. | ______ |
| Gated pipe, 40" gates—8" $.88 per ft.; 10" $1.05 per ft. | ______ |
| Tow line, including main line—$10,000 per quarter section | ______ |
| Center pivot—$22,000 for a quarter section | ______ |
| Land leveling—best to get an estimate from a contractor or the Soil Conservation Service | ______ |
| Total Investment | $______ |

To illustrate how Table 10 might be used, let's assume you are considering installing a gravity irrigation system using 8-inch gated pipe with 30-inch gates to irrigate 120 acres. Most wells in your area are producing about 900 gallons per minute (gpm) and are drilled about 150 feet deep. The vertical lift, however, is only about 100 feet. There is a natural gas line half a mile from where the well would be located and you plan to use a natural gas power unit. You will need 1,320 feet of gated pipe and 660 feet of 10-inch conveyor pipe. On the basis of the above information, you calculate the water horsepower to be 28.6, but for practical purposes, you decide to use an even 30. The figures you would put in your form would be those shown in Table 11.

**Table 11. Form for estimating the total investment required for irrigation.**

| *Investment Item* | *Cost* |
|---|---|
| Well—total drilling depth x $11.50 a foot | $1,725 |
| Pump—see preceding discussion | 2,010 |
| Gear drive—see preceding discussion | 648 |
| Power unit—see preceding discussion | 1,735 |
| Fuel tank—see your local dealer or figure about $300 | |
| Natural gas line—talk to your natural gas distributor or figure 30 cents per foot | 792 |
| Distribution system (the most accurate estimate can be made if you work with one or more of your local dealers; otherwise, the prices shown here (1973) can be used as a basis for making your estimate) | |
| Conveyor pipe, underground—8" $1.30 per ft. | |
| 10" $1.43 per ft. | |
| Conveyor pipe, above ground—8" $1.00 per ft. | |
| 10" $1.15 per ft. | 759 |
| Gated pipe, 30" gates—8" $.95 per ft.; 10" $1.12 per ft. | 1,254 |
| Gated pipe, 40" gates—8" $.88 per ft.; 10" $1.05 per ft. | |
| Tow line, including main line—$10,000 per quarter section | |
| Center pivot—$22,000 for a quarter section | |
| Land leveling—best to get an estimate from a contractor or the Soil Conservation Service, 120 acres x $70 | 8,400 |
| Total Investment | $17,323 |

You should adjust your figures up or down depending on how current prices of irrigation equipment compared to those in 1972.

## Estimating the Variable Costs of Pumping Water for 120 Acres

Variable pumping costs should be similar to those shown in Table 2, i.e., $1,071 less $652. If the land is to be used for corn, and assuming you will need to pump about 10 inches of water or 5/6 of a foot per acre, you would need to pump 120 x 5/6 or 100 acre feet of water. Your variable pumping costs for the year would be close to

$$\$255 \left(\frac{1071 - 652}{165} = \$2.54 \times 100\right)$$

plus any adjustment for changes in prices since 1972.

The capital requirement and variable cost of pumping arrived at by this process are not extremely accurate, but they should be close enough to be very helpful in making a decision relative to whether to proceed with actual installation of an irrigation system.

ACKNOWLEDGMENT

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Staff members of the Department of Agricultural Engineering were consulted regarding the engineering phases of this study. Some of the costs were calculated according to the procedures described in E.C. 64-733—Pump Irrigation Cost Analysis, by Deon Axthelm and J. F. Decker, Agricultural Extension Service, University of Nebraska-Lincoln.