

## Mississippi Dam Safety Program

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Many of us have been guilty of making statements about the "abundant water resources in Mississippi." Obviously, this has usually been true. In fact, the greatest problem in the water management field is still that of handling the excess flows.

Flood control and drainage have always received a high priority in Mississippi. Levee districts and drainage districts were authorized by some of the earliest legislation on record. Prior to the Civil War, levees and drainage ditches were being constructed in most parts of the State.

The first dams built in Mississippi were for the purpose of operating small mills. Some of these dams are still in existence today.

Later, it became necessary to construct small ponds to provide livestock water in the areas that could not be supplied from natural streams. The earlier ponds were constructed with mules and slips, and similar methods, that rather limited the size of the dams.

After World War II, with the assistance of Federal cost sharing programs and with the use of large earth moving equipment, there were thousands of dams built to supply stock water. Without going to the official source to get the most recent facts, there is reason to believe that as many as 125,000 livestock water ponds have been constructed. If anyone has doubts about the magnitude of these programs, he should fly over any part of Mississippi, with possibly some exceptions in the Delta, and he will be able to see hundreds of these small ponds dotting the landscape.

In order for the ponds to provide more recreational opportunities, the reservoirs were constructed larger. The Soil Conservation Service technicians provided assistance to many of the landowners in the preparation of their plans for the dams. Where the dams were constructed as designed, the owner usually got a good dam. Unfortunately, the bulldozer operator sometimes failed to follow the recommendations of the SCS personnel and problems developed.

Even those dams that were designed correctly and built properly did not always receive adequate maintenance, and over the years some of them developed problems. Tree roots, crayfish, cow paths, wave wash, and a number of other things, when neglected have led to the failure of dams.

When the Water Rights Act was passed in Mississippi in 1956, there had been several years of drought conditions. The Legislature enacted the Prior Appropriation Doctrine to govern the use of surface water in the State. This principle has been used for many years in the Arid West, and has provided a workable method for states to develop their limited water resources. Instead of dividing an inadequate supply among an increasing number of landowners, and all of them possibly losing their investments because of water shortages, the Prior Appropriation Doctrine gives the first user the highest priority. As long as there is any water available, the senior appropriators can get their full amount of water. The latest users to establish an appropriative right to use the water must cease diverting as long as senior

rights require the water. My part on this program is not to explain the water rights laws, but dam safety has now become a part of these laws in Mississippi.

Under the old Riparian Doctrine, used by most of the Humid Area States, and used prior to 1956 in Mississippi, persons who owned property on the banks of streams were entitled to have the flow of these streams undiminished as they flowed past their property. Under the strict interpretation of this doctrine, a downstream owner could prevent the construction of a dam that would reduce these flows. This possible restraint to the construction of dams must have been considered when the Water Rights Act was being developed. The Act encourages the construction of dams for the purpose of storing the surplus water to be used during times of shortages.

The new law required permits for the withdrawal of surface water, but to encourage dam construction, it allowed a person to build a dam and use up to 300 acre feet of the stored water without having to apply for a permit. As a result of this provision in the Act, and in some cases with an improper interpretation by the owner of the proposed dam, several thousand dams have been built without any official knowledge by the regulatory agencies.

During the past 20 to 25 years, the developers of real estate have found that a large lake can be a major attraction to future home owners. There have been hundreds of dams built in conjunction with these development projects. Of course, the lots with the houses are usually on the shore of the lake, but as the development matures, other lots are sold below the dam. With no regulations applying to the construction of these dams, it is not surprising that some of them have become problems.

Ten or fifteen years ago, after the failure of several dams in the Meridian area, interest was generated for the enactment of legislation that could provide safety to persons and property below the dams built in Mississippi. A number of unsuccessful attempts were made to obtain passage of this type legislation, but in 1978, the Water Rights Act was amended to provide for a program to deal with safety of dams.

Congress passed a National Dam Inspection Act in 1972, but only provided enough funds to finance an inventory of non-Federal dams capable of storing fifty acre feet or more of water. The failure of the Teton Dam in Idaho in 1976 caused renewed interest in the program, and after the Toccoa Falls Dam in Georgia failed, \$15 million was made available to begin a program to inspect those dams whose failure could cause loss of life or extensive property damage.

The Corps of Engineers was instructed to inspect at least one dam in each State "by the middle of December", 1977. Personnel from the Vicksburg District of the Corps complied with this mandate and began an inspection program.

The State of Mississippi, under a contract with the Corps of Engineers, completed an inventory of dams in 1975. Limited funds did not allow for field investigations, so the inventory was made from high altitude photographs. Since the program was concerned with only those dams capable of storing 50 acre feet or

more, we were looking for those water bodies with about five acres or more of surface area. With the assistance of the Soil Conservation Service technicians in the offices located in each County, we were able to obtain much of the pertinent data over the telephone. Many of the dams had been designed by these same people, and we found that they were quite knowledgeable about most of the other dams built in their areas.

It is felt that most of the dams were included in the original inventory, but we have since found that the hazard classifications left something to be desired. A Category I was used to identify those dams located where, if they were to fail, "more than a few" lives would be endangered. There had been 70 Category I dams listed on the 1975 inventory, and it was from this group that the inspections were started.

As a result of the publicity received about the National Dam Safety Program, when the Mississippi Legislature met in January, 1978, a bill was introduced to provide for dam safety in the State. During the 1978 Regular Session, the bill was passed and signed into law.

The immediate impact of the new legislation was to provide the vehicle for State participation in the National program. The Act did not become effective until July 1, 1978, but it contained sufficient authority to justify the execution of a contract between the State and the Corps of Engineers prior to that date. The State entered into an additional contract with a firm of consulting engineers to make the necessary inspections of those dams considered to be hazardous.

One portion of the contract with the Corps of Engineers covered up-dating the inventory of dams in the State. This time field verification was permitted. Several hundred dams on the original list were found to contain less than 50 acre feet of storage, but an offsetting number were added from those thought to have been too small in the original survey. A review of the 70 original Category I dams revealed what has been previously mentioned, that we made some mistakes in the initial classifications. About one-half of these kept their classification, but additional ones were added to the list.

There were some minor problems in establishing these categories. Our staff developed a plan that has worked very well, in our opinion. Visual inspection of the aerial photographs gave a good indication of those dams that needed further investigation to determine if there were downstream hazards. Nine out of ten of these dams were obviously not in Category I, since there were no homes below them. The dam sites that were questioned were viewed stereoptically on the high altitude photos, and where some of the homes downstream seemed to be in the floodplain, these dams were flagged for further review. After checking topographic maps, and sometimes making aerial reconnaissance, we eliminated additional sites from consideration as Category I. Those dams needing further checking were visited by members of our staff.

After classifying a dam as Category I we have sometimes had differences of opinion with personnel of the Corps of Engineers. Even though water still runs downhill, we have had differences about how much, if any, damage will be done to the homes downstream. Unless the Category I classification is verified, no inspection can be made to determine whether the dam is safe. Sometimes it seems that the toughest part of the program is getting acceptance of the fact that the people living downstream may be in danger if the dam were to fail. There have been only minor disagreements in the results of the inspections themselves.

Inspections by the consultant find a dam to be "unsafe" when the spillway will not pass the estimated floodwaters without overtopping the dam. Most of the dams that we have to inspect are required to handle 50 percent of the Probable Maximum Flood. When the reports of the first inspections were released, we tried to justify what seemed to the owners to be an excessive amount of flood water, by pointing out that there have been

several times when rainfall in parts of Louisiana has exceeded 20 inches in 24 hours. Now, of course, we can cite the 21.5 inches that fell in Mississippi during the "April, 1979, Flood".

The Corps of Engineers contract does not include any work below the dam itself. If the program provided for running a "dam break" hydrograph, we could better determine the actual effects on the downstream property. This would help us get verification for those dams we have considered to be Category I. Even though the current program does not allow us to study below the dam, it may be necessary at some time in the future to make a determination of which homes will be involved in case of a dam failure in order to develop a warning plan.

All of the 70 Category I dams that were on the 1975 inventory have either been downgraded or inspected. Other dams added to the list have also been inspected. At the present time, we have about 20 additional dams that we feel will need to be inspected under this program, and have scheduled these inspections to begin early in the fiscal year that starts on October 1.

The inventory is rapidly being completed and most of the "clean up" work will be finished before the end of the calendar year. We will maintain the inventory, and hope to get a copy of the data tape from the Corps to put in the State computer for our future work.

If we were to summarize the results of the inspections that have been made to date, it would be fair to state that the principal deficiency has been the inadequate size of the spillways. Even those that had engineering assistance with the designs could not provide for 50 percent of the Probable Maximum Flood (PMF). Economic feasibility usually dictated a design more like a 50-year frequency flood, and very seldom more than a 100-year frequency.

Many of the dams that were designed by "a bulldozer operator" were found to have structural problems. Some of the basic considerations had been overlooked. Problems with stability and seepage were fairly common.

It may be helpful to point out that very few of the dams have received proper maintenance — and usually *none*. Dams designed and constructed under the supervision of competent engineers have developed serious problems after many years of neglect.

What are we doing about those dams that are found to be unsafe? The Dam Safety Act that became effective July 1, 1978, authorized the Mississippi Board of Water Commissioners to issue the necessary orders to obtain the required remedial action for any dam that endangers lives or property. (Now under the reorganization, these matters will be performed by the Bureau of Land and Water Resources, of the Department of Natural Resources.)

It may surprise some of you to know that we have received unusually fine cooperation from the owners of the dams. A number of the owners were required to lower the level of their lakes to a point where failure of the dam would not endanger the downstream houses. A couple have been completely drained. Several have modified the spillways to handle the additional flood water as required. It can be said that all of the "unsafe" dams have had some work done to remedy their problems, and work will continue on the balance as required.

Much work has been done to correct the lack of maintenance. Trees and brush have been removed, erosion areas repaired, and grass mowed.

We will set up a program for routine inspections of all dams that have been found to be Category I, and any others that we feel would endanger lives or property were they to fail. We will also develop a program for periodic reporting of the dam conditions to assist in detecting any piping or other warning signs that may occur in the future.

The Dam Safety Act that became effective July 1, 1978, now requires written authorization for all future dams built in

locations where the drainage area is equal to or exceeds fifty acres. Engineering plans will be required when deemed necessary. Orders can be issued to obtain remedial action when required to remove the hazard posed by any dam, not just those covered by the Corps of Engineers guidelines.

The State now has the authority to inspect *any* dam that may endanger lives *or* property. We can probably expect to be called upon to check out many that will not be a problem, but hopefully

we will be able to catch most of the unsafe ones before they cause any destruction.

Mississippi's laws seem to be adequate at this time to locate and remove the hazards caused by dams. Funding will be a problem, both for the administration of the law and for financing the remedial work on those dams found to be unsafe, but since we are dealing with human lives, somehow we will manage to get the job done.