

CHAPTER 90

WASTE STABILIZATION PONDS (Lagoons)

91 Supplement To Engineer's Report

The engineer's report shall contain pertinent information on location, geology, access, flood hazards, soil conditions, area for expansion, and any other factors that will affect the feasibility and acceptability of the proposed facilities. The following information must be submitted in addition to that required in Section 11, engineer's report.

91.1 Supplementary Field Survey Data

91.11 The location and direction of all residences, roads, buildings, commercial development, water courses, and water supplies within 1/2 mile of the proposed facility.

91.12 Soil borings to determine surface and subsurface soil characteristics of the immediate area and their effect on the construction and operation of the proposed facility.

91.13 Data demonstrating the percolation rates to be anticipated at the elevation of the proposed pond bottom.

91.14 A layout of the facility showing suitable area for expansion with complete contours of the site and adjacent area and other pertinent information.

91.15 Sulfate content of the basic water supply.

92 Basis Of Design

92.1 Area and Loadings

The maximum design loading on the primary cell or cells shall be 30 pounds per acre per day of 5-Day 20 C BOD and the primary cell or cells

shall be designed to satisfy the total design organic loading. At least three cells designed for series operation shall be provided and the area in the primary, cell or cells shall be approximately one-half (1/2) of the total surface acreage of the ponds. The surface area of the ponds shall be determined by the computation requiring the largest surface area based upon organic and hydraulic loading. The total organic loading for the total surface area shall be less than 20 pounds of 5-Day 20°C BOD per acre per day. The total hydraulic loading, including infiltration and inflow, shall be used to determine the volume required to provide a minimum storage capacity of 180 days. The 180-day storage shall be provided between the 2- and 5-foot liquid levels. The Department may consider and allow deviations where hardship cases can be documented and proved to the satisfaction of the Department. Higher design loadings may be permitted where mechanical aeration is utilized. Such designs may be approved by the Department after all the required information is reviewed. Due consideration shall be given to possible future municipal expansion and/or additional sources of wastes when the original land acquisition is made. Suitable land should be available at the site for increasing the size of the original construction. The facility shall be designed and operated to retain all wintertime flows.

92.2 Industrial Wastes

Due consideration will be given to the type and effects of industrial wastes on the treatment process.

92.3 Multiple Units

Multiple cells are required and the design may include facilities for series and parallel operation for additional flexibility. However, series operation

is required to meet effluent standards and to provide for better nutrient reduction. Flexibility is desirable if one cell must be taken out of use for repair, enlargement or for some other reason. Where a greater degree of treatment is necessary or desirable, or when population growth requires additional treatment, more cells can be added as primary or secondary cells. The required surface area and loadings shall be as set.

92.4 Pretreatment

When ponds are used to provide additional treatment for effluents from existing or new primary, or secondary sewage treatment works, the reviewing authority will, upon request, establish BOD loadings for the pond after due consideration of the efficiencies of the preceding treatment units.

92.5 Pond Shape

The shape of all cells should be such that there are no narrow or elongated portions. Round, square, or rectangular ponds with a length not exceeding 3 times the width are considered most desirable. Other shapes will be considered by, the reviewing authority. No islands, peninsulas, or coves should be permitted. Dikes should be rounded at corners to minimize accumulations of floating materials.

93 Location

93.1 Distance From Habitation

A pond site should be as far as practicable from habitation or any area which may be developed within the reasonable future. A distance of at least 1/4 mile is recommended whenever possible.

93.2 Prevailing Winds

If practicable, ponds should be located so that local prevailing winds will be in the direction of uninhabited areas.

93.3 Surface Runoff

The facility shall be designed to exclude surface run-off and shall not interfere with the natural drainage system unless adequate drainage is incorporated into the design.

93.4 Ground Water Pollution

The site of waste stabilization ponds shall be critically evaluated with regard to locations in areas of porous soils and fissured rock formations, as well as location of water supplies and other facilities subject to contamination to avoid creation of health hazards or other undesirable conditions. The possibility of chemical pollution shall be considered.

94 Pond Construction Details

94.1 Embankments And Dikes

94.11 Material

Embankments and dikes shall be constructed of relatively impervious materials and compacted sufficiently to form a stable structure. The minimum compaction shall be 90 percent of Proctor Density, however, 95 percent Proctor Density is recommended. Vegetation should be removed from the area upon which the embankment is to be placed.

94.12 Top Width

The minimum embankment top width shall be 8 feet to permit access of maintenance vehicles.

94.13 Maximum Slopes

Embankment slopes should not be steeper than:

94.131 Inner: 3 horizontal to 1 vertical.

94.132 Outer: 3 horizontal to 1 vertical.

94.14 Minimum Slopes

Embankment slopes should not be flatter than:

94.141 Inner: 5 horizontal to 1 vertical.

Flatter slopes are sometimes specified for larger installations because of wave action but have the disadvantage of added shallow areas conducive to emergent vegetation which also is conducive to producing mosquito breeding habitat.

94.142 Outer: Not Applicable.

94.15 Freeboard

Minimum freeboard shall be 3 feet.

94.16 Minimum Depth*

The minimum normal liquid depth in a primary call should be 2 feet.

94.17 Maximum Depth*

Maximum normal liquid depth in a primary cell should be 5 feet. The reviewing authority may consider depths over 5 feet in the secondary or multiple cell facilities for special conditions.

***Not applicable for facilities with mechanical aeration.**

94.18 Seeding

Embankments shall be seeded from the outside toe to the high water line on the inside slope of the dikes. Perennial type, low growing, spreading grasses that withstand erosion and can be kept mowed are most satisfactory for seeding of embankments. In general, alfalfa and other long-rooted crops should not be used in seeding, since the roots of this type plant are apt to impair the water holding efficiency of the dikes. The County Agricultural Extension Agent can usually advise as to hardy, locally suited permanent grasses which

would be satisfactory for embankment seeding. Additional protection for embankments (riprap) may be necessary where the dikes are subject to erosion due to severe flooding of an adjacent watercourse or severe wave action.

94.19 Vegetation Control

A method shall be specified which will prevent growth of vegetation on the bottom of the ponds and to the high water line on the dikes.

94.2 Pond Bottom

94.21 Uniformity

The pond bottom should be as level as possible at all points.

Finished elevations shall be within 2 inches of the average elevation of the bottom. Shallow or feathering fringe areas usually result in locally unsatisfactory conditions.

94.22 Vegetation

The bottom shall be cleared of vegetation and debris. Organic material thus removed shall not be used in the dike core construction. However, suitable topsoil relatively free of debris may be used as cover material on the outer slopes of the embankment.

94.23 Soil Formation

The soil formation or structure of the bottom shall be relatively tight to avoid excessive liquid loss due to percolation or seepage. Soil borings and tests to determine the characteristics of surface soil and subsurface soil shall be made a part of preliminary surveys to select pond sites. Gravel and limestone areas must be avoided.

94.24 Percolation

The ability to maintain a satisfactory water level in the ponds is one

of the most important aspects of design. Removal of porous topsoil and proper compaction of subsoil improves water-holding characteristics of the bottom. Compacted clay, bentonite, or other approved material shall be used to adequately seal areas containing sand, gravel, or other porous material, and these areas shall be indicated on the plans. Where excessive percolation is anticipated, sealing of the bottom with a clay blanket, bentonite, or other sealing material should be given consideration. Percolation from the facility should be limited to 1/8 inch per day.

94.3 Influent Lines

94.31 Material

Any generally accepted material for underground sewer construction will be given consideration for the influent line to the pond. The material selected should be adapted to local conditions. Special consideration must be given to the character of the wastes, possibility of septicity, exceptionally heavy external loadings, abrasion, the necessity of reducing the number of joints, soft foundations, and similar problems. Surcharging of the sewer upstream from the inlet manhole is not permitted.

94.32 Manholes

A manhole shall be installed at the terminus of the gravity outfall line and shall be located as close to the dike as topography permits and its invert should be at least 6 inches above the operating level of the pond to provide sufficient hydraulic head without surcharging the manhole.

94.33 Influent Lines

Influent lines should be located below the bottom of the pond and shall terminate in accordance with Section 94.35. This line can be placed at zero grade. The use of an exposed dike to carry the influent line to the discharge points is prohibited, as such a structure will impede circulation. A gate valve and blow off are recommended in a gravity influent line to allow cleaning of the line.

94.34 Point Of Discharge

The influent line to the primary cell or cells should be essentially center discharging. Influent lines or interconnecting piping to secondary cells of multiple celled ponds operated in series shall consist of pipes through the separating dikes. (Section 94.43)

Influent lines should be located to minimize short-circuiting within the pond.

94.35 Inlets

The inlet line for gravity influent shall discharge horizontally into a shallow, saucer-shaped depression which should extend below the pond bottom not more than the diameter of the influent pipe plus 1 foot. Force main inlet lines may discharge vertically through a 90° bend. The line should not extend more than 12 inches above the lagoon floor elevation.

94.36 Discharge Apron

The end of the discharge line should terminate with a concrete apron with a minimum area of 6 feet square.

94.4 Discharge And Interconnecting Piping

94.41 Material

Discharge and interconnecting piping should be of adequate size and shall be manufactured in conformity with the latest standards issued by the American Water Works Association or applicable Commercial Standards. All discharge or interconnecting pipe lines shall be valved with gate valves rated for use with the piping specified. Structures which allow constant overflow shall not be permitted.

94.42 Discharge Piping

Discharge piping shall be installed complete with gate valve and valve box. The invert of the pipe shall be 6 inches or more above the pond bottom to avoid pick-up of bottom deposits. Erosion protection should be provided at the discharge end of piping. The end of the discharge pipe should be screened or valved to prevent entrance of small animals. When possible, the discharge piping should be located to prevent short-circuiting. Consideration must be given in the design of all piping to protect against freezing or ice damage under winter conditions.

94.43 Interconnecting Piping

Interconnecting piping shall be installed complete with gate valve and valve box. The invert of the pipe shall be 6 inches or more above the pond bottom to avoid pickup of bottom deposits. Erosion protection should be provided at the discharge end of piping. When possible, the discharge piping should be located to prevent short-circuiting. Consideration must be given in the design of all piping to protect against freezing or ice damage under winter conditions.

95 Miscellaneous

95.1 Fencing

The complete waste stabilization pond site shall be enclosed with a suitable fence to preclude entrance of livestock and discourage trespassing. A vehicle access gate of sufficient width to accommodate mowing equipment should be provided. All access gates should be provided with a lock. Fences shall be located away from the outside toe of the dike to facilitate dike mowing and maintenance operations.

95.2 Warning Signs

Appropriate signs should be provided along the fence around the pond to designate the nature of the facility, and advise against trespassing.

95.3 Liquid Depth Operation

Optimum liquid depth in the primary cell is influenced to some extent by lagoon area since circulation in larger installations permits greater liquid depth. The basic plan of operation may also influence depth. Normal operating depths are to be controlled by the interconnecting or discharge piping and should range between 2 and 5 feet. For winter storage the operating level should be lowered before ice formation and gradually increased to 5 feet by the retention of winter flows. In the spring, the level in the secondary cell can be lowered to any desired depth providing the liquid meets effluent standards and approval to discharge has been obtained. Shallow operation can be maintained following discharge with generally increased depths to discourage emergent vegetation. In the fall, the levels can be lowered, providing effluent standards are met, to prepare for winter storage.

95.4 Laboratory Equipment

See Section 46.4.