department operation is the condition of the brushes. When showing any signs of hard wear, they should be replaced. During their service they should be subjected to frequent sterilizing baths.

Replacement of the old untidy duckboard bath "mats" by sponge rubber mats has been almost general at the better clubs. A generous supply of high-quality toilet articles also is becoming the general thing. In the old days the talcum powder and soap too often were items picked up from job lots with which some club member was stuck. Today, the toilet articles in the men's and women's bath departments of well run clubs compare favorably with the supplies in barber and beauty shops.

Women's Department Important

Women are even fussier than men about the way in which their bath departments are constructed and maintained. There is a happy medium between sheer daintiness and utility, and the policy of operation of women's bath departments should take this middle road.

Too frequently there is a tendency to have the floor covering color of shower and locker-room darker than they should be. This simply means that the attendant is liable to clean carelessly. Light colors have their place in the golf clubs bath and locker departments as well as in the members' homes. In distinctive beauty the club bath departments today are as far behind their possibilities as a Chic Sale crescent-lit job is inferior to one of the modern domestic bathrooms shown in a Crane advertisement.

Make Up for Architects' Faults

Rarely has the manager properly designed and constructed bath departments, especially if his clubhouse is old. His only hope then is incessant care in maintenance. In the smaller clubs, where there is only one locker-room attendant, one of the larger caddies or other extra help should be drafted on the rush days, so gathering of towels, mopping and other jobs necessary to keep the shower and locker departments immaculate can be done instantly.

Adequate Sewage Disposal Plant Essential for Clubhouses

By R. F. MacDOWELL
Civil Sanitary Engineer, Cleveland

THE club director or manager who has had responsibility in connection with the building or operating of a golf clubhouse well knows that there is a distinct problem involved in the proper treatment and final disposal of sewage and other liquid wastes from shower baths, toilets, kitchen sinks and other drains. If a municipal sewer is available within reasonable distance of the clubhouse the problem is an easy one. But usually the golf course is located outside municipal limits and is considerably removed from a sewerage system, so that a separate disposal system must be provided. It is the purpose of this article to outline the factors which are involved in the problem and in its solution, with the hope that the suggestions made will be of assistance to those contemplating either building a new clubhouse or making improvements to the present structure.

A large amount of water is used daily in a golf clubhouse and this water, when mixed with sewage and other wastes, must be collected by means of a sanitary sewer and thence conducted to the proper site for treatment and final disposal. The required degree of treatment or purification of the sewage will depend upon the size and constancy of flow of the stream, together with the extent of development of the adjacent territory and the use of the stream below the sewer outlet.

At the outset it should be understood that, as is usually recognized by the golf club architect, proper treatment and disposal of sewage calls for the services of a sanitary engineer, working either through the architect or directly for the club, and

unless the architect's office has such a man in his organization such services should be otherwise arranged for.

Character of Liquid Wastes

In general, the liquid wastes from a clubhouse consist of sewage from toilets, waste water from lavatories, bath tubs, kitchen sinks, shower baths, laundry machinery and tubs, and floor drains, and cooling water from refrigeration and other machinery. Although less than one per cent of sewage is putrescible organic matter, it is this small amount which creates the entire sewage disposal problem and calls for careful consideration from a sewage treatment standpoint. All water from roof and foundation drains, and all boiler drainage, should be discharged into a storm sewer which should be a pipe line separate from the sanitary sewer if the sanitary waste is to be treated before final disposal. Also, water used for cooling of refrigerators and other machinery should be kept out of the sanitary sewer. It is often worth while, in the interest of economy, to pump this water into the hot water plumbing system as its temperature is considerably raised by the cooling operation, thus effecting a saving in fuel and reducing the quantity of water consumed by the club as well as the quantity of sewage to be treated.

The character of the sewage from a clubhouse, though varying considerably at different times of the day and week, is in general not dissimilar from municipal sewage. It usually contains, however, an excessive amount of soap from the shower baths, which complicates the problem of treatment. Shower bath water should always discharge into the sanitary sewer, for soapy water will cause a nuisance as quickly as toilet water if discharged in the open without treatment.

Even more important is the greasy waste from the kitchen sinks. If allowed to flow through the plumbing pipes to the sewer without first intercepting the grease, these pipes will soon fill with grease and become clogged. A grease trap, of adequate size and water cooled, should be placed on each kitchen sink drain, and located as near as possible to the sink. This trap should be easily accessible and the grease should be removed at least twice each week. Usually the grease trap can be placed in the basement immediately under the kitchen sink which is on the floor above.

The quantity of liquid wastes to be handled must be known before the sewage treatment plant can be designed. This quantity will vary considerably, depending upon several factors. The membership of the club, partial indication of the probable flow, must be considered along with the character of the club, completeness of clubhouse facilities (including number of plumbing fixtures) kitchen and dining-room capacity, and use made of the clubhouse. Also, sewage flow will fluctuate widely for different days of the week and different hours of the day, depending upon the number of golf players and the resulting use of shower baths and other facilities. Heaviest flow will, of course, be on Saturdays, Sundays and holidays. This fluctuation of flow also somewhat complicates the problem of sewage treatment.

Quantity of Wastes

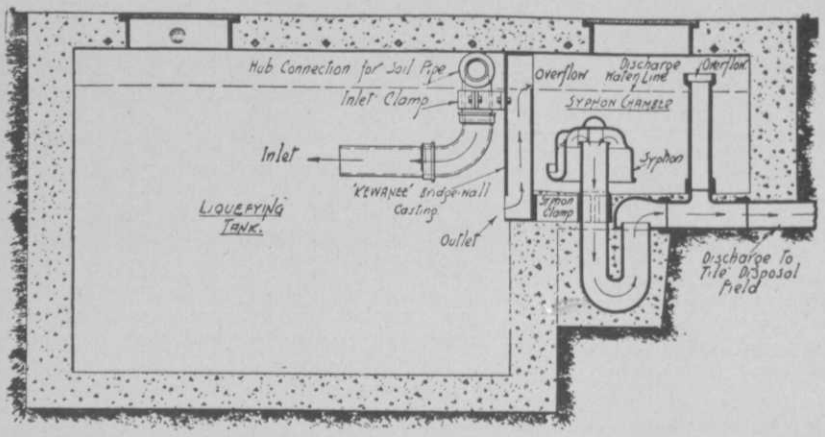
To illustrate the wide variation in the quantity of flow, the following figures are given, showing the week-day sewage flow measurements from three representative golf clubhouses in the Cleveland district.

	Manakiki.	Pepper Pike.	The Country Club.
Number of members—			
Total	325	125	450
Normal weekday attendance	125	50	150
Number of employees	35	10	90
Sewage flow—Normal weekday—			
Gallons daily	10,000	5,700	30,000
Peak hourly	1,040	940	...
Per member	31	46	67
Per member attending club normal weekday	44	114	200

This table shows very clearly that it is not safe to assume a per capita daily sewage flow without careful consideration of the factors affecting such flow.

Disposal of Sewage

Having determined the character and quantity of sewage, we are ready to consider the best method of disposal. Assuming that a city sewer is not available, the clubhouse sewage must be discharged into a water-course, after sufficient and proper treatment to insure freedom from nuisance below the sewer outlet. If a large stream is available it is sometimes possible to discharge the sewage without treatment, but such a condition rarely exists. If the stream is of fair size, so as to effect reasonable dilution of the sewage, the treatment plant may consist of a septic or settling tank alone, in order to reduce the heavy suspended matter and thus prevent a sight and odor nuisance along the stream banks below the outlet.



Only a manhole cover shows on the surface of the ground in this installation. Odorless enough to be located in a clubhouse front lawn if necessary. *(Courtesy: Kewanee P. U. Co.)*

In most cases, however, only a small water-course or a ditch is available and this is almost if not entirely dry during periods of hot dry weather, just when the greatest use is being made of the club and the sewage flow is hence heaviest. Under these conditions sewage from the clubhouse must be completely oxidized and stabilized before final discharge in order that it will not contaminate the stream and cause conditions detrimental to health and comfort. This is accomplished by a settling process in a septic or settling tank, followed by some form of filter to remove the organic matter, the type depending on the location of the plant, the topography, the soil, and other conditions.

Selecting a Plant Site

The selection of the site involves several considerations. Although the plant can be built entirely underground it must be accessible by means of manholes and there is thus some danger of nuisance from odors. The site should accordingly be well removed (at least 500 feet) from the clubhouse or any of the greens or tees. The elevation of the ground should be such as to permit gravity flow to the plant in the sewer from the building and must slope sufficiently to permit the necessary head, or fall, through the plant. If sufficient head, or fall, is not available the sewage must be pumped at the most convenient and economical location. This pumping can be made automatic. A site along the nearest water-course or ditch is usually best. After construction the plant should be screened with shrubbery especially if any part of it is exposed at the surface of the ground.

Septic Tank

The septic or settling tank is usually a covered concrete tank, of either a single or a two-story (Imhoff) design. In the latter type the upper story is a trough through which the sewage flows under which is the "sludge" compartment where the bacterial or septic action takes place. No chemicals are required for any type of settling tank. The total capacity of the tank should be approximately equivalent to the average flow for one day. The usual commercial type septic tank is inadequate in capacity and costs more than a tank built in place. The function of the septic tank is to break up and remove by settlement all settleable solid matter in the raw sewage. This constitutes roughly about half of the organic matter, the remainder being suspended matter which must be removed by the secondary or filtration process.

Sometimes a coarse iron bar screen is placed in a small chamber in the sanitary sewer just ahead of the septic tank, for the purpose of catching rags and other waste which would be harmful to sewage treatment. But experience has shown that this screen is liable to cause more trouble than good and it may be safely omitted.

Secondary Treatment

The type of secondary, or oxidizing treatment to be used will depend on the size of stream receiving the plant effluent, the quantity of sewage flow, topography of

site, and character of soil. With all types the purpose is to aerate and oxidize the tank effluent by providing conditions suitable for the growth of the proper kinds of bacteria. By this means practically all of the putrescible organic matter in the sewage is finally removed.

Sand Filters

Sand filters, if properly designed and constructed, will give the most complete purification. These may be built either at the surface or buried beneath a layer of topsoil, and should consist of two units so that either unit may be temporarily cut out of service for repairs. If the subsurface filters are used their area should be about twice as large as with the surface units, on account of the reduced aeration effect underground. In either case the filters should be comprised of underdrains laid in gravel or crushed stone, over which is placed about 24 inches of a clean, graded, coarse sand with sufficient distribution piping over the surface to carry the sewage uniformly to all parts of the filter. With the subsurface filters the distribution piping should be laid in gravel or crushed stone. Over the entire surface should then be placed a four-inch layer of straw to separate the filters from the topsoil. A 12 to 18-inch layer of soil may be placed at the surface. The distribution piping should be well ventilated by means of four-inch riser piping leading to the surface, the tops of which are protected with hoods or screens.

Between the tanks and filters there should be built a "dosing" tank, of covered concrete construction, containing siphons, the function of which is to hold back the tank effluent until a sufficient volume of sewage has accumulated in the dosing tank to fill the distribution piping and thus insure uniform filtering action by all parts of the filter. Also, between doses, the filters will have an opportunity to become aerated, which is most important for the purification process.

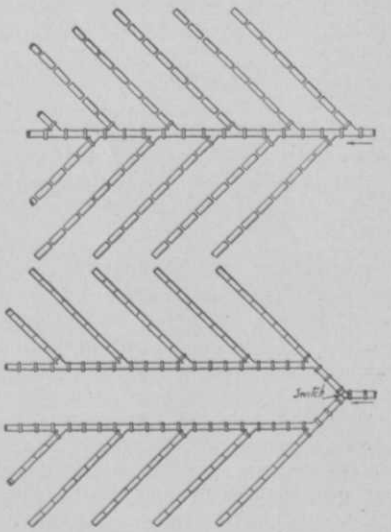
Lath Filters

Another type of filter which has recently come into the field makes use of common building lath for filtering purposes. It has the advantage of being low in cost and accessible for close control of the treatment process. With this type a covered concrete chamber is provided within which is constructed one or more columns of lath four to six feet high and of predetermined area, to serve as the filtering medium. The lath in each layer are placed in parallel rows, spaced two lath-widths apart, with adjacent layers laid at right angles to each other. The effluent from the settling tank is discharged over the top surface of the lath columns by means of a "tipping trough" so designed that it will automatically tip and spill its contents over the surface when full. The sewage then percolates down through the lath column being aerated and also purified by bacterial action on the way. The effluent is conducted to a secondary tank where it gets final settling before discharge into the stream.

The settleable matter, called "sludge," must be removed from the bottoms of the settling tanks, either by discharge (1) directly into the outfall sewer below the plant during periods of freshet flow in the stream, (2) into tank wagons whence it is hauled away, or onto small surface sand filters. The latter method, though effective, is not desirable as it is unsightly.

Percolating Filters.

Crushed stone or slag is sometimes used for the filtering process, the tank effluent being sprayed over the surface of the stone by means of fixed nozzles. Although this method is effective, it requires considerable attention in order to keep the nozzles from becoming clogged. Odors are sometimes noticeable some distance from the plant when atmospheric conditions are right for it.



Two ways to lay tile lines for soil absorption. The lower system is better on heavy soils.

Subsoil Absorption.

In place of any other type of oxidizing process the tank effluent is sometimes discharged into filter trenches forming a subsoil absorption system. If the soil is unusually porous the sewage is discharged into it by means of small tile or sewer pipe lines, with open joints, laid in trenches over a considerable area, thus allowing the flow to be absorbed by or filtered into the ground. Such area should be properly drained. If the soil is heavy clay, or even partially pervious, this system is not practical, while under the most favorable conditions it is expensive since a large footage of trenches and tile are required in order to prevent clogging.

Chlorination.

The use of chlorine gas as a disinfectant is coming into frequent use in connection with sewage treatment processes. Its purpose is to prevent an odor nuisance both from the plant and the stream below the outlet. Although its application is not always necessary or advisable it is, under certain conditions, very much worth while. The chlorine is applied either to the raw sewage, to the tank effluent or below the plant.

Costs.

From the above discussion it is apparent that the cost of the sewage treatment plant for a country club will vary greatly, and will depend upon the quantity of sewage flow and the type of plant constructed. The cost will range from as low as $1,000 to as high as $16,000, but will usually fall between $3,000 and $8,000 exclusive of sewers or pumping equipment.

Maintenance and Operation.

No matter how simple the sewage plant, it must not be forgotten or its operation neglected after it is placed in use. This is most important if satisfactory results are to be expected. Too often the plant is considered as just another plumbing fixture, to be buried and left to run itself. This is just as sensible as to neglect a piece of machinery and will result in trouble, cost and nuisance. If the investment in the plant is to be properly capitalized someone must be made responsible for its operation. The tanks should be cleaned out periodically and the filters kept in proper operating condition, including siphons, tipping troughs, and other accessories. Usually not much actual work is required but daily inspection should be made to see that all parts are functioning smoothly. Also where possible the daily sewage flow to the plant should be measured, by means of wires or other devices, in order to see that the capacity of the plant is not being overtaxed.

At some clubs, where the plant effluent must be at all times free from organic matter, technical control of the plant is maintained. By this is meant that the designing engineer or a sanitary chemist is retained, at a nominal monthly fee, to make frequent inspections of the plant and take samples of the effluent for chemical analyses.

In most states the engineering bureau of the state department of health not only approves the detail construction plans for sewage treatment plants but makes frequent inspection of their operation. Such service is worth while and is a protection to the club against faulty design or careless operation.

Conclusions.

In conclusion, and at the risk of repetition, it should be pointed out that clubhouse sewage disposal must not be taken too lightly. Many factors, most of which have been mentioned above, must be taken into consideration if unpleasant sight and odor nuisances are to be avoided and a final effluent obtained which is not detrimental to health and comfort.

"Another Tank Would Have Done the Job"

NEWS items sometimes point a moral. Here is a good example:

> Columbus, Ohio.—Three tall, fire-scarred chimneys and a smouldering pile of ashes were all that remained Monday of the fashionable Elks Country Club, located north of the city, which burned Sunday night, with loss estimated at $125,000.
>
> Lawrence Huber, greenkeeper, who lives nearby, called firemen and then, with the aid of Ernest T. Timberlake, house manager, emptied a 30-gallon fire extinguisher on the blaze.
>
> "*We almost had it out, and another tank would have done the job,*" Huber said.

The italics are ours. Make sure you have plenty of fire-fighting apparatus readily available around your clubhouse. Drill your employes in fire-fighting technique. Install a warning siren with a code of easily learned signals to tell the employes the location of the blaze.