Flooding and Spilling

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The month of February 2006 would go into the history book for the flooding experienced in Shah Alam as well as the spilling of the spillway at Kenyir Dam, Terengganu. For the flooding in Shah Alam the estimated loss to the affected population was running into millions. Millions more are requested by the State from the Federal Government to prevent the recurring of similar floods.

During the spilling at Kenyir Dam, some anxious moments were reported; such as the dam has exceeded the critical level but subsequently announcement was made to inform the public that the dam is able to withstand the increase in water level above 146m. What is actually classified as critical was not clear. No statement was made on the losses due to the spillage. This loss is with respect to the energy that can be generated by the water that was spilling. It must be quite substantial.

Interestingly these two incidents can be viewed from the engineering perspective in the way we manage our resources. History would tell us that such incidents were not new, considering that we are dealing with nature. Unless we treat nature with respect, we could be in for a surprise at any moment.

Flood is experienced not only in this country as evident from the following extract from the Paper by WJR Alexander, "Flood Management" (South African National Committee on Large Dams, Large Dams and Water Systems in South Africa, 1994) which gives us a picture of what has happened in another country for our reference.

"In 1919 the Department of Water Affairs (then Department of Irrigations) issued the first paper on Maximum Flood Curves in its Professional Paper series on design practice in the Department. In his foreword AD Lewis, then Director of Irrigation, wrote:

Too much importance must not be attached to the formula. No formula is likely to be discovered which will apply to all drainage areas. The maximum flood depends on too many uncertain circumstances, such as intensity of rainfall, size and shape of catchments and channel, and permeability of ground surface.

In 1945 Justin, Creager and Hinds published their three-volume series, "Engineering for Dams", which was widely used in South Africa and elsewhere for dam design. An empirical flood formula based on an upper envelope of observed maxima was presented with the following caution:

Possible Future Peaks-
"In making use of records of maximum recorded floods on rivers in any given district to estimate the expected peak discharge at a given place, it must be remembered that what has occurred in the past must surely be exceeded in the future."

The above two comments are as true today as they were when they were published."

"Four severe widespread flood events occurred in 1981, 1984, 1987, and 1988. There was widespread loss of life and destruction of structures, and once again the validity of current analytical methods was questioned. One irate reader wrote a letter to the editor of a local newspaper:

"I don't care a damn whether or not a degree in accountancy, engineering, medicine or anything else is recognised in foreign nations to the north of us. All I want is an accountant who can keep the Receiver off my back and look after my investments. All I want is a civil engineer who can build better bridges than the ones that are always washed away when there are floods in Natal."

From the experience in South Africa, let us now look at the experience in Australia. The extract from a paper "Integrated River Basin management and Urban Flood Mitigation" written by Ian Hampton and Ian Varley (SMEC) (2000), who wrote as follows:

"Until the mid 1970's flood management in NSW was based on the use of engineering structures to control river flows and protect development within the floodplain. Structural measures were usually implemented in the wake of large floods that had produced significant damage to property. They typically included levees, channel improvement works such as channel enlargements, straightening, removal of vegetation and lining by rock or concrete and flood control dams. However, despite the expenditure of large sums of money on structural works, flood damage across the state was increasing at an alarming rate. Indeed flood damages were often increasing in areas that had benefited from extensive mitigation programs.

It was appreciated that an entirely new approach was required if the State's exposure to flood damage was to be reduced. The revised approach was based on an entirely different attitude towards development on a floodplain. Traditionally developments were placed on floodplains without any regard to the frequency of flooding, the depth and velocity (hazard) the likely extent of damage or the suitability of the design, including materials and floor levels. At the planning stage of new developments, the opportunity is taken to improve the management of stormwater run-off by considering the potential impacts of proposed developments on stormwater. For example, when making decisions on whether a particular area should be developed and by integrating stormwater systems into the urban design of subdivisions to maximise their multiple uses. The new approach has attempted to match the nature of development with the flood hazard. Therefore, high value enterprises such as computer warehouses, or strategic facilities such as hospitals would be placed in areas with low flood risk. Developments that would experience low physical damage and low inconvenience, such as golf courses and sporting complexes, could be located in high hazard flood zones.

Building materials and layouts would be tailored to suit the flood exposure.

Another significant change in flood management was to encourage greater involvement of the local community in developing floodplain management plans for a given river or township. The new policy was set out in the NSW Floodplain Development Manual (NSW Govt. (1998)). Under this policy. A Floodplain Management Committee would be formed for a given river catchment. The committee would include representatives from local Government and the Department of Land and Water Conservation who were the principal Government authorities responsible for floodplain management. The committee would also include members from the local community and representatives from other government departments as appropriate.

The committee would then engage consultants to carry out detailed flood studies to establish a full understanding of flood behavior for existing conditions. These would determine flood discharges, levels and velocities throughout a floodplain and the likely flood damage for a range of flood events, including extreme floods such as the Probable Maximum Flood. The studies included the production of maps that showed the extent of flood inundation, depths, velocities and hazard ratings for a range of recurrence intervals. The studies would also investigate flood behavior under future development scenarios. A mix of flood management measures would then be investigated under the direction of the committee and a comprehensive flood management plan would be established.

Under the new policy, developers were required to ensure that their works did not exacerbate flooding. Generally this required compensatory measures such as the construction of retarding basins. Rather than requiring retarding basins for every new development the policy encouraged regional planning so that larger more efficient regional based mitigation works could be implemented. Significantly, the studies were used to establish future development policies for the catchment within which development applications would be evaluated rather than relying on individual assessments.

Local government under the authority of planning instruments such as the Local Environment Plan implements the floodplain management measures. The floodplain management policy includes a carrot and stick approach to encourage compliance.

Development that is carried out in accordance with an approved floodplain management plan is indemnified against legal challenge for damages. However, development that does not comply leaves the owner or approved authority (local government) exposed to expensive damage claims and penalties. The State Government is prepared to finance flood studies and their associated works if they comply with the policy.

Considered opinion is that the new policy has proven to be very effective in reducing flood damage."

The above paper was presented at the National Conference on Sustainable River Basin Management in Malaysia held in Kuala Lumpur in November 2000. The objectives of the Conference were to promote greater awareness regarding integrated river basin management (IRBM) as an important sub-set to overall Integrated Water Research Management (IWRM); to articulate the concept and practice of IRBM as a way forward to ensure the sustained multi-functional use of river basins while protecting essential ecological and physical processes; to discuss issues and challenges within the Malaysian context with a view to adapting IRBM practices in formulating a framework for action.

It is believed that some actions have been initiated to incorporate the essentials of IRBM in the development of our resources. It is also noted that in 2000 the Department of Irrigation and Drainage Malaysia published the Urban Stormwater Management Manual for Malaysia (MASMA). In the Foreword it was highlighted that "While the first drainage manual utilises the concept of rapid disposal, this current manual utilises the concept of stormwater management control at sources."

Coming back to the Kenyir spillage the available public records showed that the spillway maximum discharge is 6500m^3/s calculated at PMF corresponds to a maximum lake level of 152.95m. The water level touched 145.78m, which is 0.78 above the spillway crest on 13 February 2006. On 14 February, 2006 it was reported that the flood conditions in Hulu Terengganu and the vicinity of Kenyir Dam has improved. There was no further report of the spilling which is presumed to continue for a while after reaching the above said level. Instead it was reported that the flood situation was under control with appropriate announcement being made by the relevant authorities.

Many times it has been proven that uncontrolled flood waters are one of the most powerful and destructive forces in nature. Dams or any water retaining structures that are not designed to withstand major storms can be destroyed by them, increasing the flood damage downstream. This damage is too often catastrophic. In order to protect lives and property downstream, the International Standard Code requires that dams be constructed to safely handle an appropriate percentage of the Probable Maximum Flood (PMF). The PMF is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area. The associated percentage of PMF varies according to the height of the dam, size of the impoundment, and extent and severity of damage possible upon failure. The requirements established in Malaysia for dams constructed in early 80s are similar to those used in other countries, and the historical records of significant storms and dam failures in this century verify that the design criteria are reasonable.

The Kenyir dam constructed in the early 80s was designed based on those criteria. The spilling thus should not be a cause of undue alarm but rather a greater concern on the potential flooding downstream along Sungai Terengganu. Without the dam the extend of flood damage will be extensive.

Acknowledging the benefits and risks posed by Kenyir Dam, keeping a keen vigilance over the dam's safety and operation is paramount. Back to the recent spilling, it is important that the classification of danger or critical level be clearly defined to avoid confusion and to ensure that the public is well informed so as to be able to react accordingly. In any situation the emergency action plan for such a dam should be in place as part of the National and State Emergency Committee under the National Security Council. ■