The Farm Pond

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A pond is a body of water obtained by damming a gully, ravine, or creek. Ponds are usually filled by the rainwater that falls on the watershed drained by the ravine where the dam is made. However, in many cases it is possible to fill a pond with water that falls on the opposite slope by carrying the water around the hill by terraces. Terrace feeding is an excellent method because the pond will not fill so quickly with mud.

Other methods of obtaining water for small ponds are drainways from springs and hillside seeps. These are excellent methods where possible. Ponds are used to furnish water for livestock and in many cases, where large enough, they may be used for garden irrigation, fishing, swimming, and to furnish shady nooks on farms where trees would not otherwise grow.

Too many ponds on Oklahoma farms are too shallow to hold water through long dry spells. As a result, when water is most needed, they are dry or so low that the water is unfit for use. Every effort should be made to have the pond six feet deep or deeper, because the yearly evaporation is five to eight feet.

CHOOSING A LOCATION FOR THE POND

In choosing a location for a pond select a place where the pond will be deep and cover as much area as possible. Depth is more important than area if the pond is to retain water through long dry periods. Many times it is possible to find a narrow place in the ravine where a natural ridge forms the greater portion of the dam.

The purpose for which the pond is to be used should also have some bearing on its location. If used primarily for stock water and fish the drainage from the barn should not be allowed to run into the pond. Many times this can be cut off by a terrace and turned onto the opposite slope. If used primarily for irrigation, the barnyard drainage need not be considered.

A pond located so that the drainage area is a meadow or pasture is much preferred to a drainage from a cultivated field because it will not fill with silt so quickly. However, if the drainage area is a cultivated field, the field should be terraced and the area around the pond planted to grass. Thickets of plums, blackberries, or other shrubs may be planted in the area above the pond. This causes the water to deposit much of the silt before entering the pond. Avoid locating a pond in a deep caving gully or where the pond will soon fill with mud. Where there are no ravines available for a pond site, a tank or reservoir may be made to serve as a watering place for livestock by digging a hole 6 to 10 feet deep. If most of the dirt is put on the lower side the depth will be increased a foot or so. If drainage area to fill this watering place is not sufficient, a terrace may be made to divert the water into it.

It is important to examine the subsoil to be sure that the pond will hold water. To do this, dig several holes to a considerable depth over the area and particularly where the dam is to be built. A good tight clay subsoil is the best. If the subsoil is sand or gravel, the chances are the pond will not hold water. A clay or sandy loam can be made to hold although there may be considerable seepage for a year or so. Should a pond be completed and the seepage happens to be more than expected, it is possible many times to check it by letting cattle or horses tramp the soil in the bottom and lower edge of the dam thoroughly while it is in a muddy condition. Clay hauled and spread over the muddy bottom while the tramping is being done will be of great help.

It would be fine, indeed, if the pond could be located exactly where the farmer wished it; but unfortunately it is generally necessary to locate the pond in a ravine. Many times, it may be necessary to have the pond located somewhat inconveniently. However, the pond is generally much more valuable than the land it occupies, so it is more important to have the pond, although somewhat inconveniently located, than to do without it.

Many times the eye deceives as to the size and depth of a pond that may be built in a given location, so it is necessary that a level be used to determine how deep and about how large the pond can be made before starting on the dam. Sometimes the slope of the land is so deceiving that the builder thinks he can have a large pond, but when the level is utilized it is found that the pond will be very small.

It is also necessary to determine the approximate acres of land from which water drains to the pond, in order to determine the proper size of the spillway. A fairly large pond in a comparatively small drainage area is very desirable, that is, from four to six acres drainage for each acre-foot capicity of the pond. An acre-foot is one acre covered one foot deep with water. A small pond in a large drainage area will require a much larger and more expensive spillway. These conditions are to be considered but, after all, the pond has to be built for the existing conditions, even if they are not exactly what is desired or if the cost is a little greater.

METHOD OF LAYING OUT WATER LINE AND SPILLWAY OF A POND

Set the level as shown in Fig. 1. The rodman sets the rod on the ground at A, the desired water level. (Assume that the dam is not yet built.) The man at the level looks through it and motions the rodman to raise or lower the target until the cross hairs are on the horizontal line on the target. The target is fastened in this position. The rodman then moves up the ravine and sets his rod on the ground, and the man at the level motions him to move either up or down hill until a place is found on the hillside where the target is again on the cross hairs. (Call this Station B.) Since the traget has not been moved on the rod, Station B is on the same level as Station A. Continue this process around the pond for several stations—A,

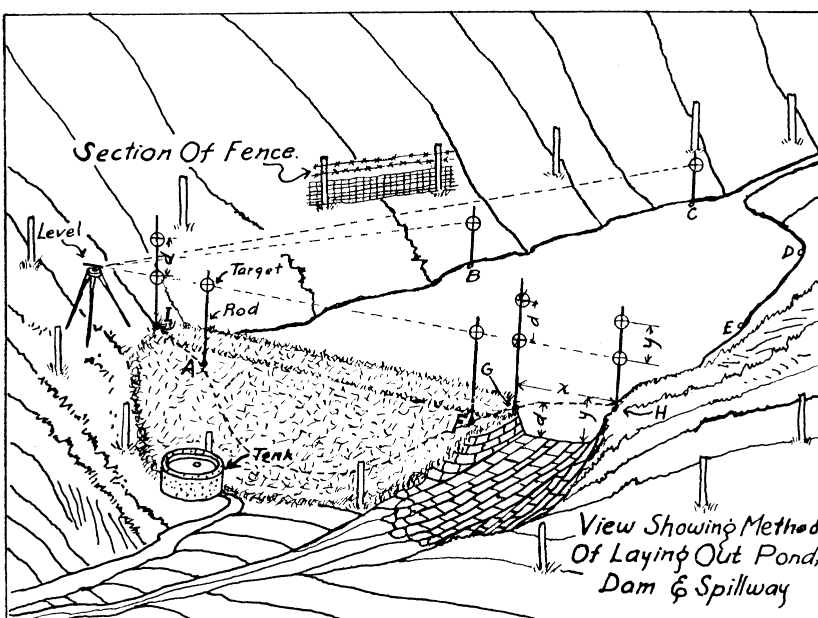

Fig. 1.—A farm level is necessary to lay out the pond.

B, C, D, E, F,—as shown in Fig. 1. A line drawn through these stations is the water edge of the pond. If the pond is not as large as desired, move Station A (Fig. 1) up higher on the hill-side and proceed to find a water line farther up the hill. The last station, F, opposite A, is the water level on the opposite side of the pond.

Since the dam is to be higher than the water level, the rod-man moves the target down a distance of four feet for an ordinary pond and five feet for a large pond, and moves uphill from Station A until the man at the level gives the signal that the cross hairs are on the target. (Call this Station I.) This is the end of the dam. The point G, on the opposite side, is found in like manner.

To lay out the spillway, the rodman steps a distance, x (to determine distance x see Table IV), along the dam uphill from G to Station H, and sets his rod and moves the target up or down until the man at the level motions that the cross hairs are on the target; then the difference in readings at Stations F and H is denoted by y and is the depth of the spillway at its outer side. The width of the spillway depends on the area drained into the pond, and somewhat on the surface of the ground, whether plowed or pasture land, whether flat or steep slopes. Because of these variable conditions, it is possible to give only approximate dimensions for the spillway. (See Table IV.)

CONSTRUCTION OF THE DAM

Clear the ground of all trash, brush, grass, and stumps the full width of the dam, and plow this entire space so there is no possible chance for a seepage line. See that all gophers and moles are killed. Then take slips or fresnos and remove the dirt from the middle of the dam, 6 or 8 feet wide, down to firm clay, the full length of the dam as shown in Fig. 3. This is to be filled in with damp clay, rather than topsoil. The clay core should be carried to the top.

Before starting to build the dam it is advisable, but not necessary, to dig a trench from the deepest part of the pond across the dam site and lay a pipe so that a tank may be placed below the dam to furnish good pure stock water; also, this may serve to drain the pond occasionaly in order to clean it. See Fig. 3. This pipe should be 2 inches in diameter for a small pond and 3 or 4 inches in diameter for large reservoirs. It would be well to put rings of concrete around the pipe every few feet so no seepage will develop along the pipe. This is well worth the cost. Be sure this ditch is filled with clay and well packed around the pipe.

After this is done, begin moving the dirt. Take the first dirt from the bottom of the pond and start building the dam, always watching to see that clay is dumped near the middle of the dam. As the dam gets higher, dirt may be obtained from the sides so that the dirt will not have to be moved so far uphill. However, it is much better to get all dirt out of a hole just above the dam, thus making a deep hole of water.

Build the dam in layers of not more than one foot in thickness; that is, one layer of dirt should cover the entire dam before starting a new layer. This insures the dirt being well packed, and it will settle evenly. Dirt can be moved more economically with a fresno than with a slip. Be sure that no porous material is put in the center or water side of the dam. Tables II and III show the safe width of dam for various heights.

Where a dam is constructed with a large tractor and scraper, the top width "w" of the dam will have to be about 12 feet instead of the widths given in Table II for safe use of this type of machinery. If the widths "W," at the bottom of the dam, that are given in the tables, are used and the dam is made 12 feet wide on top, the inner slope of the dam will be a little steeper than the figures given in the table. This will still meet specifications. By counting the top width as given in the table, there is a little more dirt in the dam than necessary. However, this extra dirt in the dam is very little to what would be required to widen the top to 12 feet and widen the bottom proportionately to keep the slopes as given in the table.

The inner slope of the dam of a rather large pond should be riprapped with rock or paved with concrete to protect against wave action, especially if the slope faces in a southwesterly direction. (See Fig. 3.) The top and outer slope should be sodded with grass. The soil should contain some moisture while the dam is being built so that it will pack. Dry soil will not pack well.

LAYING OUT THE POND DAM

A great many dams are now being built by contract, and government payments are made for a definite number of cubic yards of earth in the pond dam. Under these conditions, it is necessary that the yardage of earth in the dam be known.

Two methods of calculating the yardage in the dam will be discussed: first, the actual cross-sectional method and second, the trapezoid method. The trapezoid method approximates very closely the actual cross-sectional method and is much easier for the average person to use.

Actual Cross-Sectional Method (Refer to Figure 2 and assume the dam is not yet built). Set up the level at some point L so that the rod reading will be zero at a point A on the center line chosen for the top line of the dam. (It may be necessary to set up the level several times before finding the place where the rod will read zero on the chosen point A for the top of the dam.) Of course, point A may be varied slightly in choosing it. After point A is properly located, choose a bench mark (BM) at some convenient place where it will not be disturbed when constructing the dam, and where the ground is nearly level with point A. The stake for the (BM) should be driven a little at a time until the cross hairs just coincide with the top of the stake. This gives a reading of zero and is exactly level with point A. Station B is found next by setting the target so that it reads the same number of feet "d" in Table 2 that the freeboard is above the water level, and move downhill along the centerline of the dam until the target is on the cross hairs and drive the stake B. This point B is the water level of the spillway of the pond. Now drive stakes C, D, E, F, etc. along the center line of the dam at each change of slope. Measure the horizontal distances "z" between all points such as AB, BC, CD, etc. and record in Table I. These distances may be made an exact number of feet instead of feet and inches so that calculations will be made easier. Now take rod readings at each of these stakes, setting the rod on the ground instead of the stake. Since the rod reading was zero at A, the top of the dam, all of the readings on stations A, B, C. D, E, etc. will be the height (H) of the dam. Record these readings in Table I under Column H.

Refer to Table II and determine "a" and "b" for the given heights on points A, B, C, D, E, F, etc. Measure distance "a" upstream at right angles to the center line of the dam to point "xx" and take a rod reading. Suppose that the rod reads one foot less than it did at the center stake, the distance "a" will have to be made three feet less because the distance "a" on the upstream side is three feet less for each foot higher. After the rod has been moved three feet, from "xx" to "x," take the actual reading at "x" and record it under column "x" in Table I. In like manner measure distance "b" from the center line downstream to point "yy" and take a rod reading. If the rod reads one-half foot more than it did on the center line, it will be necesary to move from "yy"to "y" one foot farther from the centerline and take the actual rod reading because the slope on the downstream side of the dam is 2:1. Record the reading under column "y." This procedure can be made a little clearer by referring to the cross-section of the dam in Figure 2.

Get similar readings for all stations A, B, C, D, E. F. etc. See that the top and bottom widths are recorded in Table I. The distances "a" and "b" may be figured instead of taken from table II. "a" = (H×3) + (w÷2) and "b" = (H×2) + (w÷2).

Find the area of the cross sections at A, B, C, D, E, F, etc. with a perimeter or rotometer and record in Table I. After the areas of the cross-sections at A, B, C, D, E, F, are determined, the volume of the dam is found by adding the area of cross-section B to the area of cross-section C and dividing by two and multiplying by "z," the distance between them. This gives the volume in cubic feet (reduced to cubic yards by dividing by 27). Record this in Table I. Do this for each section of the dam. The sum of the volumes of all sections equals the total volume of the dam.

Trapezoid Method. Laying out the dam by the trapezoid method is done exactly like the cross-sectional method except the distances "a" and "b" from Table II and Figure 3 are used as indicated at points "xx" and "yy" in Figure 2. Instead of finding new points "x" and "y" as was done in the actual cross-sectional method, make the bottom line of the section of the dam parallel with the top line and use H for the height. Since the top line, "w," and the bottom line W are parallel, the figure is a trapezoid. The areas of these trapezoids are found in Table II for each height up to 25 feet. The distances "a" and "b" may be figured instead of taken from Table II by the same method as in the actual cross-sectional method. Where one does not have access to Table II, the area of the trapezoids may be figured thus: (w+W) H÷2. It will be noted from the cross-section of the dam in Figure 2 that there will be very little error for the average pond by using this method because the dirt that has to be added on the downstream side just about cancels the dirt that is already in place above the horizontal line on the upstream side. (See cross-section in Figure 2.)

Checking the Dam

The AAA program requires that these dams be checked to see that specifications have been met. For the purpose of checking the dam after it is completed, it is necessary to take readings at "x" and "y" for the actual cross-sectional method and at "xx" and "yy" for the trapezoid method when laying out the dam. The readings at "xx" and "yy" are not used in figuring volumes in the trapezoid method but for the purpose of checking only. When the level is set up for checking the dam, it should be set at some point so the rod will read exactly one foot when on the bench mark stake. That is, the level is one foot higher than when the dam was laid out. To check the dam, take the readings at the points on top of the dam above the stations A, B, C, D, E, F, etc. and at all points "x" and "y." Record these readings on the second set of lines in Table I. It will be noted that the readings of "x" and "y" when checking the dam will be one foot greater than the readings on the line just above which were taken when the pond was laid out and the readings H on the center line should be just one foot. The reason for this one foot difference in readings is because the reading on the (BM) is one foot more when checking than when laying out the pond. Since it is not always possible to locate the exact points on which the readings were originally taken, these figures may vary as much as six or eight inches and still be up to specifications.

TABLE II

(This table shows dimensions of a standard dam for a pond with a 3:1 slope upstream and 2:1 slope downstream.)

H ft.	a Ft.	b Ft.	a-b W Ft.	w Ft.	d Ft.	H-d Ft.	Area of Trapezoid Square Ft.
3	11	8	19	4	3	0	34.5
4	14	10	24	4	3	1	56.0
5	17	12	29	4	3	2	82.5
6	20	14	34	4	3	3	114.0
7	23	16	39	4	3	4	150.5
8	27	19	46	6	3	5	208.0
9	30	21	51	6	4	5	256.5
10	33	23	56	6	4	6	310.0
11	36	25	61	6	4	7	368.5
12	39	27	66	6	4	8	432.0
13	42	29	71	6	4	9	500.5
14	45	31	76	6	4	10	574.0
15	49	34	83	8	4	11	682.5
16	52	36	88	8	4	12	768.0
17	55	38	93	8	4	13	858.5
18	58	40	98	8	4	14	954.0
19	61	42	103	8	5	14	1054.5
20	64	44	108	8	5	15	1160.0
21	68	47	115	10	5	16	1312.5
22	71	49	120	10	5	17	1430.0
23	74	51	125	10	5	18	1552.5
24	77	53	130	10	5	19	1680.0
25	80	55	135	10	5	20	1812.5

H - Height of Dam
a -Width from center to upstream edge of dam at bottom
b =Width from center to downstream edge of dam at bottom
a-b- W -Total width of dam at bottom
w -Width of dam on top
d -Distance from water level to top of dam, called freeboard
H-d -Approximate depth of water in pond above dam
Area of Trapezoid (w+W) H : 2

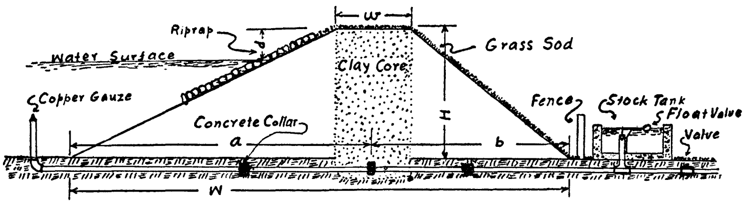

Fig. 3.—Cross-section of dam for the farm pond.

Slope on dam means ratio of horizontal distance to vertical distance. For example assume a dam is 12 feet high. From Table II, H=12 feet; W, the total width of the dam at the bottom=66 feet. The upstream slope is 3:1 and the downstream slope is 2:1.

Then the width of the dam at 1 foot height will be 3 feet less on the upstream slope and 2 feet less on the downstream slope. Therefore, the total width of the dam at 1 ft. height will be 66 feet—(3+2)=61. At 2 feet height, the width will be 61—(3+2)=56 feet. At 12 feet height it will be 66—12 (3+2)=66-60=6 feet.

TABLE III

(Minimum dimensions of dam for small pond with 2:1 slope upstream and 1½:1 slope downstream.)

H Ft.	a Ft.	b Ft.	a+b W Ft.	w Ft.	d Ft.	H-d Ft.	Area of Trapezoid Square Ft.
3	8	6.5	14.5	4	3	0	27.75
4	10	8	18	4	3	1	44
5	12	9.5	21.5	4	3	2	63.75
6	14	11	25	4	3	3	87
7	15	12.5	28.5	4	3	4	113.75
8	18	14	32	4	3	5	144
9	20	15.5	35.5	4	3	6	177.76
10	22	17	39	4	3	7	215

THE SPILLWAY

The spillway must be large enough to carry all surplus water so that the flood water will not overtop the dam. (See Table IV.) The freeboard, or the distance (d) that the dam should extend above the level of the spillway, can be obtained from Table II or III. It should never be less than three feet. Where possible, place the spillway well to one side away from the dam. If the slopes are too steep, then place it at one end of the dam, as shown in Figs. 1, 4, and 5. Never put it on the dam unless the dam is built of concrete or masonry.

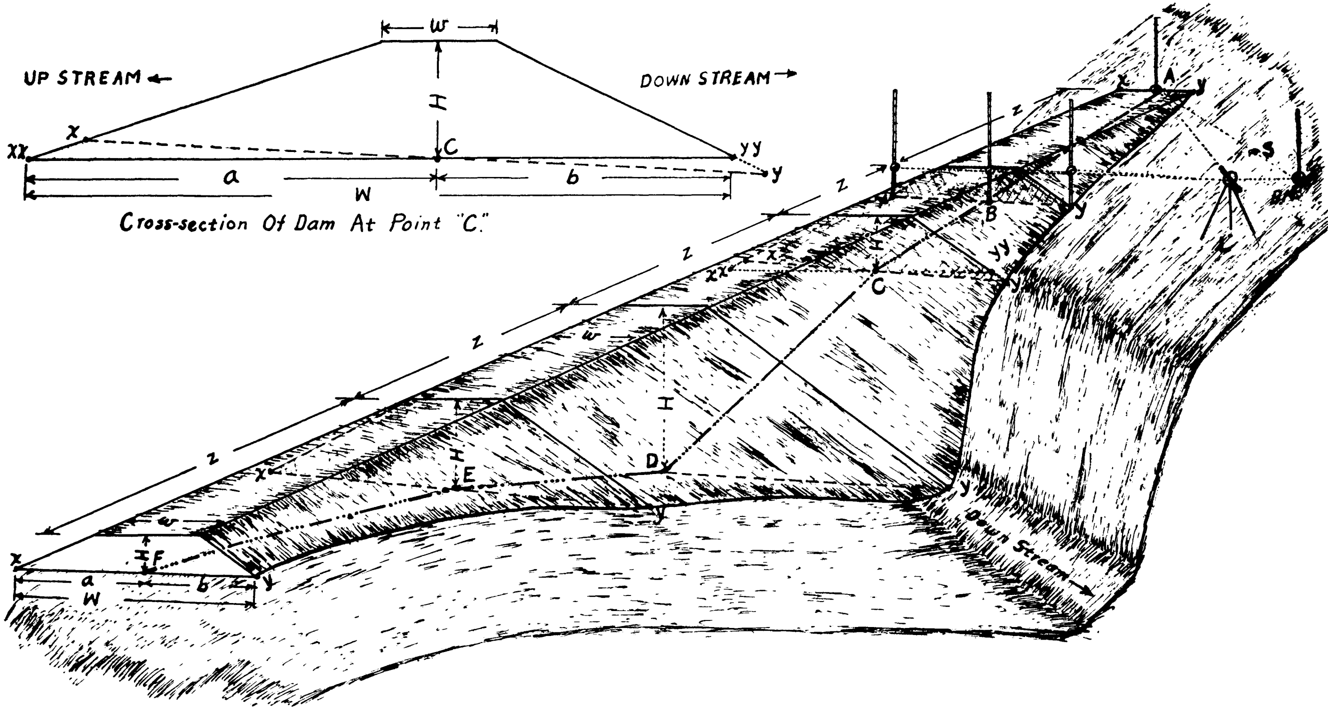

Fig. 2.—Pond Dam (Method of making calculations using assummed data from above drawing shown in Table I) BM reading is zero feet when laying out dam and 1 foot when checking dam. BM is located 50 ft. down-stream on about the same level as A. To locate A from BM when checking dam, stretch tape from BM over stake S, then 50 ft. upstream will be location of point A. Upstream slope 3:1, Downstream slope 2:1, Freeboard 4 feet, taken from Table II. Depth of water=H-d=18-4=14 ft. "a" is distance from center line to xx (Values of "a" and "b" may be taken from Table II or calculated as follows: "a"= (3×H)+½w, "b"=(2×H+½w.) Values of "z" were obtained by measuring. Figures in column "x" of Table I are rod readings at "x." To locate "x" subtract rod readings at "xx" from rod reading at H and multiply by 3, then subtract this from "a." Figures in column "y" of Table I are rod readings at "y." To locate point "y" subtract reading at H from reading at "yy," multiply difference by 2 then add to "b." "w" is obtained from Table II. W is the distance from "x" to "y" or "a" plus "b." Areas of cross section are obtained by use of rotometer or perimeter. For trapezoid method A=(w+W) H+2. Volume of sections of dam (Area at A+area at B) z÷2;)Area at B+ area at C) z÷2; etc. The total yardage of earth in the dam is the sum of all these values.

TABLE I
(Assumed data for laying out and checking pond dam)

Station	Distances between stations z	Rod readings or elevation in feet x	H	y	WIDTH OF DAM IN FT. top w	bottom W	Area of Sections sq. ft.	Volume of Sections cu. yds.
A, or		0	0	1	8	8		
0	0	1.1	1	1.3	8			
B, or	A to B	3	4	4.5	8	26		
0+20	20 ft.	4.2	1..1	5.6	7.9			
C, or	B to C	5.5	6	6.5	8	37.5		
0+32	12 ft.	6.8	1.2	7.5	8			
D, or	C to D	17	18	19.5	8	98		
0+56	24 ft.	18.9	1.3	19.9	8.1			
E, or	D to E	8	9.5	11	8	53		
0+78	22 ft.	9.1	1.4	12.1	8.2			
F, or	E to F	3.5	4	4.5	8	28.5		
1+11.5	33.5 ft.	4.7	1.3	5.7	8			

Notice that for all stations A, B, C, D, F, etc. there are two lines each. The top line is for readings taken when laying out dam; lower line readings taken when checking dam. Readings "x" and "y" will be one foot more when checking than when laying out dam because the level is set one foot higher. H should be exactly one foot because the BM reading is one foot higher than when laying out dam. Readings may vary from .4 to .5 feet because the rod cannot be placed in exactly the same place when checking the dam as when laying it out.

Where the dam is short and there is considerable flood water to be taken care of, it may be cheaper to build the dam of concrete. The masonry dam serves both as a dam and spillway. For masonry or concrete dam construction, it should be well to call an the county agent, who will be able to put you in touch with the proper assistance.

The protection of an earth spillway is very important. If it is not protected, the flood water flowing through it will cut it deeper each rain, thus lowering the water level of the pond and also endangering the dam.

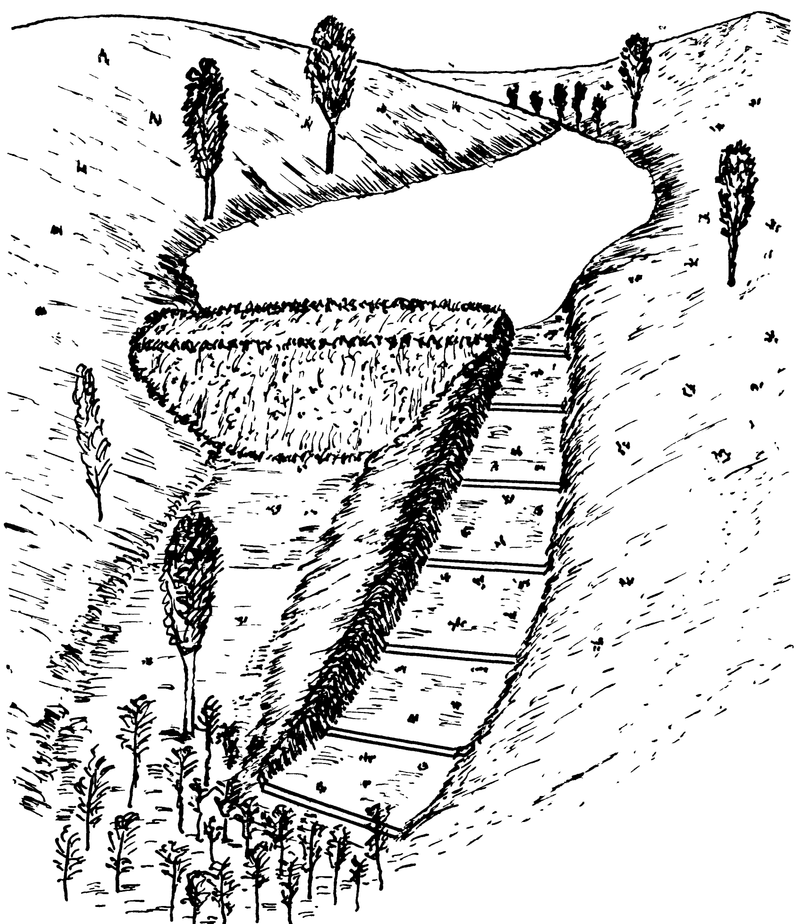

Fig. 4.—Concrete curbs or spreaders and a grassed spillway will be adequate for many ponds.

Where the acreage draining to the pond is comparatively small, that is, not over 6 to 10 acres for each acre-foot storage capacity of the pond, the spillway may be riprapped with loose rock (See Fig. 1) or a series of level concrete curbs placed across it and the entire area sodded to Bermuda grass.

The width of a grassed spillway should be much greater than for masonry or concrete structures as given in Table IV. In fact the width should be doubled if space will permit. The wider the spillway, the less liable it is to wash. Where the spillway is rather flat and excessively wide, no spreader curbs are necessary. However, where the spillway slopes considerably or where sufficient width cannot be had, it is advisable to put in concrete spreaders or curbs. These concrete curbs should be about three inches thick and extend into the ground about 12 inches. The tops of the curbs should be level or just below the surface of the ground. A piece of poultry wire should be fastened to the top of the curb and allowed to lay flat over the grass below the curb, the lower edge of the wire held by small stakes. By planting Bermuda grass roots below the curbs and covering them with straw fastening the wire with stakes, the grass will be held in place until it gets a good growth; and by having the curb below the surface, the water will be less liable to jump and cut holes below the curb. The curb should extend squarely across the spillway. It may be necessary to take off some soil in places to make the flat ditch level so the curbs are flush or a little below the surface. Of course, this flat ditch will have a fall, as shown in Fig. 4. It is well to do the excavating before putting in the curbs and sodding with Bermuda or buffalo grass.

The curbs should be level, but each curb will be on a lower level than the one above. The steeper the slope, the nearer together the curbs should be. It is also advisable to increase the width of this flat ditch as the slope gets greater so as to spread the water over a greater area. This is shown in Fig. 4. In order to get the grass started in parts of the ditch where all the topsoil has been removed, it may be wise to dig a narrow trench just below each curb and fill it with straw and good soil. Then sod with Bermuda grass and pin a strip of hog wire over the Bermuda sod to hold it in place until it gets firmly established. It is sometimes possible to use a short, heavy terrace for a spillway and carry the water some distance from the pond to a naturaly protected place to discharge the water.

Where a large quantity of water must pass through the spillway, it will be necessary to build the spillway of concrete or masonry, as shown in Fig. 5, unless there is a very flat, wide

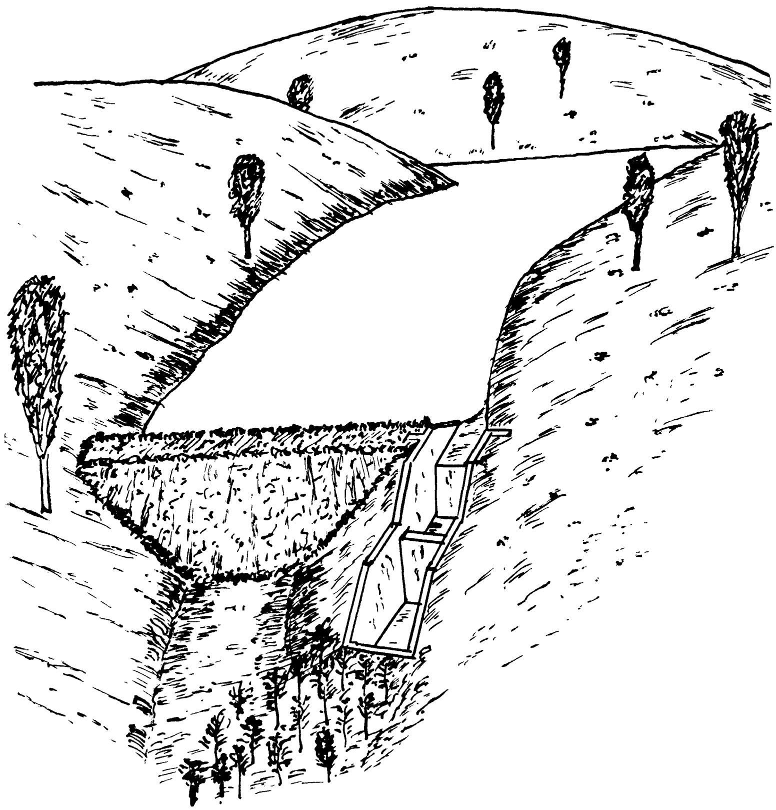

Fig. 5.—When the spillway must handle large amounts of water, it may be built of concrete or masonry in this style.

area of grass for a spillway. There are various ways of constructing the concrete spills. Sometimes the spillway may be made in the form of an inclined trough, but it is generally safer to make one or more vertical drops, as shown in Fig. 5, or the drops may be separated, with level areas between them. Should the drainage area be large, it would be wise to call on the county agent for help rather than make a costly mistake.

The ravine below the dam where the spillway discharges its water should be set to a dense growth of willows, black locust, blackberries, or some dense, heavy brush growth or Bermuda grass, so that the ravine will not be cut deeper by the water coming over the spillway. (See Figs. 4 and 5.)

Width of Spillway

Table IV shows the approximate width of the spillway in feet required for various areas drained into the pond. Figures given check fairly closely with the curves for rates of runoff from rolling cultivated land as found by C. E. Ramser, senior drainage engineer, U. S. Department of Agriculture.

TABLE IV

Drainage Area Acres	Width of Spillway Feet	Drainage Area Acres	Width of Spillway Feet	Drainage Area Acres	Width of Spillway Feet
1 to 3	3	66 to 70	18	136 to 140	32
4 to 6	5	71 to 75	19	141 to 145	33
7 to 10	6	76 to 80	20	146 to 150	34
11 to 15	7	81 to 85	21	151 to 155	35
16 to 20	8	86 to 90	22	156 to 160	36
21 to 25	9	91 to 95	23	161 to 165	37
26 to 30	10	96 to 100	24	166 to 170	38
31 to 35	11	101 to 105	25	171 to 175	39
36 to 40	12	106 to 110	26	176 to 180	40
41 to 45	13	111 to 115	27	181 to 185	41
46 to 50	14	116 to 120	28	186 to 190	42
51 to 55	15	121 to 125	29	191 to 195	43
56 to 60	16	126 to 130	30	196 to 200	44
61 to 65	17	131 to 135	31	201 to 205	45

A study of the above table shows that there is an increase of one foot in width of the spillway for every five acres of added drainage area. This increase of one foot width for every five acres continues to 400 acres. Therefore, if desired, any one may continue the table to 400 acres. Above 400 acres, the increase is at the rate of one foot width to the spillway for every 10 acres continues up to 400 acres. Therfor, if desired, any one maximum depth of two feet of water in the spillway.

Many times it may be difficult to get a spillway more than 30 to 40 feet wide. When this is the case, the spillway may have to be designed to carry a greater depth of water. A spillway carrying a depth of water just a little over three feet will take care of about twice as much water as a spillway of the same width only two feet deep. This means that a spillway carrying a depth of three feet of water will take care of practically twice the drainage area that a spillway of the same width but only two feet deep would take care of. It is better and safer, however, to make the spillway wide where possible rather than to require the depth of water to be greater.

Should the drainage area to the pond be much greater than 400 acres, it may be wise to call on the county agent for assistance. A spillway that is sodded to grass should always have a greater width than indicated by the table, if possible, twice the width in order to spread the water in as thin a sheet as possible.

SOME FACTS TO REMEMBER

Be sure the pond is deep and large enough that it will not go dry, and the dam sufficiently strong and impervious to water, and that an ample spillway is provided, and that there is sufficient drainage area to fill the pond—at least three acres to each acre-foot pond capacity.

CARE OF THE POND

It is well to fence the pond so as to keep all livestock out. Stock wading out into a pond keep it roiled and filthy. It is desirable that the stock drink from a tank placed below the dam and outside of the pond fence. (Se Figs. 1 and 3.) This tank is filled from the pond by pipe leading under the dam. The tank is kept filled by aid of a float valve. If this is provided, stock will always have good clean water to drink. The water edge of the dam should be riprapped to prevent the waves from lapping the earth away. (See Fig. 3.) The top and lower side of the dam should be set in grass. The border or edge of the pond should be planted to grass. It is well to plant some shade trees around and below the pond. When the pond is new, it is well to watch it after each rain until it is filled and the dam is well settled.

A SUGGESTED METHOD TO AID FLOOD PREVENTION

Ponds that are full of water will not keep any water out of creeks and rivers during heavy rains. So, a pond that will serve the farmer as a full pond and at the same time serve as an empty pond to keep water out of the streams during heavy rains is the ideal pond.

This double purpose pond can be made as follows: The pond may be laid out with a high and a low water level; that is, a pipe spill put in at the permanent or low water level, and a flood spill put in two or three feet above the pipe spill. The volume of water held temporarily between these two spillways is the flood capacity of the pond. This volume of water may be owned and controlled by the state and government in payment for aid given as help in the construction of the dam and spillway. This does not mean that the government should actually take possession of the pond, but that the government's portion of the water is held temporarily for a few days after each rain until it flows through the pipe spill, gradually feeding into the streams to prevent floods. Within a few days after each rain this portion of the pond is empty and ready to catch the next rain. All other rights and privileges of the pond belong to the owner. Of course the owner should be required by contract to keep the pipe spill open at all times.

CONCLUSION

When all the land in the country is terraced that needs to be terraced, and there is an average of one acre pond of the double spill type on every 160 acre farm, we will have a good start toward reducing the flood menace so that people living on the bottom lands will be protected. The chances for hot winds will be less; there will be a better chance for shallow wells and springs; there will be more tree growth in the plains area; there will be no shortage of stock water. Good gardens will be possible on most farms in spite of dry weather. People will be able to have fish for food and the recreation of catching them. In fact, farm ponds on all farms where possible will enable the farmers to have a better living and the country at large will be benefitted in many ways.