STATE OF ILLINOIS

DWIGHT H. GREEN, Governor

MINIMUM SANITARY REQUIREMENTS

FOR

SWIMMING POOLS AND BATHING PLACES

WITH

Additional Information and Suggestions on Design and Construction

Adopted July 15, 1935

Revised May 1, 1938 - Revised May 1, 1945

DEPARTMENT OF PUBLIC HEALTH

ROLAND R. CROSS, M. D., Director

(Printed by authority of the State of Illinois)

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MINIMUM SANITARY REQUIREMENTS

FOR

SWIMMING POOLS AND BATHING PLACES

WITH

Additional Information and Suggested Satisfactory Compliance for the Design, Construction, and Equipment, Including Items of Safety

(Adopted July 15, 1935 - Revised May 1, 1938 - Revised May 1, 1945)

DEPARTMENT OF PUBLIC HEALTH

ROLAND R. CROSS, M. D., Director

Prepared by

DIVISION OF SANITARY ENGINEERING

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FOREWORD

The successful modern swimming pool involves a multitude of problems not always appreciated by the general public. Such a pool includes not only engineering and architectural problems but also health, recreational, and social problems. A swimming pool, to be successful from a public-health, financial, and recreational standpoint, requires careful planning in regard to its location, size, layout, construction, equipment, and operation.

It is the aim of this bulletin to acquaint those involved in swimming pool design, construction, and operation with the particular details with which this Department is primarily concerned. This bulletin not only includes the Department's minimum sanitary requirements but also sets forth opinions as to good practice in meeting those requirements necessary for a successful swimming pool. Each pool project has its particular problems, and it is the intention in presenting this material that it serve not merely as "minimum standards" but as a guide in successfully meeting the problems of the particular pool project.

Through investigations, study, and contact with pools throughout the State, the Department is in a position to observe many types of swimming pool facilities, and thus to act as a clearing house for improvements which will result in more successful pool installations. Considerable of this bulletin's material is based on such investigations and studies. If those persons contemplating new or improved pools will make contact with the Department prior to the preparation of the final plans, it is believed that much benefit will result.

It has been the policy of the Department of Public Health to revise its swimming pool bulletin from time to time in order that latest developments in swimming pool construction, design, and operation may be brought to the attention of interested individuals in Illinois. Previous bulletins were issued under dates of July 15, 1935, and May 1, 1938.

A satisfactory and successful swimming pool results in benefits to the owners and patrons and reflects credit on all those connected with its design, construction, and operation. It is hoped that this bulletin will aid in promoting the installation, and efficient and economical operation, of swimming pools, and it is to this end that this material is offered.

AUTHORITY FOR CONTROL OF SWIMMING POOLS AND BATHING PLACES

Authority for control of swimming pools and bathing places is vested in the Department of Public Health by the provisions of Paragraphs 2 and 3 of Section 55 of the Civil Administrative Code as amended in 1931, which states: "The Department of Public Health shall have power to have the supervision of the interests of the health and lives of the people of the State * * * shall have power to examine public swimming pools and bathing places and prepare and enforce rules and regulations covering their construction and operation and use to the end that they will be constructed and maintained in a sanitary manner"; also in accordance with "An Act for the control of swimming pools" (Approved July 8, 1931, in force October 1, 1931):

"Be it enacted by the People of the State of Illinois, represented in the General Assembly:

"1. **DEFINITION**: Swimming pool as used in this Act shall mean an artificial pool of water and auxiliary structures including dressing and locker rooms, toilets, showers and other areas and enclosures that are intended for the use of persons using the pool but shall not include pools and auxiliary structures and equipment at private residences intended only for the use of the owner and friends.

"2. **SANITARY REQUIREMENTS**: The State Department of Public Health shall prepare, adopt and have printed minimum sanitary requirements for the design, construction, equipment and operation of swimming pools.

"3. **PLANS AND SPECIFICATIONS — APPROVAL**: No swimming pool shall be constructed after October 1, 1931 unless and until plans, specifications and any additional information relative to such pool as may be requested by the State Department of Public Health shall have been submitted to said department and after review by said department found to comply with the minimum sanitary requirements provided in Section 2 of this Act and a permit for the construction of the pool issued by said department.

"4. **OPERATION**: After October 1, 1931 swimming pools shall have equipment and shall be operated so as to comply with the minimum sanitary requirements provided in Section 2 of this Act. Swimming pools constructed prior to October 1, 1931, which

do not fully comply with the minimum sanitary requirements as regards design and construction may be continued in use for such period as the State Department of Public Health may authorize, provided the equipment and operation of such swimming pool comply with the minimum sanitary requirements.

"5. **DEPARTMENT OF PUBLIC HEALTH TO DETERMINE SANITARY CONDITION**: The owners and/or operators of swimming pools shall submit such operation and analytical records as may be requested by the State Department of Public Health to determine the sanitary condition of the swimming pool.

"6. **PROSECUTIONS**: Whenever any duly authorized representative of the State Department of Public Health shall find that a swimming pool is being constructed, equipped or operated in violation of any of the provisions of this Act, the said department may grant such time as in its opinion may reasonably be necessary for changing the construction or providing equipment for operating the swimming pool to meet the provisions of this Act. If and when the duly authorized representative of the State Department of Public Health upon inspection and investigation of swimming pool considers that the conditions are such as to warrant prompt closing of such swimming pool until the provisions of this Act are complied with, he shall notify the owner and/or operator of said swimming pool to prohibit any person from using said swimming pool and upon such notification to the sheriff and State's attorney of the county in which such pool is located, it shall be the duty of said State's attorney and sheriff to see that the notice of said representative of the State Department of Public Health shall be enforced. If and when the owner or operator of said pool, has in the opinion of the State Department of Public Health, met the provisions of this Act the said department may in writing authorize the use again of said swimming pool.

"7. **FAILURE TO COMPLY WITH ACT—PENALTY**: Any owner and/or operator of a swimming pool failing to comply with any provisions of this Act shall be guilty of maintaining a public nusiance and it shall be the duty of the State's attorney of the county in which such swimming pool is located and/or the Attorney General in the name of the people of the State of Illinois to act as provided by law for the abatement of public nuisance."

INTRODUCTION

The following comments, suggestions, and recommendations are offered to:

(1) Acquaint consulting engineers and architects with items given consideration by the State Department of Public Health in the review of plans and specifications which are submitted in accordance with Section 3 of the Act previously quoted in this bulletin.

(2) Serve as a guide in the interpretation of the items considered in the sanitary condition of existing swimming pools under Sections 4 and 5 of the Act previously quoted in this bulletin.

(3) Set forth for reference purposes miscellaneous suggestions on swimming pool features and appurtenances not necessarily affecting sanitary conditions.

It is hoped that this bulletin will facilitate the preparation and submission of swimming pool plans and specifications as well as guide in improving, when necessary, existing installations.

PROJECTS NOT REQUIRING A PERMIT FOR CONSTRUCTION AND OPERATION

No permit from the State Department of Public Health is required for the construction or operation of pools and auxiliary structures at private residences intended only for the use of owner and friends.

GENERAL COMMENTS

(a) **Design Data.** A summary of the basis of design, including information relative to bathing load, recirculation equipment, pool capacity, dressing rooms, disinfection, equipment, etc., should be submitted with plans.

(b) **Plans.** Detailed construction plans and specifications are required and must be approved before a permit for construction can be issued.

(c) **Structural Details.** The review of plans by the State Department of Public Health does not cover structural designs.

(d) **New Processes, Methods, and Equipment.** The policy of the Department of Public Health is to place no obstruction in the path of progress in swimming pool design, equipment, and ma-

terials. However, any new development must have been tested to the satisfaction of the Department before a permit for a pool, including the development, can be issued. An experimental installation may be permitted, but should the development fail to produce results satisfactory to the Department it must be replaced with accepted design, equipment, or materials. If the experimental installation is made with public funds, any required changes shall be made at no expense to the owner.

(e) **Inspections and Opening Approval.** Before any new pool, or any pool which has been closed for a period longer than one year, is opened for public use it shall be inspected by a representative of the State Department of Public Health, and approval for opening obtained in writing from the Department.

MINIMUM SANITARY REQUIREMENTS

WATER SUPPLY

ITEM 1. POOL WATER SUPPLY. The water supply for all pools shall be adequate and of satisfactory bacterial, chemical, and physical quality.

Public-health reason—The water from which a pool is supplied should have substantially all of the qualities required for a satisfactory domestic water supply for essentially the same reasons.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The water meets the bacteriological standards of the State Department of Public Health for a safe drinking water.

(2) The source of the supply and any treatment given are approved by the State Department of Public Health.

(3) The water is not unusually corrosive, unless special provision is made to protect against corrosion the piping, equipment, and fixtures with which it will come in contact.

(4) The water is of such chemical and physical quality that when in the pool the following clarity criterion is met:

A black disc, 6 inches in diameter on a white field, when placed on the bottom of the pool at the deepest point, is clearly visible from the sidewalks of the pool at all distances up to 10 yards, measured from a line drawn across the pool through the disc.

(5) The water can be delivered at a sufficient rate to enable the pool to be operated satisfactorily.

ITEM 2. SHOWER, LAVATORY, AND DRINKING WATER SUPPLY. The water supply for all shower, lavatory, and drinking water facilities included as adjuncts to the pool shall be of satisfactory sanitary quality and adequate in quantity.

Public-health reason—It is necessary for water supplied to showers, lavatories, or drinking facilities to be safe for drinking to prevent users from contracting a water-borne disease.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The water delivered to any shower, lavatory, drinking fountain, or other fixture from which water might be drunk shall meet the bacteriological standards of the State Department of Public Health for a safe drinking water.

(2) The source of the supply and any treatment given are approved by the State Department of Public Health.

(3) The water is delivered in sufficient quantity and with sufficient pressure to assure the satisfactory functioning of all fixtures served by the water supply.

POOL AND POOL AREA

ITEM 3. MATERIAL. Pools shall be constructed of concrete, or other approved material, with an impervious finish adapted to the bathing demands of the various parts of the pool.

Public-health reason—If the waste discharges of the swimmers and other extraneous contamination introduced into the pool can not be removed from the pool surfaces with a reasonable amount of effort, the pool will probably not be properly maintained, with the resultant danger of a biologically unsatisfactory water.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The pool surface is constructed of a permanently impervious material which will retain a smooth finish with no cracks or open joints.

(2) The bottom surface below a depth of 5 feet is smooth to facilitate cleaning and the movement of bottom deposits to the main drain.

(3) The bottom surface above a depth of 5 feet is as smooth as practicable while having a nonslip finish.

(4) The walls and bottom are of a white or other light color.

(5) The walls are smooth.

(6) All junctions between floor and walls are rounded. (Coved.)

ITEM 4. SHAPE, DESIGN, SLOPES. The pool shall be designed and constructed of such shape, contour, etc., that efficient and safe control of the pool and bathers can be accomplished. The pool bottom shall have definite slopes to the outlet. Protection of the pool area shall be provided so that spectators in street apparel can not enter the area used by bathers.

Satisfactory compliance. The acceptable variations in this requirement are so numerous that each design must necessarily be judged upon its own merits at the time of submission to the State Department of Public Health.

ITEM 5. WALK AREAS. Walk areas shall be ample in size and adequately drained.

Public-health reason—Dry walks are of considerable aid in the control of skin diseases, such as "athlete's foot." The presence of low spots in the walk allows water to stand, tending to spread skin disorders and permitting accumulations of dirt which the bathers track into the pool.

Unless curbs surround the outer edges of the walks, especially on outdoor pools, excessive quantities of dirt, litter, and surface water may be blown, kicked, or washed onto the walks, making the maintenance of a clean pool difficult. Any increase in pool turbidity increases the load on the recirculation system and reduces the effectiveness of disinfection treatment.

Since many of the pool patrons will normally use the walks, adequate walk area to prevent overcrowding and accidents is necessary.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The walk is not less than 4 feet wide and is as much larger as is necessary to prevent overcrowding and reduce the accident hazard.

(2) The walk is impervious and entirely surrounds the pool.

(3) A curb is provided on the outside of the walk area where necessary to prevent spectators' litter from being kicked onto the pool walk or to prevent surface water from flowing onto the pool walk.

(4) The walks have a slope of not less than 3 inches in 10 feet; have a reasonably smooth, nonslip finish; and drain so that, after flooding, no standing water may be observed.

(5) The walks slope away from the pool, or when a curb is provided around the pool edge of the walk. Regardless of the direction of the walk slope, a pool-edge curb is highly desirable.

(6) A pool-edge curb is provided for pools having a closed-type recirculation system.

(7) The walk drains are not connected to the recirculation system piping.

ITEM 6. INLETS. Inlets shall be submerged, and be located to produce uniform circulation of water throughout the pool without the existence of dead spots, and to carry pool-bottom deposits to the outlets.

Public-health reason—Stagnant water areas will allow the disinfecting agent residual to disappear and organisms to multiply to the detriment of the bacteriological quality of the water.

Unless the pool-bottom deposits continuously move toward the outlet to be removed by the recirculation equipment, they will be stirred up by the bathers, thus increasing the turbidity of the pool water, which reduces the effectiveness of disinfection, and increases the accident hazard.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Rectangular pools not exceeding 40 feet by 75 feet have inlets across the shallow end which serve a maximum lineal distance of 8 feet.

(2) Rectangular-shaped pools with outlets more than 5 feet from the deep-end wall are provided with additional inlets at the deep end on a maximum of 12-foot centers.

(3) Inlets are provided on not more than 20-foot centers entirely around the perimeter of larger pools.

(4) All inlets are designed as adjustable orifices, or are individually valved.

(5) All inlets discharge at a depth of 10 to 15 inches below the pool overflow level.

(6) Proof can be furnished to the satisfaction of the State Department of Public Health that adequate circulation can be obtained by other inlet arrangements.

ITEM 7. OUTLETS. Outlets shall be ample in size and located at the low points of the pool. The grating area shall be sufficient to decrease the possibility of clogging, or of suctions dangerous to the safety of the bathers.

Public-health reason—It is desirable to have the outlets in the low points of a pool to aid in obtaining proper circulation of the pool water and to facilitate the removal of bottom deposits, the necessity for which removal is described in the previous section. By having sufficient grating area the possibility of clogging with leaves or other material and of bathers being held by suction is decreased.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Each low point in the pool is adequately served by an outlet.

(2) There are no flat areas near the outlets on which bottom deposits may accumulate.

(3) The area of the grating openings is not less than 10 times the outlet pipe area for outdoor pools.

(4) The area of the grating openings is not less than 5 times the outlet pipe area for indoor pools.

(5) The grating is of such design that it can not be readily removed by bathers and will not injure their fingers.

ITEM 8. LIGHTING. All pools shall be satisfactorily lighted.

Public-health reason—Satisfactory lighting is essential to the maintenance of a clean pool and pool area, a clear water, and the safety of the pool patrons.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) A satisfactory system of artificial lighting is provided for an indoor pool and for any outdoor pool to be used at night.

(2) Lighting fixtures are of such number and design as to light all parts of the pool, the water therein, and the entire pool area. Lights must be installed in such manner as to create no hazard to the bathers, and to prevent light-attracted insects from falling into outdoor pools.

(3) The arrangement and design of the lights are such that lifeguards may clearly see every part of the pool including walks, springboards, towers, floats, and other appurtenances, without being blinded by glare.

ITEM 9. HOSE CONNECTIONS. Sufficient hose connections of adequate size and supplied with sufficient water pressure shall be provided for cleaning all of the pool area.

Public-health reason—Probably no single factor will better encourage the thorough cleaning of the pool area than a relatively large volume of water under good pressure from conveniently located hose connections.

A thoroughly cleaned pool walk area is a material benefit in reducing the amount of dirt carried into the pool by the bathers, and in reducing the danger of spreading skin infections.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Hose connections have a minimum size of 1 inch and are served by not less than a 1-inch pipe.

(2) A sufficient number of connections is provided to enable all parts of the pool area to be reached with easily manipulated hose lengths.

(3) Water pressure is sufficient to provide effective cleaning.

ITEM 10. OVERFLOW GUTTERS. Pools shall be entirely surrounded by overflow gutters having the necessary pitch to prevent any accumulations, having ample size to carry off normal amounts of water introduced into them, and having easy access for cleaning.

Public-health reason—Flushing off the surface accumulations at frequent intervals will allow less material to settle to the bottom of the pool. Both scum and sediment may upset the action of the disinfecting agent.

If the bathers are properly controlled the overflows will be used for the disposal of nose and throat discharges, thereby reducing the possibility of introduction into the pool of infectious bacteria.

Overflows should not be completely recessed into the sides of pools because recessed overflows are difficult to clean and may be overlooked.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The overflow gutter extends around the entire perimeter of the pool.

(2) The overflow gutter edge is level within 0.2 inch on pools smaller than 40 by 85 feet and 0.3 inch on larger installations.

(3) The overflow gutter bottom has a pitch of not less than 3 inches in 10 feet.

(4) The drains are a maximum of 15 feet on centers.

(5) The runoff capacity is sufficient to carry away all normal amounts of water splashed or displaced into them without flooding of the overflow gutter.

(6) The overflow gutter has a minimum depth of 4 inches.

(7) The overflow gutter is of the open, roll-over, or semi-recessed type, having a smooth finish, and having an opening sufficient to permit satisfactory cleaning of the overflow channel.

(8) Overflow drains that discharge to a sewer or drain have a free-fall discharge with an atmospheric break of 2 inches minimum.

ITEM 11. STEPS AND LADDERS. Steps and ladders shall be of an impervious material, and of such design that they can be easily cleaned. They shall be so designed and constructed that no water is left on them when the pool water level is lowered.

Public-health reason—Most of the factors in relation to steps and ladders affect safety rather than the sanitary conditions of the pool.

Satisfactory compliance. It is felt that this requirement is sufficiently clear so that no interpretation is necessary, except that when step holes are used, provision must be made to provide drainage to prevent dirt accumulation.

ITEM 12. SUCTION CLEANER. Equipment shall be provided to remove sediment, sludge, and other accumulations from the bottom of the pool.

Public-health reason—In every pool, bottom deposits accumulate which are too heavy or adhesive to be carried to the main drain by the normal recirculation velocities in the pool. These bottom deposits, along with those progressing toward the main drain, may be stirred up by the bathers with a resultant increase in the turbidity of the pool water. Bottom deposits and resultant turbidity reduce the effectiveness of disinfection.

The removal of the bottom deposits by the suction cleaner directly reduces the turbidity in the pool. Long-handled brushes are comparatively ineffective in moving bottom deposits toward the main drain.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The pool is provided with a satisfactory suction cleaner system of either the built-in or portable type. Built-in types are preferable.

(2) There is sufficient suction and capacity to remove all normal accumulations from the pool bottom.

ITEM 13. SAND BEACHES, GRASS AREA, ETC., IN POOL ENCLOSURES. Sand beaches, grass areas, etc., shall not be allowed inside of the pool enclosure unless properly fenced off to prevent access on the part of bathers. If access is allowed to such areas, satisfactory facilities shall be provided for the proper cleansing of bathers before they again enter the bathing area.

Public-health reason—The volume of sand, grass, and dirt carried into the pool by bathers indiscriminately passing between the pool and beach area with no intermediate cleansing, makes the proper operation of the pool extremely difficult.

Satisfactory compliance. It is believed that this requirement is sufficiently clear so that no interpretation is necessary.

ITEM 14. OUTDOOR POOL LOCATION. Outdoor swimming pools shall be located where they will not be exposed to excessive pollution by dust, smoke, soot, or other undesirable substances.

Public-health reason—By so locating the pool that a minimum of extraneous contamination is introduced into the pool and pool area, the problem of maintaining them in a satisfactory condition is materially reduced, as well as making them more attractive for the patrons.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The pool is located away from roads or drives which are not surfaced or treated to prevent dust.

(2) The pool is located away from playgrounds, tennis courts, etc., which become dusty.

(3) There are no trees adjacent to the pool.

(4) The pool is located a sufficient distance from railroads or industries which may produce smoke, soot, or other undesirable substances, so that the pool area will not be affected adversely.

ITEM 15. DOUBLE-LEVEL POOLS. Double-level pools shall not be permitted.

Public-health reason—If overflows are provided at the lower level, then when the pool is maintained at the upper elevation this overflow is submerged. The difficulty in keeping the lower overflow clean because of its location, and the fact that when it is submerged it may become a source of pollution, are the principal objections.

Satisfactory compliance. It is felt that this requirement is sufficiently clear so that no interpretation is necessary.

RECIRCULATION SYSTEM AND APPURTENANCES

ITEM 16. RECIRCULATION SYSTEM. The recirculation system shall consist of pumping equipment, hair- and lint-catcher, and filters, together with all necessary pipe connections to the inlets and outlets of the pool and for backwashing the filters. As an integral part of the system, equipment shall be provided for disinfecting the water and adding any necessary chemicals and make-up water. The entire system and all its component parts shall be capable of producing a 6-hour turnover of the entire contents of the pool.

Public-health reason—The biological and inorganic contamination introduced in a pool's water will quickly result in its becoming hazardous to the bathers unless the water in the pool is being constantly replaced with water of satisfactory quality.

Experience has shown that, to date, a modern recirculation system of the capacity, and incorporating the units, specified above is normally the most economical method of maintaining a pool water in satisfactory condition.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) In addition to providing the 6-hour turnover, the individual types of equipment meet the requirements given, as follows, for that type of equipment:

ITEM 16 (a). PUMPING EQUIPMENT. Adequate pumping equipment shall be provided.

Public-health reason—The pump is the heart of the recirculation system, and, therefore, must be of adequate size.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The pump has sufficient capacity to discharge the volume of water required for a 6-hour turnover of the pool against the maximum head in the recirculation system.

(2) The pump used for backwashing the filters has sufficient capacity to backwash one filter at the rate of at least 15 gallons per minute per square foot of filter area.

(3) The pump develops a good suction when the pipes for a suction cleaner are connected to the recirculation system.

ITEM 16 (b). HAIR- AND LINT-CATCHER. A hair- and lint-catcher of acceptable design shall be provided.

Public-health reason—The strainer, by preventing hair, lint, etc., from reaching the filters, results in longer filter runs and facilitates filter maintenance.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The hair- and lint-catcher is installed ahead of the filters.

(2) The strainer is located so as to be easily accessible for cleaning.

(3) The hair- and lint-catcher has the following design features:

Water passes through the strainer from the outside.

The strainer is made of noncorrosive metal.

The width or diameter of the strainer openings is not more than one-eighth inch.

The area of the strainer openings is at least 10 times the area of the inlet pipe to the strainer.

The hair- and lint-catcher is so constructed that it can easily and quickly be taken down for cleaning.

A removable cylindrical strainer, with slotted openings, is provided unless sufficient cause can be shown for using some other type.

ITEM 16 (c). DISINFECTION EQUIPMENT. Equipment shall be provided for the adequate disinfection of all pool water.

Public-health reason—Only by the adequate disinfection of swimming pool water will disease germs introduced into the pool be promptly destroyed.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Chlorine or chlorine compounds are used as the disinfectant.

(2) The chlorination equipment has sufficient capacity to feed at least 3 parts per million of available chlorine based upon the recirculation rate. This capacity shall be increased where abnormally high chlorine demands are encountered.

(3) The chlorine is introduced into the recirculation system ahead of the filters.

ITEM 16 (d). COAGULANT EQUIPMENT. The system shall include a unit for the addition of a coagulant prior to filtration at such point that its use will be effective.

Public-health reason—A coagulant must be introduced into the recirculation system far enough ahead of the filters and effectively mixed with the water, in order to produce a sparklingly clear filter effluent, which is necessary for proper pool sanitation.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The coagulant is introduced at a point in the recirculation system ahead of the filters and is thoroughly mixed with the water so that:

The floc will be retained on the filters.

No floc will be formed in the pool.

(2) The equipment for the addition of the coagulant is convenient to use.

ITEM 16 (e). FILTRATION EQUIPMENT. Filtration equipment shall be provided on all swimming pools.

Public-health reason—Adequate filtration will produce a turbidity-free water which is easier to disinfect, reduces the possibility of accidents, and is a primary factor in maintaining the popularity of the pool.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Sufficient filter area is provided to filter the entire contents of the pool in 6 hours at the rate of not more than 3 gallons per square foot per minute.

(2) At least 2 filter units are provided.

(3) When a standard-type underdrain system is used the gravel bed is at least 15 inches in depth and varies in gravel size from approximately 1½ inches at the bottom to approximately ⅛-inch at the top.

(4) The filter sand depth is not less than 24 inches; the effective grain size is between 0.45 and 0.55 millimeters; the uniformity coefficient does not exceed 1.6, and there is sufficient distance between the top of the filter to the point of discharge of the wash water to allow for filter media expansion during backwashing at the specified rate without loss of filter media.

(5) Filter media other than sand is employed; special requirements are satisfied.

(6) Individual rate-controllers and loss-of-head gauges are installed on each gravity filter.

(7) The underdrain system is properly designed to collect efficiently the filtered water and to distribute properly the backwash water at a rate of not less than 15 gallons per minute per square foot of filter area.

(8) Each pressure filter is provided with:

(a) Gauges on the inlet and outlet pipes for determining loss-of-head in the filter media.

(b) Rate-of-flow indicator.

(c) Air release with a manual control on the highest point of the filter, or pipe, on all filters located above pool level.

(d) An easily removed sight glass on the waste discharge line (unless the wash-water discharge is plainly visible) for indicating the progress in filter-washing or the clarity when filtering to waste.

(e) A readily removable head or a large manhole to facilitate inspection and repairs.

(9) The filter piping arrangement is as simple as possible to accomplish filtration, backwashing, and filtering-to-waste.

ITEM 16 (f). MAKE-UP WATER FACILITIES. All pools shall be equipped with provisions for adding make-up water.

Public-health reason—Water lost to the overflow (other than in closed system) must be replaced in sufficient amounts to skim floating contamination from the surface of the pool.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Suitable facilities are provided for adding make-up water as needed.

ITEM 16 (g). CROSS-CONNECTIONS. No piping arrangements shall exist which under any conditions will permit sewage or waste water to enter the recirculation system, or water from the recirculation system or pool to enter the make-up water supply.

Public-health reason—Numerous outbreaks of water-borne diseases have resulted from contamination of water supplies

through plumbing installations which allowed contaminated water or sewage to enter safe water supplies during adverse hydraulic conditions.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) No pipe furnishing water for the make-up water supply is physically connected to the recirculation system regardless of valve arrangements, unless an approved vacuum breaker is properly installed on the make-up water line.

(2) The make-up water line discharging directly to the pool has its point of discharge at least 6 inches above the pool overflow level.

(3) The make-up water line discharging to a surge or balancing tank has its point of discharge at least 6 inches above the rim of the tank.

(4) The main drain line, and the filters' backwash and filter-to-waste lines have a free-fall discharge to the sewer or drain at such elevation that a surcharged sewer or drain could not force contamination back into the pool or recirculation system. Provisions may be made, however, for directly connecting the main drain to the sewer or drain as a means of off-season drainage.

(5) All other accessories to the recirculation system such as chemical solution pots, water-fed chlorinators, etc., are protected against back-siphonage into the water supply.

ITEM 16 (h). CLEANOUTS. Cleanouts shall be provided at such points in the recirculation system as will enable obstructions, accumulations, etc., to be readily removed.

Public-health reason—Unless stoppages in the recirculation system can be removed without undue expense or labor, the pool management is inclined to operate the pool without recirculation.

Satisfactory compliance. This item is believed to be sufficiently clear so that no interpretation is necessary.

ITEM 16 (i). PIPING SYSTEM. The piping system shall be designed to reduce friction losses to a minimum.

Public-health reason—An ample factor of safety in the pipe sizes of the recirculation system is necessary for the maintenance of the required turnover rate, even with allowance for the reduction in the carrying capacity of the pipes because of corrosion and scaling.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Pipe capacities in general are at least twice the theoretical value.

(2) Flanged joints or unions are inserted at intervals to permit any part of the system to be taken down quickly for cleaning or repairs.

ITEM 17. ACCESS TO EQUIPMENT. Filters and other equipment shall be accessible.

Public-health reason—Recirculation equipment systems that are difficult to inspect or service because of their location or arrangement are frequently neglected.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The recirculation equipment is conveniently located for inspection and servicing. Special attention is called to the necessity of providing adequate head room above pressure filters.

ITEM 18. pH DETERMINATION OUTFIT. Every pool shall be provided with an outfit for the determination of hydrogen-ion concentration.

Public-health reason—As previously stated, the effectiveness of the disinfection process and the absence of skin irritation of the bathers are often dependent on the pH of the pool water.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) An approved outfit for the determination of hydrogen-ion concentration in the pH range 6.5 to 7.6 is provided.

ITEM 19. RESIDUAL CHLORINE DETERMINATION OUTFIT. Every pool shall be provided with an outfit for the determination of residual chlorine.

Public-health reason—The only method of being assured that the residual chlorine in all parts of the pool is within the proper limits is by means of a residual chlorine determination.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) An approved outfit for the determination of residual chlorine in the range 0 to 2 parts per million is provided.

ITEM 20. EQUIPMENT ROOM. The equipment room shall be satisfactorily located and adequately drained.

Public-health reason—Damp equipment rooms tend to cause excessive deterioration of portions of the recirculation equipment. If the room can be directly entered from the shower room or pool area, dirt would tend to be tracked into the showers or pool area by the operator.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The equipment room is so located that it can not be entered directly from shower rooms or pool area.

(2) The floor has a minimum pitch of 2½ inches in 10 feet toward the drains with no low spots which will allow water to stand.

(3) The equipment-room drains do not discharge to a sewer or drain which may surcharge onto the equipment-room floor.

BATHER-PREPARATION FACILITIES AND APPURTENANCES

ITEM 21. DRESSING ROOMS. Dressing rooms shall be satisfactorily designed, located, drained, equipped, lighted, and ventilated.

Public-health reason—Unsatisfactory dressing rooms with damp floors, overcrowding, poor lighting, poor ventilation, and inadequate or poorly designed equipment are factors contributing to inadequate bather-control, improper cleansing of the dressing rooms, and the spread of infectious diseases.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) The dressing rooms are located adjacent to the locker or check room and showers.

(2) Floors have a minimum pitch of 3 inches in 10 feet to the drains with no low spots which will allow water to stand.

(3) Floors are of smooth but nonslip finish, impervious to moisture, with no open cracks or joints.

(4) The rooms are lighted so that all parts are easily visible for cleaning.

(5) The rooms are ventilated so that they do not remain excessively damp.

(6) Hose bibs of 1-inch minimum size and served by not less than a 1-inch pipe are provided to enable the entire dressing room to be conveniently flushed by hose.

(7) The material used for walls, partitions, furniture, etc., is such that it can be easily cleaned, and will not be damaged by frequent hosing, wetting, or disinfection.

(8) Dressing-booth partitions have a minimum clearance of 6 inches above the floor, and curtains, if used on the booths, are of sufficiently heavy material to discourage their use as a substitute for towels.

ITEM 22. SHOWER FACILITIES. Adequate and satisfactorily designed and located shower facilities, including warm water and soap, shall be provided.

Public-health reason—The best-designed pool with proper operation of the recirculation system can not be considered assuredly safe for swimming without proper bather-preparation. Provisions for warm showers to be taken in the nude with plenty of soap are essential so that each bather may wash off the residual body wastes which are deposited on the body's surface. These body wastes may contain pathogenic organisms which could cause pool bathers to contract an infectious disease. Without the showers an excessive amount of body pollution could be introduced into the pool, even though no bather actually became ill.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Separate shower facilities are provided for men and women and are so located that bathers must pass from the shower room directly to the pool area.

(2) Shower facilities are provided as follows:

Pools used by groups, classes, or platoons on a regular time schedule of 1 hour or less have 1 shower for each 4 bathers in the maximum class or 1 shower for each 10 if the period is 2 hours.

Pools with continuous bathing have a minimum of 1 shower for each 40 bathers expected at the time of maximum load.

(3) The ceilings, walls, and floors of the shower room or area are constructed of impervious material not adversely affected by steam or water.

(4) The floor is smooth, nonslip to bare feet, has no open cracks or joints, and has a minimum pitch of 3 inches in 10 feet toward the drains with no low spots which will allow water to stand.

(5) A minimum of 5 gallons of water per shower per minute, having a temperature of not less than 90°F., is provided. Water from the discharge side of the recirculation-system filters may be used, provided special provisions are made to obtain adequate pressure, quantity, and temperature.

(6) The showers are so designed that a proper mixture of hot and cold water may be obtained without danger of scalding the bather.

(7) Liquid or powdered soap in suitable dispensing equipment is provided for each shower unit.

(8) Shower booths are provided in the women's shower room, the partitions of which booths will not be damaged by the shower water and will have a minimum clearance of 6 inches above the floor.

(9) Shower rooms are adequately lighted so that all parts are easily visible for cleaning.

(10) Shower drainage is discharged to an approved municipal sanitary sewerage system, or to sewage-disposal facilities approved by the State Sanitary Water Board.

ITEM 23. TOILETS. Adequate, satisfactory, and properly located toilet facilities of acceptable design shall be provided.

Public-health reason—Toilet facilities should be so designed and located that bathers are encouraged to use them while in the pool area.

If bathers desiring to use the toilet facilities must cross areas which patrons in street shoes use, an excessive amount of dirt may be carried back into the pool area.

The plumbing fixtures in a toilet may become the source of a contaminated water supply if they are not so protected that their contents can not be siphoned back into a safe water supply during unusual hydraulic conditions.

Satisfactory compliance. This item shall be deemed to have been satisfied when:

(1) Toilets known as "inside dry" for each sex are provided for the patrons in the dressing area, to which toilets they may have convenient access without crossing floors or using fixtures wet from bathers.

(2) Toilets known as "inside wet" for each sex are provided for the patrons while in the shower rooms or pool area, to which toilets they may have access without crossing areas used by persons in street shoes.

(3) Fixtures are provided in the numbers specified below:

(a) For pools not larger than 50′ x 100′ in area with a permissible bathing load not to exceed 700 persons:

	Inside Dry	Inside Wet
Men	2 closets	1 closet
	2 urinals	1 urinal
	1 lavatory	
Women	3 closets	2 closets
	1 lavatory	

(b) For pools larger than 50′ x 100′ in area with a permissible bathing load of over 700 persons:

	Inside Dry	Inside Wet
Men	3 closets	2 closets
	4 urinals	2 urinals
	2 lavatories	
Women	4 closets	2 closets
	2 lavatories	

(4) All fixtures are properly protected against back-siphonage to the satisfaction of the State Department of Public Health.

(5) All fixtures are so designed that they may be readily cleaned, and that frequent cleaning and disinfection will not damage them.

(6) Urinals in the inside wet toilet are of a type which will not cause splashing of urine upon the feet and legs of bathers.

(7) Toilet floors are constructed of impervious material with no open cracks or joints, have a smooth nonslip finish, and pitch not less than 3 inches in 10 feet toward the drains.

(8) Partitions, walls, and ceilings are constructed of material not adversely affected by steam, water, or a disinfectant.

(9) Toilet rooms or areas are lighted so that they are easily visible for cleaning.

(10) Toilet rooms are ventilated so that no odor nuisance may exist.

(11) Hose bibs of not less than 1-inch size, and served by not less than 1-inch pipe, are provided for convenient hosing of the toilet rooms or area.

(12) Toilet-room sewage is discharged to an approved municipal sanitary sewerage system, or to sewage-disposal facilities approved by the State Sanitary Water Board.

SPRAY POOL

SPRAY POOL DEFINITION. A spray pool is defined as an artificial pool for use by children, into which water is sprayed but is not allowed to pond in the bottom of the pool.

ITEM 24. MATERIAL. Spray pools shall be constructed of a permanently impervious material which shall have and retain a finish as smooth as possible that is nonslip to bare feet.

ITEM 25. DESIGN, SLOPES. Spray-pool bottoms shall slope not less than 3 inches in 10 feet toward the drains.

No obstructions such as raised drains, steps, or concrete gadgets, on which children may fall or become injured shall be placed in the spray-pool area.

ITEM 26. DRAINS. The spray pool shall be equipped at its low point with an unvalved drain.

The drain shall have a free-fall discharge to the sewer or storm drain so that contamination from a surcharged or clogged sewer can not be forced back into the spray pool.

The drain shall be of such size and design that water sprayed into the pool will not pond in the pool bottom.

ITEM 27. WATER SUPPLY. The water sprayed into the pool shall meet State Department of Public Health bacteriological standards for a safe drinking water.

ITEM 28. HOSE CONNECTION. At least 1-inch minimum-sized hose bib served by not less than a 1-inch pipe, shall be provided for cleaning the spray pool.

ITEM 29. WALK AREA. The spray pool shall be entirely surrounded by a walk constructed of permanently impervious material which shall have and retain a finish as smooth as possible and nonslip to bare feet.

DESIGN AND CONSTRUCTION FEATURES OF WADING POOLS

WADING POOL DEFINITION. A wading pool is defined as an artificial pool with a maximum depth of not more than 36 inches.

ITEM 30. MATERIAL. Wading pools shall be designed of a permanently impervious material which shall have and retain a finish as smooth as possible that is nonslip to bare feet.

ITEM 31. LOCATION, DESIGN, SLOPES. Wading-pool bottoms shall slope not less than 3 inches in 10 feet toward the drains.

The pool shall be located so that drainage from the surrounding area will not wash contamination into the pool during rains.

No obstructions such as raised drains, steps, or concrete gadgets, on which children may fall or become injured, shall be placed in the wading pool area.

ITEM 32. OVERFLOW GUTTERS. An open-type overflow shall be provided around the entire perimeter of the wading pool with a maximum variation in elevation of 0.1 inch.

The bottom of the overflow shall have a pitch to the drains of not less than 3 inches in 10 feet.

Where a wading pool is adjacent to a swimming pool, overflow drainage shall not be returned to the recirculation system.

ITEM 33. FENCE OR BARRIER. A fence or other barrier shall surround the wading pool to prevent spectators from trespassing on the pool walk.

ITEM 34. WALK AREA. The wading pool shall be entirely surrounded by a walk constructed of permanently impervious material which shall have and retain a finish as smooth as possible that is nonslip to bare feet.

The walk shall slope not less than 3 inches in 10 feet toward the drains or overflow.

ITEM 35. DRAINS. The wading pool shall be equipped at its low point with a drain.

The drain shall have a free-fall discharge to the sewer so that contamination from a clogged or surcharged sewer can not be forced into the wading pool.

The drain shall be of such size that the entire pool contents can be drained in 10 minutes.

ITEM 36. INLETS. The inlets shall be of such size that the pool can be entirely filled in 1 hour, and shall be so located as to produce uniform circulation throughout the pool.

The point of discharge of the inlets, when not served by a swimming pool recirculation system, shall be at least 6 inches above the pool overflow level.

ITEM 37. MAKE-UP WATER. The water entering the wading pool shall meet State Department of Public Health bacteriological standards for a safe drinking water.

ITEM 38. DISINFECTION. The water in the pool shall have a chlorine residual of not less than 0.5 parts per million.

ITEM 39. TOILETS. Separate toilet facilities for each sex shall be provided adjacent to the wading pool.

These toilet facilities shall meet the design features specified in Item 23.

ITEM 40. HOSE CONNECTIONS. At least one 1-inch minimum-sized hose bib served by not less than a 1-inch pipe shall be provided immediately outside the wading pool enclosure.

STATE OF ILLINOIS—County of Sangamon

I, Roland R. Cross, M. D., Director of the Department of Public Health of the State of Illinois, do hereby certify that the foregoing is a true copy of the forty (40) Minimum Sanitary Requirements for Swimming Pools and Bathing Places, in said State, promulgated under date of May 1, 1945.

IN WITNESS WHEREOF, I hereunto set my hand and Official Seal of the Department of Public Health of the State of Illinois, this first day of May, 1945.

Roland R. Cross M. D.

DESIGN AND ADDITIONAL MISCELLANEOUS SUGGESTIONS

GENERAL

This section of the bulletin sets forth certain design features which it is believed should receive consideration in any proposed installation or improvement to an existing installation. The various items discussed may have no direct sanitary significance, but will aid in achieving the most desirable design to fulfill the particular purpose for which the pool is intended. Many of the items that should be considered in an indoor pool design are omitted here in order to encourage the designing engineer or architect to discuss these matters personally with engineers of the State Department of Public Health.

POOL AND POOL AREA

Outdoor Pool Location. The location of water mains, electric power lines, and sewer and drainage facilities should all be considered in selecting the proper location for a pool. Spectators in large numbers are more frequently present at the outdoor pool in the afternoon; hence, it is desirable to provide for them on the west side of the pool with their backs to the sun. For this reason it is best to have the pool, if typical, with its long dimension in a north and south line. In many installations along heavily traveled highways, the bathhouse has been located away from the highway with the pool in the foreground, with excellent results from an advertising standpoint.

Size. Of all the shapes which have been evolved, undoubtedly the rectangular one is the most commonly used and perhaps the most popular. Size, which should be adapted to potential bather demand, will to a great extent determine the shape. Most existing outdoor pools are too large. Size alone can not provide the degree of sanitation which is now required. It is more desirable to build a complete unit with more permanent material and having adequate water-treatment equipment, than to attempt to construct a larger unit with many of the essential details lacking or limited due to size of unit or lack of funds.

A pool may meet all of the accepted sanitary and safety requirements and still be uneconomical in size and in the use of material, from a structural standpoint. Authorities should, as far as possible, allow only those pools to be constructed which are of such economical size that their continued operation will be justified.

Dimensions. Dimensions, except as they handicap economical control and supervision, are a matter to be determined largely by competitive requirements, the bather demand, and the area available for a particular installation.

Suggested lengths (to meet competitive requirements):

60 feet (20 yds.) 5 lengths—100 yds....11 lengths—220 yds., etc.
75 feet (25 yds.) ..... 4 lengths—100 yds., etc.
82.02 feet (25 meters)..... 4 lengths—100 meters
120 feet (40 yds.) 100 yds. 2½ lengths (not especially desirable)
150 feet (50 yds.) .....50 yds., straightway
164.04 feet (50 meters—54.58 yds.).....50 meters, straightway
300 feet (100 yds., straightway)
330 feet (100+ meters—110 yds.)

Suggested Desirable Dimensions. The following combinations of dimensions are suggested, based upon competitive requirements and ease of operation:

30′ x 60′		
25′ x 75′	50′ x 150′	30′ x 82′+ (25 meters)
30′ x 75′	60′ x 150′	35′ x 82′+ ”
	75′ x 150′	40′ x 82′+ ”
35′ x 75′		40′ x 120′
	50′ x 165′	50′ x 120′
40′ x 75′	60′ x 165′	60′ x 120′
	75′ x 165′	

Suggested Multiple Pool Dimensions.

Diving Pool	50′ x 60′	
	60′ x 75′	(For high platform diving)
Competitive Pool	40′ x 82.02′	
	60′ x 165′	
General Pool	50′ x 165′	
	60′ x 165′	
	75′ x 165′	
	82.02′ x 300′	
	82.02′ x 330′	

Width. In pools where competition may be in effect the pool width should provide 6-foot lanes for four competitors (minimum). In strictly competitive pools the lanes should be a minimum of 7 feet wide.

Depth of Water. The large majority of swimmers and bathers, excluding small children and divers, desire water of a depth suitable for wading (3′ to 5′6″). To obtain a 3-foot depth in the shallow area it is necessary to have a pool 3 feet 3 inches to 3 feet 6 inches at the overflow. From 3 to 5 inches of water, except in pools with closed systems, are lost to the drains after a relatively few bathers and swimmers enter the pool.

Proportion of Deep and Shallow Water. Some authorities recommend that the area of shallow water, 5 feet or less in depth,

should be 80 per cent or more of the total area of large outdoor pools. Such proportioning must be considered in relation to the pool volume, the bathing load, the recirculation system, etc. Insufficient information is available at present to make any definite recommendations on this point.

Deep Water. Deep water is needed only insofar as it is required to meet the demands for water polo and diving. The following depths and area are, in general, required for diving:

	Depth		Area with 5½ feet
Springboard	Minimum	Recommended	depth or more
1-meter	8 feet	9½ feet	260 sq. ft. (20′ x 13′)
3-meter	9½ feet	11 feet	325 sq. ft. (25′ x 13′)
high dive	12 feet	14-15 feet	468 sq. ft. (36′ x 13′)

When various combinations of low and high springboards are used, an overlapping of these areas is possible within reasonable limits.

Off-Center Hopper. In pools of moderate size where one high springboard and one low board are used, an "off-center hopper" bottom with the deepest point under the high board represents the "latest" in adaptation of the bottom contour to the diving requirements. A saving in excavation, material, and water to be treated results from this particular bottom contour and the deep water is provided where needed.

Proportioning Pool Area to Expected Load. In the design of an artificial pool, due allowance must be made for the number of bathers who may be expected at the time of maximum use. In computing the area which must be provided, it is recommended that the pool be divided into 3 zones, and the area of each computed separately.

It is apparently the consensus of opinion that an area extending 10 feet from the extremity of a diving board or tower should be considered as reserved for divers, and that no more than 2 or 3 persons should be permitted in the water in this area at one time while diving is in progress. About three times that number will be on the shore or diving platform awaiting their turn to dive. Twelve persons is, therefore, the maximum number which may be permitted for the area within a 10-foot radius of each diving board or platform.

The consensus of opinion of swimming pool operators is reportedly that the space required by a swimmer might fairly be expressed as five-fourths the square of his height, and that, on an average, two-thirds of the swimmers present would be in the pool at the same time. On this basis the average space requirement for an adult swimmer is 36 square feet and, allowing for one-third of swimmers on the shore, an average of 27 square feet should be provided for each swimmer who may be expected to be present at time of maximum load.

In computing the area to be provided for persons who do not swim, we must take into consideration the character of the pool. At indoor pools and small outdoor pools, this area should probably be included with the swimming area and the crowding limit computed on this basis. At large outdoor pools where a considerable proportion of the water is shallow water, we may assume that 50 per cent of the nonswimmers would be on shore. The average space allowance for each nonswimmer in the water is approximately one-half that of the swimmer in deep water. Combining these factors, an allowance of 10 square feet per bather should be allowed for this portion of the pool.

Accuracy of Competitive Course. For competitive purposes and where the pool may be used at any time for swimming events in which records may be established, care should be taken to assure that the distance measured from wall to wall will be the full required distance and not fall short by even a fraction of an inch, in which case the record would not be allowed to stand as official.

Subsurface Drainage. All pools should have adequate subsurface drainage not directly connected to a sanitary sewer. Whenever possible the pool should be located at such elevation that it will not be necessary to use a sump and pump. When gravity subsurface drains are not possible, the drainage should be into a sump, and provisions made to insure its proper functioning during the off-season of an outdoor pool.

Proper provision for subsurface drainage will prevent damage to the floor due to freezing, and damage to the pool structure due to hydrostatic pressure (when pool is emptied). In pools not equipped with proper subsurface drainage, pollution from sanitary sewer lines which pass near the pool structure is often possible.

Adjustable Courses. Several types of adjustable courses have been worked out with varying success. In the most desirable design the pool proper has a maximum course possible for 50 meters (54+ yards). Two movable barriers which divide the pool into three separate sections are used. Three pools, one for diving, one for competition, and one for beginners, are available. With this design, courses which cover all the recognized distances are possible.

Twin Pools. Twin pools providing two separate pools and rooms, with a removable wall or barrier, have not, to our knowledge, been worked out satisfactorily to date, for mechanical reasons.

Pool Markings. Two types of pool markings should be provided, as a usual thing. One concerns the depths and relates to safety, the other concerns competition. Depths in pools and bathing areas should be plainly marked in a conspicuous manner. This can be done in tile pools by incorporating the information in the design.

In pools where competition will be the usual thing, lanes should be provided to guide the swimmers when using strokes in which the

face is submerged. The lanes should be so situated that the swimmer swims over the marker or lane, not between the lanes.

Unless these lanes are constructed by the use of tile or cement of a different color (dark) they will not be permanent or satisfactory. Painting lines on the bottom of the pool is unsatisfactory. Lanes should be at least 6 feet wide, preferably 7 feet in competitive-event pools. Five-foot lanes, which are commonly used, result in crowding competition, especially in the breast-stroke events. The lanes should end at a point approximately 4 to 6 feet from the end of the pool and should be marked with a short transverse line.

Springboard and other equipment should be so placed with reference to the lanes that the swimmers will be able to take off directly over the line or marker.

If the dimensions of a pool are in yards, then the standard competitive metric distances should be designated in the tile or concrete with permanent nonrusting markers. The reverse should be done if the pool dimensions are in meters.

The outlet of the pool should also be plainly marked by a black or dark-colored circle, unless outlet grating is of conspicuous coloring. The depth of water at the deepest point and at the 5-foot point should be conspicuously marked on both sides of a pool having deep water at one end. Markings showing depths in 1-foot increments are desirable. In large pools with deep water in the middle only, the 3- and 5-foot depth lines should be conspicuously marked on the bottom and also designated by surface floats.

Surface Markers for Competition. In pools frequently used for competition, provision should be made for installing surface lane lines. The lane markers when properly designed and installed also reduce the wave action and result in more satisfactory competitive conditions.

Slope of Bottom. The slope of any part of a pool where the water is less than 6 feet deep must not be more than 1 foot in each 15 feet.

The bottom of the floor should slope definitely to the main drain or outlet. Deep water, except as required for safety in diving, should be limited to areas where it is actually needed. Deep water when provided in excess of this requirement is a decidedly uneconomical use of pool structure and water. The adaptation of the pool bottom to the diving needs will result in a "double-spoon" or "hopper" bottom. Any flat areas on the pool bottom offer excellent lodging places for deposits and should be avoided. Sudden changes in depth should not be made where the water is less than 6 feet deep. With a "hopper" type of bottom it is possible to provide deep water where it is really needed. With this type of construction, deposits which accumulate on the bottom of the pool will tend to work their way to the deep water, where the outlets are located.

Ledges, Obstructions, Barriers. The use of barriers or fences between the various depths is not recommended, unless they can be

constructed in such a manner as not to prevent the movement of deposits toward the outlet. Steps or flat ledges are not recommended, but when used should pitch very definitely so that there will be no accumulation of objectionable deposits.

Steps and Ladders. Steps or stairways for entering and leaving the pool should be of such construction as to minimize danger of accidents. Ladders or stairways should be located at one or both sides of the deep end of the pool. If the distance from the bottom of the pool to the runway is more than 2 feet, a ladder or steps should also be placed at the shallow end of the pool. Treads of ladders or steps should be of nonslip material.

Ramps in lieu of stairs are to be preferred in all cases where transition from one level to another in the pool or pool area is required.

Pool Lining. Tile or glazed brick lining is recommended for all indoor pools and for small outdoor pools. White cement smoothly finished is satisfactory for large outdoor pools. When white concrete is used, protection should be provided during construction to prevent staining, soiling, and discoloration and irregularities due to the wires, reinforcement rods, and form marks. Dirt does not show on asphalt or other similar dark material, and such materials are not suitable for pool lining.

With the excessive abrasion on the floor from the bathers' feet and the suction-cleaner brush and wheels, most paints have been found unsatisfactory, although certain of the chlorinated rubber type have been successful. Certain dark-colored paints or coverings have demonstrated some degree of permanence but because of their dark colors are objectionable. Plaster coats have been found generally unsatisfactory for pool linings.

Nonslip Walks, Mats. The most common type of accident around a pool is a fall. All areas used by bathers in bare feet should be nonslip to bare feet. If funds are available, tile of the nonslip variety should be used. Tiles are nonslip either as the result of having definite abrasive material included in their composition, or by virtue of an uneven surface (ridge-raised portions). Concrete walks and floors can be made nonslip by the proper methods at the time of their construction. After they have hardened they can be made nonslip but at the cost of spoiling the finish as far as ease in cleaning is concerned.

Two methods are commonly used to give a nonslip finish to concrete and at the same time provide a surface which can be cleaned with reasonable care. Of these methods the brush finish is the least desirable because, while it is definitely nonslip when the surface is clean, the surface when exposed to service that is usual in pools and dressing areas becomes very slippery and unsafe. The more desirable finish, which is known as the "lift" or "suction" finish, is produced as follows: The surface is troweled smooth, then an object such as a block of wood covered with burlap or

canvas is pressed down and then lifted up quickly. This produces little ridges and striations, and when properly done results in a surface which is fairly nonslip, easy to clean, and retains this nonslip quality to a fair degree even when dirty. In addition to this, materials of an abrasive nature may be added to the concrete.

Existing pool facilities which have been constructed with slippery terrazzo floors may be made nonslip by the application of certain cleaning materials. The use of acid for this purpose is not recommended, because the resulting excessive deterioration of the surface makes it difficult to clean these surfaces and keep them clean.

Concrete coated with a paint to which sand or some abrasive material has been added will produce a nonslip surface, but this treatment makes the floor very difficult to clean. In many cases it is better to remove the paint and use certain strong cleaning powders at frequent intervals and not allow the floor to be repainted.

Bushhammering the floor surface or roughening it with hand tools is often done, but probably represents the least desirable method of trying to overcome defects in original construction.

The use of rubber mats, wooden mats, and other materials of this nature is permissible in pools and pool facilities to cover floors which have been imperfectly constructed as to nonslip qualities, but this procedure should be followed only when no other solution of the problem can be found. In such cases the daily removal of all mats, runners, etc., is required and it will be necessary to provide for their daily disinfection with acceptable disinfectants. Mats (cocoa, rubber, etc.), we believe, are responsible for the majority of infections to bathers' feet.

Underwater Coaching Windows. Provision for viewing the form and movements of competitive swimmers can be made in pools where competition is a considerable item, by installing clear glass panels below the level of the water, and making access easy to the coach or teacher through an "access tunnel."

Winter Protection. Many pools which have tile included in their design have been provided with covers which keep out snow and water and, when necessary, provide heat to protect the pool structure from the deleterious effects of extreme winter temperature.

Portable Pools. Pools which can be transported from place to place where needed for competition or exhibition purposes, and which are provided with portable water-treatment apparatus, are now available.

Underwater Pool Entrance. On pools used for exhibition and entertainment purposes, an underwater entrance is very effective and its construction is not particularly difficult.

Lighting. When natural light is provided by windows or skylights for indoor pools, the sky light area should be equal to at

least one-half of the area of the pool and walks. Underwater lights are recommended for pools which will have considerable use after sundown. They should be designed so as to prevent the possibility of accidents. In indoor pools, lights should be protected or recessed to prevent breakage.

Heating. All heating units should be isolated or protected to prevent injury to bathers. The heating units should be capable of maintaining a temperature between 70°F. and 82°F. Thermostatic control of the temperature is desirable.

Acoustics. All indoor pools should receive acoustical treatment when necessary. Design, materials, and construction should be used which will prevent reverberation of sound which may result in lack of control on the part of the instructors or attendants.

Walk Areas. In outdoor pools the walk area should be protected at the outer edge with a curb to prevent litter and dirt, rodents, snakes, etc., from obtaining access to the pool area.

A curb at the edge of the pool possesses distinct advantages. Such a curb prevents accidental flushing of walk accumulations into the overflow or pool. Curbs, if properly constructed, present no physical hazard to the bather. Walk drainage should, in no case, go into the sanitary lines which drain the pool overflow, and should in all cases be run to waste. Walks should be as spacious as possible, because a majority of the patrons will be found on the walk areas. By increasing the walk areas and cutting down pool areas, considerable economy in original cost and operation may be effected with no sacrifice of usability.

If a curb around the pool at the overflow edge is used when the walk drainage is toward the pool, then adequate and properly located drains are necessary to prevent water from collecting on the walk adjacent to the curb. This curb prevents the litter and dirt on the walks from being carelessly hosed or flushed into the pool. It also gives a better take-off for divers. Certain objections, from a safety standpoint, to this curb may be overcome by designing it with sufficient height and with a width of at least 8 inches. The top surface of this curb should be of nonslip construction and the "take-off" edge rounded to enable the diver's toes to properly retain their grip on the edge.

Not only has white concrete been used for pool bottoms, but colors have been used with artistic effects on pool walks, curbs, etc.

Hose Connections. Hose connections should be recessed, or so located as to prevent accidents. Hose should be of the type adapted to excessive abrasion and necessary hard usage.

Overflows. When the open-type overflow (See illustration A.) is used, the design should be such that the diver is not tempted to use as a take-off the actual overflow edge instead of the edge where the overflow and walk meet. This can be accomplished by limiting the vertical distance "y," from the maximum water level to

the top of the curb, to a value not less than 0.6 of the horizontal distance "x" of the overflow. However, this ratio does not apply to cases in which the "y" distance is less than the recommended minimum value of 6 inches and the "x" distance exceeds the maximum of 12 inches.

When semi-recessed overflows are used they should be of such design that bathers' limbs will not be caught in them when climbing out of the pool. In pools with the open type of overflow, starting blocks or pedestals may be provided for competitors but they should be so constructed that they will not interfere with the proper runoff of the overflow water.

All drains or openings in the overflow should be provided with easily removable, coarse gratings or strainers. The drain pipes should be 2½ inches in diameter and the gratings should be twice the cross-sectional area of the drain outlet, and both should be so designed that they may be quickly serviced for repairs.

Consideration should be given to arranging the piping in such manner that with minor changes the overflow may be discharged to waste, to the balancing or surge tank, or to the recirculation pump suction.

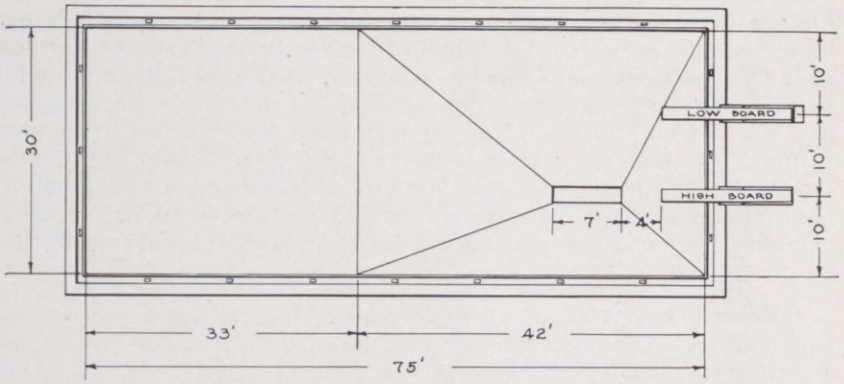
Diving Equipment. The type of diving equipment, its location, etc., for the most part involve problems of safety. The diving equipment should be limited to standard types and heights of installations. Springboards are located at two heights, 1 meter (1.1 yards) and high boards at 3 meters (approximately 118 inches or 3.28 yards). If these two regulation boards are provided, lower and intermediate heights may be included. For diving over 3 meters, solid platforms 10 meters (32.8 feet or 10.94 yards) and 5 meters high are standard. The 5- and 10-meter platforms, when necessary, may be placed one above the other. An overhang over the water's edge of at least 36 inches should be provided on the 10-meter platforms and not less than 18 inches on the 5-meter platforms. Permanent diving platforms should not be permitted over a height of 10 meters in a public pool.

The main hazard in diving from high platforms lies in the manner of access to the platform. Stairs or steps of an approved design adapted to this particular use should be provided.

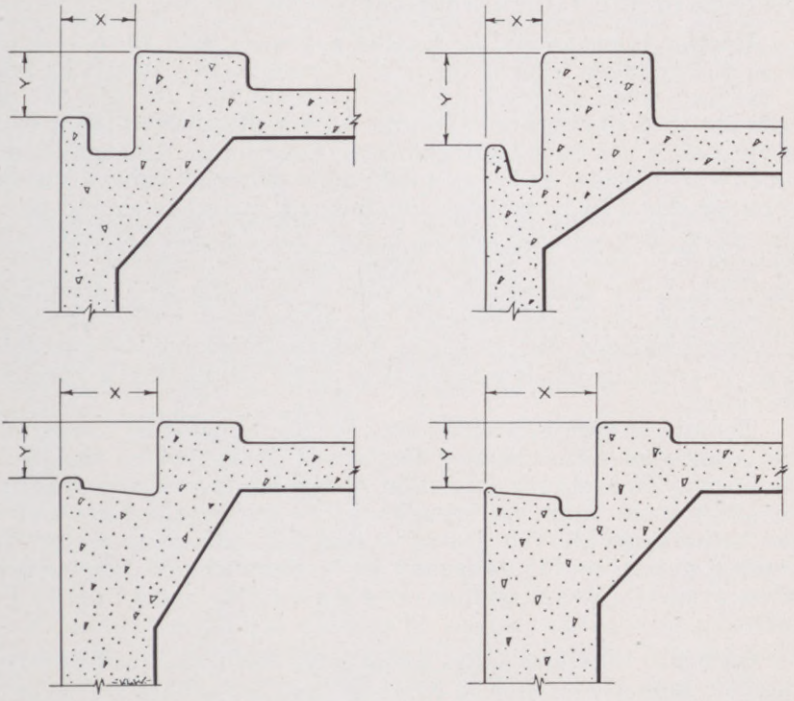
Springboards should be located not less than 8 feet center to center, and so that all diving traffic (aerial and water) is in the same direction. A low springboard should not be located directly below a high board. At least 13 feet of head room must be provided above the highest board to avoid accidents.

Concrete has been used very effectively and artistically to construct diving towers and platforms. Several designs of adjustable fulcrum diving boards are available which make it possible to obtain, by a quick adjustment, any desired "reaction time."

Floats, Rafts, Piers. Equipment such as floats, wheels, slides, etc., if used, should be located in such portions of the pool that they will not interfere with competitive or general swimming requirements.



SMALL POOL ADAPTED FOR HIGH AND LOW BOARDS WITH OFF-CENTER HOPPER BOTTOM.



SUGGESTED OPEN TYPE OVERFLOWS

FOR EXPLANATION OF RATIO BETWEEN X & Y SEE ITEM 18

ILLUSTRATION - A

Floats should be of such construction that it is not possible for divers and swimmers to be caught under them. This can be accomplished either by providing a minimum space of not less than 12 inches beneath the floor of the float when it is crowded to capacity, or by constructing the float so that underwater access can not be obtained. When floats, buoys, or life lines are used to mark the boundary lines between shallow and deep areas, they should be so constructed that bathers will not submerge them by hanging upon them. A type of marker or line which will remain exposed even when supporting a large number of bathers should be provided.

Fences, Barriers. Only by providing a real barrier around a pool and its walk area can the pool be made reasonably safe from a sanitary or safety standpoint. In country club pools, whenever possible, the pool should be located where building, impenetrable hedges, etc., will encircle the pool area without the use of unsightly fences. During the portion of the day when supervision is not provided in a pool of this type, a temporary barrier or restraining line should be provided to warn persons against entering the pool area.

Inlets. Inlets should be located not more than 10 to 15 inches below the overflow level of the pool. Consideration should be taken of the fact, when determining inlet locations, that the greatest pool loads are in shallow water and that for the most part these patrons are probably the most susceptible to infections. The question of velocity at the inlet orifice is a debatable one with valid arguments on either side. In large pools, we believe, the inlets should have a directional flow. Inlets having a free fall into the pool are often objectionable because of the noise, especially indoors. Multijet inlets which are designed to distribute the water in a great many directions at increased velocity are being used with success. If inlets are provided with gratings, such gratings should be designed so as to avoid undue friction and to avoid presenting a hazard to swimmers.

The use of sprays, nozzles, etc., for the purpose of temperature regulation should be confined to periods during which the pool is not in use. When such operation dissipates the chlorine residual, the latter must again be brought up to the required content before bathers are allowed access to the pool. Make-up water from a spray, nozzle, or fountain may be introduced into the pool, but unless properly filtered will adversely affect the clarity of the pool water.

Outlets. In a few cases pools have been designed for fresh water or repurified water to enter at the deep points and overflow through outlets or overflow gutters in the shallow portion. It is believed that there may be some advantage in having flow through the pool in this direction, thus permitting floating matter and dirty water from the more crowded shallow area to be carried off more rapidly. However, during periods when the pool is not being used, normal recirculation has very definite advantages.

The covering or grating should be of such design as to prevent bathers' fingers from being injured, and should have sufficient weight or be secured in place so as to prevent easy removal by prankish swimmers. The outlets should be so marked as to be plainly visible from the pool walks.

Diving Masks for Underwater Work. Diving masks and other necessary equipment have been available for some time for use in large pools for cleaning the bottom drains, using suction cleaner, etc.

RECIRCULATION SYSTEM AND APPURTENANCES

Piping System. A sump and blow-off should be provided at the lowest part of the system to permit removal of any accumulating iron rust. Openings should be provided for insertion of gauges to permit vacuum or pump suction and pressure at discharge to be determined, should a study of the recirculation system be desirable. It is advisable, also, to make provision for insertion of Pitot tubes or meters for checking the actual volume of water passing through the system under working conditions. Other requirements for piping are discussed under the heading "Inlets and Outlets."

Access Tunnel. It is very desirable to provide easy access to piping, and this can be accomplished by including in the design a tunnel extending around the pool.

Hair- and Lint-Catcher. The best type of hair-catcher consists of a metal chamber containing a removable cylindrical strainer, so arranged that the water passes through the strainer from the outside. The cylinder and housing should be of noncorrosive metal. Hair-traps should be so constructed that they can be quickly taken down for cleaning by loosening two or three wing-nuts. Proper valves should be provided to prevent flow of water through the strainer while cleaning.

Pumps. Centrifugal pumps are preferable for swimming pool circulation, although plunger pumps are sometimes used. Electric drive is also preferable. When pipe lines from suction cleaner lead to pump suction, a pump which will develop good vacuum must be used. When designed to operate with multiple-unit filters, it is advisable to have pumps in duplicate, with proper cross-connections to permit one filter to be washed with the effluent from another. If filters are located at an elevation higher than the water line of the pool, a check valve must be placed on the pump suction. If possible, the installation should include a duplicate pump and motor with cross-connection making it possible to operate the suction cleaner, or to wash one filter with the effluent of another while the recirculation system is in operation.

Water-Heater. In northern climates some method of heating the water is essential for indoor pools. Blowing steam directly

into the pool, as is practiced in some instances, or heating-coils placed directly in the pool are not recommended. A heater designed to heat all or a part of the circulation water is preferable. In designing a heater, ample surface for heat interchange must be provided. Such a heater may be designed for use with steam or hot water. Automatic thermal control is desirable. Provision should be made for easy removal of the heater parts for cleaning.

Temperature Control on Outdoor Pools. Pools located where the water supply comes from a surface source whose temperature during the summer is too high to keep the pool temperature below 80° by the addition of make-up water, may use a "low grade" water (for example, extremely high in iron), not suitable without extensive treatment for use in the pool, but of a temperature considerably lower than the pool, by jacketing the pool recirculation lines and pumping the undesirable water of ground temperature through this jacket. Copper pipes will increase the effectiveness of this "heat exchanger."

Thermometers. At indoor pools a fixed thermometer should be placed on the recirculation line beyond the heater and another near the outlet of the pool. At outdoor pools one thermometer is usually sufficient. Thermometers should be accessible and have a type of scale that is easily interpreted.

Testing the System. After the recirculation system has been installed and the various units have been tuned up, a test of the hydraulic properties of the entire system and of each integral unit should be made. In such a test the velocity in the piping system at various points, the discharge capacity of each filter and each pump, the velocity and volume of wash water in each filter, and the rate of discharge at each pool inlet should be determined under actual working conditions with the pool at normal working level. The full data of this test should be a matter of permanent record for future comparison. A similar test repeated at least once a year is desirable.

Chemical Feed. Positive-feed chemical machines are far preferable to alum and soda ash pots and their use is recommended. Point of application should be as far as possible ahead of the filters, and generally the most desirable point is in the suction of the recirculation pump. In addition to the longer reaction time, there apparently is an advantage in the more thorough mixing obtained. "Treatment sumps" are desirable and should be included in new pool designs, and provisions made for the application of the coagulants in such sumps. These sumps also receive the make-up water, described later. Where possible, mixing and coagulation basins would be desirable. In some pools, soda ash addition direct to the pool by hand has been preferred to soda ash pots.

Filtration. Both pressure and gravity filters can be used on pools. However, the pressure type is by far the most generally

used. Gravity filters are commonly used on the larger installations where the pool capacity is greater than one-half million gallons. However, general requirements for filtration are the same for both types.

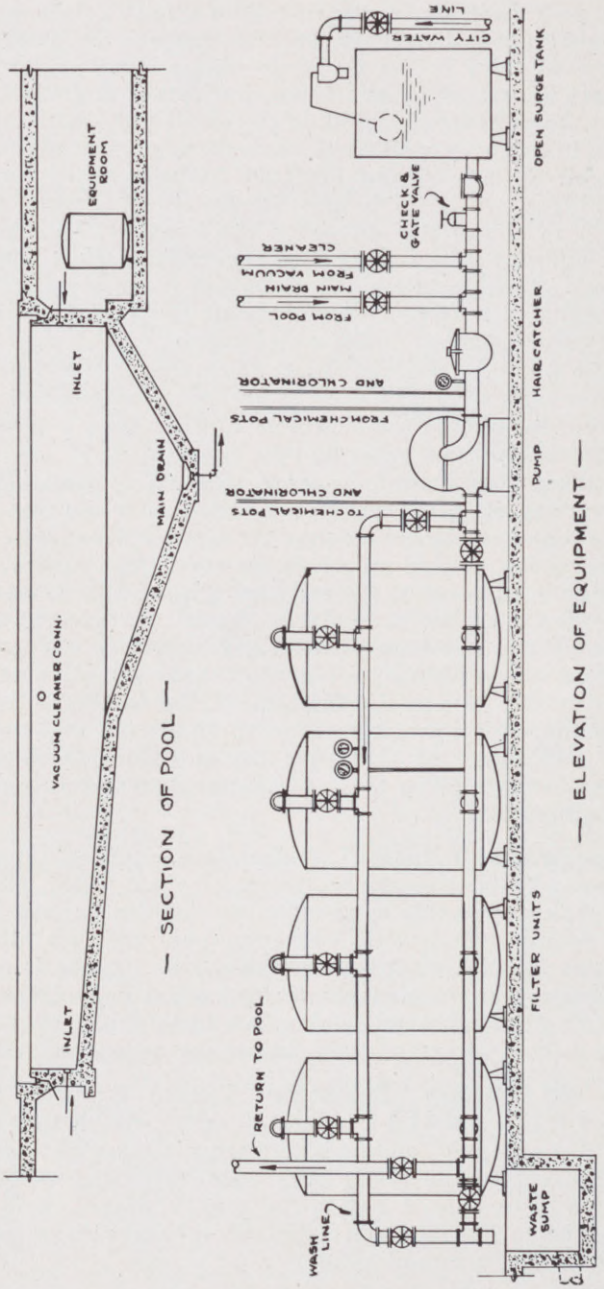
Pressure filters are of two types, horizontal and vertical. The vertical types are generally used on the small-sized pools up to 400,000 gallons in capacity, and the horizontal type on pools ranging in capacity between 300,000 and 1,000,000 gallons. Both vertical and horizontal types are used to best advantage in groups of 4 (not less than 3) to obtain the necessary wash rate without the use of additional pumps. If washing with the recirculation pump is not feasible, one alternate method is to install a wash-water pump of higher capacity. A suction well or small elevated feed tank, supplied with water from the public water supply, can be used to supply water to the pump. Over-rim inlets from the public water system to the well or tank should be used to prevent cross-connections.

Apparent latitude in the character of filter sand is possible with satisfactory results. In general, two types of sand are used, the irregular, sharp variety and the more spherical grains. The sharp, irregular variety may, because of its shape, have greater efficiency in the filtration of the water passing through the filter bed, but more difficulty is encountered in removing the accumulations during backwashing than in the case of the rounded grains. There also appears to be a tendency of the irregularly shaped particles gradually to become round, due to accumulations and abrasions during washing and filtration. Permeability of a filter bed, which is of extreme importance in its proper clarification of the water, is apparently affected by the viscosity of the water to be filtered and the graduation, size, and shape of the filter media. Considerable thought should, therefore, be given to this important part of swimming pool filtration equipment.

Surface Wash on Filters. The surface wash on filters, which many believe effects economy in the use of wash water while at the same time making possible more effective cleansing of the filter bed, should be equally effective on swimming-pool pressure filters as on gravity types. Surface wash pressure should be 10 pounds per square inch or more at the jet to give sufficient velocity. Orifices of three-sixteenth- or one-fourth-inch and a rate-of-flow of about 3 gallons per square foot of filter area per minute are recommended.

Surge and Overflow "Balancing" Tanks. Overflow reservoirs which prevent the loss of 4-5 inches of water, which takes place in the typical "open type" overflow pool when a class or sizable group of swimmers enters the pool, have been used successfully. This water, which ordinarily is lost to the sewers, enters these tanks, is returned to the pool at intervals, and sufficient make-up water is added to flush off surface accumulations.

In pools so equipped a considerable saving is effected in heat and water, and the frequent overflowing results in a safer and more attractive pool.


EQUIPMENT ROOM
INLET
VACUUM CLEANER CONN.
MAIN DRAIN
INLET
— SECTION OF POOL —
CITY WATER LINE
OPEN SURGE TANK
CHECK & GATE VALVE
CLEANER
FROM VACUUM
MAIN DRAIN
FROM POOL
HAIR CATCHER
AND CHLORINATOR
FROM CHEMICAL POTS
PUMP
AND CHLORINATOR
TO CHEMICAL POTS
FILTER UNITS
RETURN TO POOL
WASH LINE
WASTE SUMP
— ELEVATION OF EQUIPMENT —

Where overflow drains are discharged to a closed recirculation system, they may be piped to a balance tank which in turn is connected to the pump suction, with the tank so designed that surface oils and accumulations may be discharged to waste. Incidentally, a balancing tank, whether connected to receive overflow gutter discharge or placed in any recirculation system, has two other useful purposes: (1) It provides an excellent place for introduction of chemicals into the system; (2) it may be used as a surge tank to overcome the tendency to cross-connect the recirculation system with the public water supply. It is recommended that consideration be given to installations of balancing tanks in connection with pool recirculation systems.

When a surge tank is installed for receiving make-up water only, it should be placed, whenever practical, so that the maximum level of its contents will correspond to the elevation of the pool at the overflow edge. When not at pool level the pump connection to the pump suction should be equipped with a check valve. The surge-tank float (when tank is located at pool level) may be set to maintain a definite level, which should be at a point even with the overflow edge of the pool. Whenever possible, the make-up water control, when not automatic, should be so located as to be convenient for the operator.

Make-Up Water. When the water supply for a pool contains large quantities of calcium bicarbonate, and especially when such water must be heated for use, difficulty is often experienced in maintaining clear water in the pool by the usual methods of coagulation and filtration. To a certain extent this difficulty may be overcome by passing the alum-treated water through a properly designed coagulation and sedimentation basin before filtration. Where the installation of a proper coagulation basin is impracticable, it is suggested that water-softening apparatus of the zeolite or base-exchange type be installed as an adjunct to the recirculation system, to permit the calcium content of the pool water to be reduced to a reasonable amount.

Water meters should be included in all pool installations on the make-up water supply line to assist in checking proper operation, water consumption, etc. Meters should be located where they are easily accessible for reading.

Closed Systems. For reasons of economy and other considerations, the installation of so-called "closed systems" is permissible, provided certain conditions are met. This type of layout will have doubtful value on outdoor pools where the temperature is such that vast quantities of make-up water are required to keep the pool below 80°F. In cases where the water supply has some chemical content which requires special treatment, this type of design will have value. If the temperature-control is otherwise satisfactory, it will be possible to keep the make-up requirements at a minimum necessary to replace water lost by evaporation, carried out by bathers, etc.

Temperature-control in a closed system may be worked out by the use of a heat-exchanger, using a low-temperature supply of possibly unsatisfactory quality, to maintain the proper temperature in the pool. The system may also use this same source of water for the pool by providing satisfactory treatment. Sprays or fountains may also be used for temperature-control. In the latter case, however, the disinfection process must be adapted to meet this situation because many believe aeration tends to remove the cholorine residual.

Chlorine-Ammonia. Because the use of ammonia in conjunction with chlorine produces chloramine, a product of greatly reduced disinfecting power, the addition of ammonia in any form is not recommended. Most pool waters in regular use will contain some ammonia or other organic nitrogen compounds which for all practical purposes are active dechlorinating agents. The addition of ammonia makes a bad situation worse. All measures which help to keep the ammonia content of the pool water at as low level as possible will increase the efficiency of chlorination. A high degree of bather cleanliness is an important factor in the reduction of the ammonia content of the pool water.

Other Disinfectants. Other agents which have been proposed as disinfectants for swimming pools are:

1. Ultra-violet light
2. Ozone
3. Silver
4. Bromine

None of these is recommended for one or more of the following reasons:

1. Slow disinfecting action
2. No residual disinfecting action
3. Lack of adequate control
4. Unsatisfactory or expensive equipment required
5. Inadequate research

Location of Equipment. Often there is a psychological advantage in locating disinfecting equipment within view of the patrons. Chlorinators located in populated buildings such as clubs or schools should be suitably housed to prevent escape of gas due to accidental leak. A gas-tight, rust-resisting enclosure, vented to the outdoors with a positive ventilator, such as a fan, is desirable.

Electric Chlorination. Disinfection by means of electric chlorination is acceptable, provided the equipment has sufficient capacity to furnish the maximum demand necessary for the particular pool capacity. With this method an "alkalinity feeder" is often unnecessary, because in the production of chlorine by electrolysis an alkaline solution is formed which helps maintain sufficient alkalinity.

Off-Season Protection. In the case of outdoor pools, off-season protection, which is required during the major portion of the year, is important. In cold winter climates, protection of the pool structures

against damage by ice should be considered. All pipe lines should pitch to low points and be provided with drain-cleanout plugs. Equipment such as motors, which might be damaged if exposed to possible flooding by high water or failure of sump pump, should be removed or elevated to a point where protection will be afforded.

Equipment Room. If the equipment provided for maintaining the proper water condition in a swimming pool is not accessible or convenient, the operation will suffer. The practice of installing the equipment under the walk at the deep end of the pool should be permitted only when the elevation is such that proper protection can be made against flooding, and proper drainage, light, ventilation, etc., can be provided.

Provision should be made to convey oil drippings from the pump to a drain. If gravity drainage is not possible and the equipment area drains to a sump, provision should be made for the off-season months (if an outdoor pool). Heat will be necessary in a majority of such installations to prevent freezing.

Easy access, preferably not through the pool area, with heavy supplies such as barrels of alum, chlorine cylinders, etc., should be provided and storage space for them included.

Provision should be made for hoisting motors in large installations. A nonclogging type of pump will be required on the sump. Equipment, including motors, which might become damaged by immersion in water due to the failure of the pump, should be removed or elevated to a point where it will not be damaged during the off-season. Ventilation and sufficient air movement will be required to prevent condensation of moisture on filters, pipes, etc., and consequent damage.

BATHER-PREPARATION FACILITIES

Location. The location and layout of dressing-room facilities should be such as to enforce the routing of all persons who use the pool, through these various facilities in a direct manner and without cross-traffic, in the following order: Locker rooms (if provided), toilets (inside dry), toilets (inside wet), showers, footbaths (if provided), and entrance to pool area.

Showers. Devices are available which will turn off a shower after allowing it to run for a timed interval. This allows the bather the use of both hands while showering.

Foot-Controlled Showers. Methods have been designed whereby shower control is effected by the use of the feet, similar to those methods used by doctors and dentists on lavatories.

Photoelectric Control of Straddle Showers. The "electric eye" has been used with some success to turn on the entrance shower.

A Bidet or upward-flow spray beneath each shower to permit washing between the legs is desirable.

The piping of each shower bath should be carefully designed for ease of operation and prevention of leakage, and should be fitted with a tight check valve in the cold-water pipe near the shower head.

Controlled Baffle Gate. Personnel may be kept to the minimum and effective control still maintained in a pool and its facilities by the use of "controlled" baffle gates. Details will be given to those interested.

Dressing-Room Furniture. All furniture used in dressing rooms should be of simple character and of easily washable material. Lockers, where provided, should be of vermin-proof construction with tight joints. All lockers should be properly ventilated.

Ramps. Transition from one level to another in the "bathhouse" should be made with ramps and not with steps or stairs.

Footbaths. In our opinion, the primary function of footbaths is to prevent persons in street shoes from entering the pool area and to rinse excess dirt from the feet. Since improper maintenance of footbaths may aid in the spread of foot infections, it is felt that such should be forestalled by providing a suitable design such as a "flowing-through channel" or a conventional type in which the water is continuously added and withdrawn. Various shower or spray arrangements to wet the bathers as they pass to the pool area have been used. Some of these installations are automatically controlled by an "electric eye" to conserve water.

All water inlets to the footbaths must terminate at least 6 inches above the maximum possible water level in the footbath.

Team Rooms. In indoor pools which have considerable competition to which spectators are admitted, one of the problems has been to keep the spectators comfortably cool and the competitors sufficiently warm. This can be accomplished by including "team rooms" at the side or end of the pool where a proper temperature for the competitors can be maintained and their view of the events made possible by the use of glass partitions and doors.

MISCELLANEOUS

Drinking Fountains. Drinking fountains should be provided in the pool area, in the dressing rooms, and for the spectators. Any fountains that are provided must meet the following design features:

1. The fountain shall be constructed of impervious material such as vitreous china, porcelain, enameled cast iron, other metals, or stoneware.

2. The jet of the fountain shall issue from a nozzle of nonoxidizing, impervious material set at an angle from the vertical. The nozzle and every other opening in the water pipe or conductor leading to the nozzle shall be above the edge of the bowl so that such nozzle or opening will not be flooded in case a drain from the bowl of the fountain becomes clogged.

3. The end of the nozzle shall be protected by nonoxidizing guards to prevent persons using the fountain from coming into contact with the nozzle. The guard shall be designed so that the lips, when drinking, will not touch the guard.

4. The inclined jet of water issuing from the nozzle shall not touch the guard. (This will prevent spattering.)

5. The bowl of the fountain shall be so designed and proportioned as to be free from corners which would be difficult to clean or which would collect dirt.

6. The bowl shall be so proportioned as to prevent unnecessary splashing at a point where the jet falls into the bowl.

7. The drain from the fountain shall not have a direct physical connection to a waste pipe unless the drain is trapped.

8. The water-supply pipe shall be provided with an adjustable valve fitted with a loose key or an automatic valve permitting the regulation of the rate-of-flow of water to the fountain, so that the valve manipulated by the users of the fountain will merely turn the water on or off.

9. The height of the fountain at the drinking level shall be such as to be convenient to persons utilizing the fountain. The provision of several steps will permit children of various ages to drink comfortably.

10. The waste opening and pipe shall be of sufficient size to carry off the water promptly. The opening shall be provided with a strainer.

The fountain should be recessed or located so as to prevent accidents.

Separate Spectator Provision. Separate provision shall be made for spectators outside the pool area, and the drainage from the spectator area shall in no case be allowed to drain upon the area used exclusively by bathers.

The spectator area should be at a point of vantage. When a balcony, it should not overhang the pool area. Gallery floor should slope to a drain. Seats should be so located that vision is not interfered with by pillars, railings, etc., and constructed of nonabsorbent material to permit washing. Spectators should preferably be located at right angles to the diving boards with their backs to the sun. A curb or other provision should be used to prevent litter and dirt from being kicked or scuffed by spectators into the pool or pool area. Shade, and protection from rain in outdoor pools should be provided.

Fancy diving is much more attractive to the spectator when viewed from right angles to the diving. Spectators should be lo-

cated as close as practical to the diving area because the relationship of performer and spectator is much more satisfactory at close range.

Spectators' Toilets. Toilets should be provided for spectators to prevent their entering the dressing area provided for bathers, with accompanying lack of control and the introduction of excessive dirt.

At pools not larger than 50′ x 100′ in area, with a permissible bathing load not to exceed 700 persons, there should be provided for the spectators, 3 closets, 4 urinals, and 2 lavatories for men, and 4 closets and 2 lavatories for women. Larger pools should provide 5 closets, 8 urinals, and 4 lavatories for men, and 6 closets and 4 lavatories for women. The toilet rooms should meet the requirements as set forth in the minimum requirements.

Parking Facilities. Adequate provision should be made to handle the problem of parking. The parking area should be as conveniently located as possible, should be properly lighted, provided with adequate drainage and, of course, surfaced in such a way that it can be used in rainy weather when necessary. When the topography is such that the parking area overlooks the pool area, it will meet with popular approval of the older persons who do not swim, but who enjoy watching their friends and families disport themselves in the pool.

Salt-Water Pools. Salt water, both natural from deep wells, and also from an artificial source, has been used with success in pools. Provision must be made, however, to prevent corrosion when this is done.

Pools for Specialized Requirements. In the design of pools such as those intended primarily for crippled children, other therapeutic purposes, etc., consideration should be given in the design to the specialized requirements of such installations. This Department will gladly go into the details believed desirable in such pools, upon application from those authorities contemplating their installation.

Laundry. All pools should include in their design provisions for the proper laundry equipment for handling suits and towels. Equipment for proper washing, rinsing, drying, and storing should be included, and this equipment should be so located that it is accessible, properly lighted, and ventilated. The same standards of cleanliness, disinfection, etc., should be required in the handling of suits and towels as are required at public laundries. The necessary steam or hot water required for the proper operation of the laundry must be available.

Patents. Some items in connection with pools, such as special shapes, contours, inlet arrangements, etc., have been patented.

However, most basic items have been in common use for many years and may be used without question of infringement. It is suggested that when such questions arise the services of a qualified patent attorney be retained.

WADING POOLS

Location. A wading pool should be located where the afternoon sun will fall on the major portion of the area. While some shade is desirable, too much shade will result in an unpopular pool.

Sizes. Wading pools should not be too large. A smaller, better-designed, and better-operated layout, even if used in relays, is to be preferred.

Overflow. A wide overflow edge (2 feet to 3 feet) with a non-slip finish (concrete) is recommended, with a slightly depressed trough surrounding the entire area.

Spray Pools. Recently there has been a trend to convert existing wading pools, which lack the proper design to make it possible for them to be maintained in a sanitary condition, into spray pools. A spray pool uses the former wading pool as a basin, the drains being open at all times. Considerable variation can be made in the spray mechanisms. A spray pool serves approximately the same purpose as a wading pool with almost none of the public-health hazards to be found in the typical wading pool. In a spray pool the individual does not expose himself to water which has already been exposed to other persons' body wastes. Without doubt, many existing wading pools could be changed to spray pools with very definite advantage.

Drinking Fountain. A sanitary drinking fountain should be provided at one side or end of the area with a raised step to enable the very small children, as well as the older ones, to drink without assistance.

The fountain must meet the requirements given previously in this bulletin.

INDEX