

Water Distribution Systems

By EDWARD J. CASEY

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Since the first days of golf in America, at St. Andrew's Golf Club, Hastings-on-Hudson, N. Y., golf course development has reached a fantastic rate of development. Paralleling this growth has been the progress in golf course maintenance—standards, quality, and utility. Irrigation is but one of the important components of golf course maintenance; it has progressed from practically nothing to the critically engineered design, pressure-

volume, full coverage systems we have today. Whether an irrigation system is to be of pressure-volume, full coverage, or to be one of lesser extent, the fundamentals determining its workload and its accomplishments remain the same in each case.

However familiar these supporting fundamentals may be, there is some value accompanying a review of the important ones, in the order of their importance.

From Origin to Objective

Water Supply	Propulsion	Transmission	Objective
Lakes	Vertical	4 inch pipe - Costs per foot	18 holes - greens, tees, and fairways - 46 acres
Rivers	Turbine pump adaptable to water sources	Cast iron per M ft. \$1.56 Transite " " " \$1.14 Plastic " " " \$1.75 Steel " " " \$1.53	1 acre inch per week = 1.25 million gallons 1 trip over requires 21 hours @ 500 g.p.m. = 630,000 gallons
Wells	Well Test for static level; Drawdown Pumping level at 140 feet deep Pump stages at 150 feet deep Pump into Pressure Tank at 100 lbs. pressure Discharge Head = 150 feet Pressure Head = 231 feet Total Pump Head = 381 feet	Cost influences design; Design influences costs. Design is critical in Performance Work Load Friction Head Through Work Sheet determine: 1. Routing of lines 2. Precipitation rate 3. Pressure 4. Pipe sizes 5. Friction Head 6. Final Design Estimated Work Load 90 head feet	2 trips over requires 42 hours @ 500 g.p.m. = 1,260,000 gallons rate is adjustable Use rate of 500 g.p.m. should be provided for.

Pump Head 381 feet + Est. Work Load 96 feet = Total System Head 471 Head feet.

471 Head feet @ 500 g.p.m. = Work Load.

System Head and Power Requirements

500 G.P.M. x 471 Hd. ft. = Work load
500 x 8.337 = 4168.5 lbs. per minute
4168.5 x 471 = 1,963,363.5 foot lbs. per minute

1 H.P. = 550 ft. lbs. per second or 33,000 foot lbs. per minute

$\frac{1,963,363.5}{33,000} = 59.4$ horsepower required

If the pump operates at 70 per cent efficiency, then $59.4 \times 1.43 = 85$ per cent horsepower.

This theoretic example of system head

and power requirements indicates the system head or workload is too high for economical and practical operations. The example shows higher values are found at low head and large discharge; lower values at high head and small discharge. Design is critical. Efficient distribution of water assures irrigation in Depth (wetting the soil) at precipitation rates adjusted to the intake characteristics of the soil. Mechanical manipulation of the system should remain very close to design specifications regarding system operation.

Commentary

1. **Objective**
An efficient system.
2. **Water Supply**
Good balance in these two factors is necessary: Water supply at 300 G.P.M. to 500 G.P.M. is adaptable to system operation; total elapsed time precipitating one inch per acre is the variable factor.
3. **Transmission**
Pipeline design, pipe size, non-corrosive, smooth inside wall and minimum number of fittings are important fac-

tors in avoiding build up of friction head.

Correct size piping for efficiency and economy.

4. **Propulsion**
Pumps—Motors.
Estimated System Head and Live Discharge, plus other pertinent information regarding proposed system operation and heavy load periods are the facts upon which pump manufacturers decide the type and capacity equipment necessary for the work to be done and to guarantee performance.

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By WILLIAM RILEY

Golf Course Superintendent, Essex Fells Country Club, Essex Fells, N. J.

Our club is located in a poor water area and our watering system is designed to take advantage of all possible natural and waste water available on our property to supplement our 50 gallon-per-minute well. We like to think of our system as a "holding system" for the summer months of July and August primarily, and it is therefore designed for conservative use; it is used to irrigate the ten fairways at our course which normally are dry in summer because of their natural elevation and hilly terrain.

We designed our system so that we capture all the run-off from rainfall from our parking area, from the clubhouse leaders, and from the deck of our newly constructed swimming pool. In addition, we trap all water from the following areas of our swimming pool:

- a. From the pool deck, which is washed down daily for sanitary reasons—estimated 1,000 gallons per day.
- b. From rinse shower, which runs continuously—estimated 2,500 gallons per day.
- c. From the wading pool, emptied daily—estimated 6,000 gallons per day.
- d. From pool gutter overflow, which is created by circulating system for water sterilization—estimated 13,000 gallons per day.

All this trapped waste water feeds by

gravity flow through Orangeburg pipe to our reinforced concrete storage tank of 72,000 gallons capacity (60 feet x 20 feet x 8 feet) situated beneath one of our fairways. In turn, the water from the tank flows by gravity to our distribution pump through six-inch transite pipe. Our distribution pump capacity is 300 gallons per minute at 100 pounds pressure.

Our mains consist of 3 inch and 4 inch (PVC) plastic pipe and our laterals are 2 inch and 3 inch sizes in the same pipe, which we installed by ourselves. We utilize quick coupling, rotary type sprinkler heads which operate at 70 to 90 pounds pressure distributing 40 gallons per minute.

This is our system, designed for the conservative use of water in a poor water area, and it fully meets our irrigation requirements for ten fairways during periods of water stress.

TURF MANAGEMENT

The book "Turf Management," sponsored by the United States Golf Association and edited by Prof. H. B. Musser, is a complete and authoritative guide in the practical development of golf-course turfs.

This 354-page volume is available through the USGA, 40 East 38th Street, New York 16, N. Y., the USGA Green Section Regional Offices, the McGraw-Hill Book Co., 350 West 42nd Street, New York 36, N. Y., or local bookstores. The cost is \$7.