

Impact of Floods on Water Resource Development

By

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Introduction :

A water resource development programme must basically be an economic development venture which can be financially justified. Therefore, all the direct and indirect losses as well as tangible and intangible benefits have to be taken into consideration for arriving at benefit-cost ratio or excess of benefits over the costs. Among various other causes for losses, floods constitute a substantial component which must be taken into account. There might be occasions where floods may also contribute to the benefits and naturally these aspects have also to be taken into consideration. The fact remains that impact of floods on any water resource development plan is a vital issue which must be kept in view at the time such a plan is prepared. We know from the past experience that there were many instances where ignorance of these important aspects had resulted in serious dislocation in the implementation as well as operation of a large number of projects destined to utilise the water resources. The last minute modifications in the designs or changes in the important operational characteristics of these projects brought about lop sided implementation of such projects which resulted in unproductive investment of developmental expenditure. Any river basin which is subjected to ravages of floods cannot present a realistic picture for the beneficial exploitation of its water resource unless various causes of the floods, their effect, and the remedial measures are taken into account at the proper time.

How to initiate such a study :

The first and foremost important point to be kept in view is to have acquaintance with the salient features of the water plan for a particular area. Such a plan has to take into account detailed inventory of the water resources and the agents threatening the reduction in their benefit utilisation. The comprehensive investigations have to be carried out to assess resources of a given basin on an overall basis so that the resources can best be utilised. Priority has to be fixed in implementation of various categories of projects after initial survey has been carried out to assess the total requirement of the area, requirement so far met with, projects underway and the future growing needs of the region. Future planning and development has to be determined on such a basis. There

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might be instances of competing demands for utilisation of given resources in a manner more than one. The priority of use is, therefore, very essential to avoid clashes in the utility of given resources. Some of the important features of a water plan are physical features, land use, groundwater resources, surface water resource, quality of water, climate, soils, markets and transportation, population and industries, minerals, recreation, fish and wild life and a financial forecast plan.

Areas of water scarcity and areas suffering from floods in the same basin have to be clearly identified so that coordination in their needs for fighting famine and the floods can be established.

How to examine the impact of the floods :

For carrying out a proper examination of such an impact on the water resources of the basin a broad outline has to be laid down which should cover the activities of the river in various regions :—

(a) Upper catchments :

Snow contribution, glacial accumulation, study of run-off flow and damages caused by ice jam floods form the initial link of study in this area. In this region of the river basin effect of floods on multipurpose projects has to be considered in detail. For example the reduction in the useful live storage of the reservoirs is an important aspect to be taken into account. Other phenomena brought about by floods in this area like soil erosion, water shed damages, etc ; have to be studied for specifying certain characteristics of the flood damages caused not only in the upper catchments but also in the areas down below. The impact of floods in the upper catchment, is therefore, a damage contributing factor not only in this reach but also in the alluvial plains below. Examination in this region is thus the most important criterion. This is the area permitting maximum harnessing of the rivers which may finally eliminate the adverse effects of flooding of the rivers in the alluvial plains below. Anti-flood measures can prove most effective in this Zone. Some of the beneficial aspects of the flood generated through storage of the flood water can also be realised by proper development of the water resources in this region.

(b) Sub-Mountainous Region :

This is the transitional stage in the activity of the river as it enters from the hilly catchment into the alluvial plains where it deposits silt as the river activity is slackened at this point. It brings about soil erosion, revine formation and exhibits a pronounced effect on the soil reclamation and anti-erosion projects which may be underway for development of the water shed.

(c) Alluvial Plains :

Floods may serve as a contributing factor in development of water-logging and salinity. They may cause damage to projects meant for utilisation of the water resources such as barrages, canal spreading works,

flood control and drainage projects. They will bring about direct as well as indirect damages to agricultural development of the area and will also create interference with the administrative machinery responsible for executing and operating of the water development resource schemes. By interference in the transportation system and every day life in the basin, resources which are earmarked for certain specific purposes have to be diverted to meet the emergency situation. This brings about a double loss not only to create justification for investment of resources in directions not envisaged before but also to delay that phase of the development projects which should bring return on the capital at charge. Floods in this area may also bring sickness in their wake which will result in serious reduction in the national agricultural as well as industrial output. This again is an instance of serious damage to economy of the country.

(d) Deltaic Region :

The floods interfere with the navigational benefits of the river system in this region. They bring about major shifting of the deltaic development in the area. The interference caused in some of the most thickly populated areas of the river system by floods and their vagaries brings about serious dislocation in the civic life of a nation. The inhabitants have, therefore, to take special measures to guard against the floods for their attack on the resources which may have been developed in this area. The measure taken for canalisation of the delta, putting up of the polder system, establishment of pumping stations, sluice operation and other measures adopted are all steps in this direction. Floods have to be properly controlled and utilised for eliminating the salinity threat caused by tidal action in the river. The lands which have already been adversely affected due to salinity have to be developed by storing the flood water in the polder system and releasing it when the flood levels permit for leaching purposes. This situation is of special interest in the East Wing of the Country where sea water intrusion has already thrown considerable area of the rich deltaic region of various rivers out of production. The tidal water effect has caused salinity and flood water has to be properly controlled and utilised for removing this menace to the water resource in estuary area of the river basin.

Coordination of river basin plan with other developments :—

Any river basin plan must ensure comprehensive studies which should take into account utilisation of land, economic settlement of the population, agricultural requirements, needs for electric power, transportation system, social habits as well as welfare of the inhabitants. Floods have then to be examined to see the extent they rupture such interconnections between various segments of the river basin plan and the ties they have with other economic development of the area. It will be only after such an examination that measures can be planned to maintain such links and to guard against their disruption.

Floods as Country's National Asset :

No study for examining the impact of floods on resources in the given river basin can be completed by ignoring that aspect of floods which contributes to the national assets. Floods if properly controlled, regulated and tamed can be an invaluable resource for contribution to groundwater potential in those areas where there is scarcity of rainfall and the streams rise occasionally during the course of the year and are flashy in character. This water which goes to waste and is an agent for bringing about destruction and misery to the population can be properly stored both in surface as well as subsoil reservoirs and utilised during remaining parts of the year when there is water scarcity. Floods when properly controlled will result in very beneficial economic development of the upper catchments, improvement of the water sheds, result in healthy growth of afforestation and contribute to improvement of the nation's health by yielding recreational facilities and creating scenic points. They will also add to the wild life, fish culture and a large number of other tangible as well as intangible benefits. In the areas of the alluvial plains the floods have a predominant damage causing aspect and the comparative utilisation for benefits is rather limited. However, here again proper spillway channels with fuse plug dams could be constructed which serve as the embankments along course of the river permitting sailaba irrigation which is beneficial for the agricultural production of the lands. This system has been practised since ages particularly along river Indus in the old province of Sind where the river itself flows on a ridge with water level in the river course much higher than the surrounding lands. The floods are quite beneficial in the deltaic region of a river basin, if properly controlled and regulated. As stated before they are the means for salinity abatement and a remedy against adverse effect of the tidal action.

It is clear, therefore, that a well coordinated plan for water resource development of river basin can be evolved by taking stock of its resource potentialities and the devastating agents with their benefit reducing trends. Floods stand out as the most significant factor which has to be reckoned before any water development can be called realistic. Their likely adverse effects on the profit yielding capacity of the capital, interference in the routine functions of the water development programme and interruption in the normal life of the inhabitants of the river basin which upsets their daily life have to be taken into full account. Several functions of the water control and its uses which very often are conflicting have to be taken into account. Preference has to be given to those which make greatest contribution to the well being of the people and to areas of the greatest needs. The water plans evolved must meet those objectives with a set priority. Various economic development aspects like irrigation, drainage, power, flood control, pollution control, navigation, silt control, domestic and industrial uses of water, water shed embankments, fish and wild life, recreation, social problems connected with compensation and rehabilitation of the people affected in the reservoir areas, designs and plans for projects all go to constitute a river basin development plan. Man-

power, methods, machinery and material have to be examined in detail as the tools which will permit harnessing of the floods so as to reduce their attack on the water development resources to the minimum. In spite of best possible efforts and implementation of flood control as well as regulation projects the control and protection accomplished can never be called absolute but only a relative one. It very often so happens that while we appraise the damages expected and provide remedial measures against the attack of floods at one point some other stretches may be rendered vulnerable.

Realisation of the water resource development :

Water development and execution of major projects is a very slow process. Some of the outstanding multipurpose projects in various parts of the world have taken 20 to 30 years for their final completion. At least the need for some protection against the floods had been indicated at specific points and the span of a long period of initial plans, designs and process of implementation had to be gone through before these projects could become a reality. If the collective national will power and the totalitarian system of government is imposed on a country it may be possible to cut short some of the routines and accomplish these projects in shorter time like what Communist China is said to have done. There is necessity of arranging adequate protection and security for the available water resource which has to be utilised during the interim period when some of these major projects are underway. The inhabitants of the river basin will be subjected to greater threat and mental upheaval in the interim period from the time a water plan is made public to its stage of implementation. It is a critical period necessitating proper care and safeguards to be ensured. This period should justify proper vigilance so that floods while being controlled at one point do not recoil at some other thus rendering the water plan as an uneconomical proposition.

Conclusions :

For the purposes of examining impact of floods on the water resource of a given basin it is necessary to have full acquaintance with not only the given area and its potentialities of the resources but more so with the general characteristics and behaviour of the floods which attack on these resources. We have to appreciate that forces which we control now were the forces which built those basins and vallies which we have developed, industrially advanced and then occupied. We have to control and retard the floods in the Upper Catchments, and divert, regulate, slow them down in the plains below without any possibility of their absorption or capturing. Their effect has to be hastened and accelerated in the deltaic region without the least detention. Floods have to be considered as a companion to man since his creation. However, they must be taken into full account at various stages for the planning and development of the water resources and then it can be possible to make a water plan of the given river basin realistic and an economical feasible proposition. I have briefly tried to bring out these points so that consideration of important impact of the floods on resources of the given river basin is not lost sight of at the various stages when the appraisal of the resources and methods for their exploitation as well as utilisation are under consideration.